



CHINA'S SEAD TACTICS & DOCTRINE



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Modern air warfare has demonstrated air superiority can no longer be assumed, even by technologically advanced militaries. The proliferation of mobile, networked, and resilient air defense systems has engendered a crucial shift. Once characterized by rapid dominance, aerial campaigns now manifest as prolonged contests over detection, tracking, and control of the electromagnetic spectrum. To project power, maneuver, and control escalation, suppression of enemy air defenses (SEAD) is no longer a support function; it is a prerequisite. In a Taiwan contingency, the People's Liberation Army's (PLA) ability to suppress Taiwan's air defense network will shape the opening phase of the conflict and follow-on operations to include amphibious assault or airborne insertion.

Chinese military thinkers explicitly recognize this reality. In their writings, the PLA frames SEAD as a logical development required to expand China's security interests and for its military to "go global" by protecting overseas assets, citizens, and influence.¹ Unlike Western SEAD concepts, shaped by decades of combat experience and iterative adaptation, Chinese SEAD doctrine developed in the absence of combat. As a result, PLA authors emphasize preplanned effects, long-range fires, electromagnetic dominance, and unmanned systems as means to engineer windows of air superiority, while minimizing the exposure of high-value manned platforms to air defense threats. The PLA's approach reflects broader features of Chinese military thought, including active defense, systems confrontation, and a preference for systems engineering solutions to operational problems.

The war in Ukraine, however, highlights the limitations of viewing air defense suppression as a deterministic engineering challenge. Adaptive defenders leveraging mobility, deception, and emission control have shown that SEAD is fundamentally a competitive interaction with a thinking adversary rather than a problem that is static where targets can be eliminated one at a time. These competitive dynamics are relevant to Taiwan, where similar approaches could exploit Chinese weaknesses in reactive (real-time integrated) SEAD and significantly complicate PLA efforts to achieve air superiority.

This paper argues the PLA is developing a coherent approach to SEAD, but that this effort remains unevenly translated from doctrine into operational capability. Chinese SEAD thinking is sophisticated at the conceptual level, emphasizing Electromagnetic warfare, system paralysis, and tightly coordinated, preplanned joint firepower strikes. These ideas are well developed in PLA doctrinal writings and academic analyses. However, the platforms, weapons, training, and tactical integration required to execute adaptive, real-time SEAD against a resilient and learning adversary remain immature.

In practice, the People's Liberation Army Air Force (PLAAF) SEAD today is more conceptual ambition than demonstrated operational competence. While PLA electromagnetic attack capabilities are expanding and credible, its kinetic SEAD capacity relies disproportionately on a narrow set of aging systems—most notably the YJ-91 anti-radiation missile (ARM) derived from 1990s Russian designs. Unmanned and distributed SEAD concepts feature prominently in doctrinal and academic discussions, but open-source analysis of force development suggests persistent limitations in autonomy, scale, and cross-domain integration. Publicly available evidence of PLA SEAD tactics indicates

an approach optimized for short-duration, scripted operations against cooperative targets rather than sustained suppression of non-cooperative (adaptive) air defense networks.

Assessing the PLA's broader approach to offensive air operations requires understanding how the PLA conceives of and prepares for SEAD. This paper synthesizes Chinese military doctrinal concepts, platforms, and training patterns to assess both areas of genuine progress and persistent gaps between theory and execution. Characterizing the gaps serves two functions: 1) to represent current capability limitations in the PLA; and 2) to provide warning indicators. Should the PLA succeed in closing the gaps described here, through improved integration, training realism, and autonomous systems, the SEAD threat to U.S., allied, and partner forces will be substantially more dangerous. SEAD thus provides a critical window into the strengths, assumptions, and vulnerabilities of the development of airpower in China.

STRUCTURE

The paper proceeds in five parts. Section I establishes a comparative baseline through a brief introduction to the evolution of U.S. SEAD. Section II examines the intellectual and doctrinal foundations of Chinese SEAD, demonstrating lofty and disconnected Chinese aspirations. Section III evaluates PLA SEAD weapons and platforms, highlighting proliferation without diversification of YJ-91 and the unmanned aerial vehicles (UAV) gap between doctrine and current force mix. Section IV analyzes PLA SEAD tactics and training as available in open sources and emphasizes the rudimentary nature of tactics. Section V assesses implications for Taiwan and U.S. planners.

SECTION I: THE SEAD MISSION—OPENING THE DOOR

SEAD is best described as the art of "opening the door" for an air campaign. In modern warfare, an adversary does not just have isolated missile launchers; they operate an Integrated Air Defense System (IADS). IADS are a complex, redundant web of sensors, command centers, and surface-to-air missiles (SAMs) that share data in real-time. Aircraft flying into an IADS without a deliberate plan are detected, tracked, and targeted long before reaching their objectives. SEAD enables friendly operations at acceptable levels of risk by degrading IADS through blinding, confusion and destruction.

The U.S. approach to SEAD is defined by a specialized philosophy born during the Vietnam War known as the "Wild Weasel" mission. The core concept is "First In, Last Out." SEAD pilots fly into the enemy defenses specifically to be shot at. By forcing an enemy radar to turn on and "paint" them, the U.S. pilot can locate the signal and retaliate. This mission is executed through a combination of kinetic and non-kinetic effects. Kinetic effects involve physical destruction using tools like the High-speed Anti-Radiation Missile (HARM). Conversely, non-kinetic effects—like electromagnetic jamming or cyber-attacks—suppress the enemy by flooding their radar screens with false targets or disrupting the communication lines between a radar and its launcher. Figure 1 on the following page illustrates the Air Force SEAD concepts of integrated stealth aircraft, non-kinetic jamming and employment of anti-radiation missiles in 1990.

Crucially, the U.S. executes SEAD effects across two different levels: campaign SEAD and localized suppression. Campaign SEAD is a theater-wide effort that often targets command and control (C2) centers to decapitate the IADS network. By destroying the system's "brain," the U.S. forces individual missile batteries into autonomous mode, where they are isolated and easier to find and engage. In contrast, localized suppression focuses on a specific geographic window, requiring synchronization of jamming and ARM shots. ARM shots are largely divided into two categories: preplanned and reactive. Preplanned shots are fired at a known site's coordinates to hit a radar as it turns on during an engagement. Reactive shots are fired when the pilot responds to a sudden radar lock to ensure the strike package survives.

In the modern era, the U.S. baseline relies on three pillars: stealth, jamming, and stand-off. The F-35 uses its stealth to identify targets undetected, while the EA-18G Growler provides an electronic "umbrella" to mask movements. Simultaneously, "standoff" weapons like cruise missiles allow the U.S. to strike fixed nodes from hundreds of miles away. Understanding this U.S. baseline of aggressive, specialized, and highly synchronized "door-kicking" is essential to seeing how other nations, such as China, are evolving their own fleets to match or counter these specific tactical windows and campaign-level strategies.

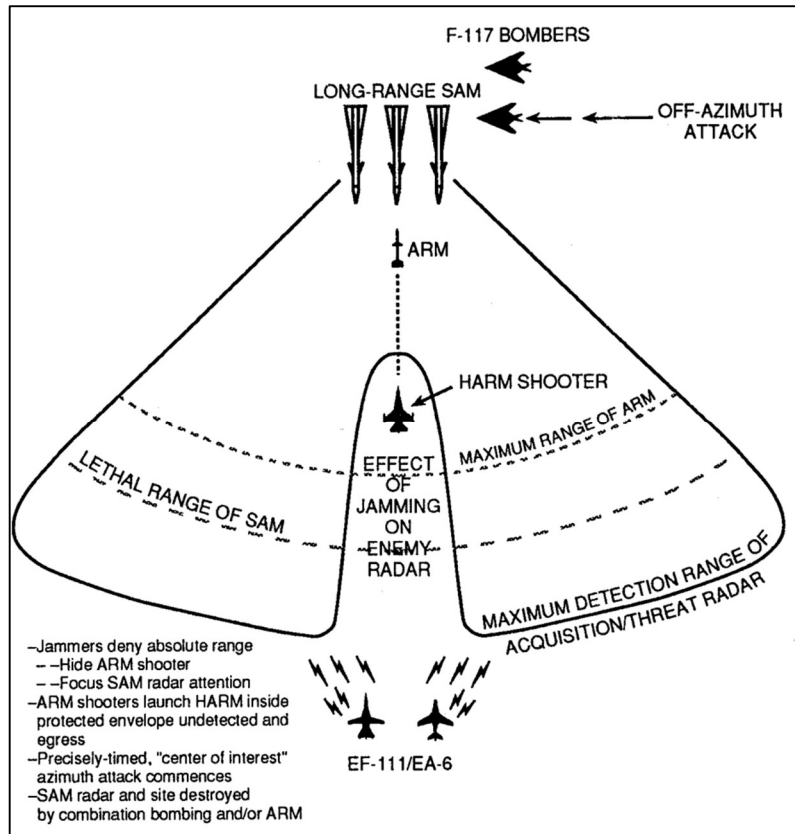


Figure 1: USAF Concept of SEAD & Jamming Attacks in 1990s²

SECTION II: CHINESE SEAD DOCTRINE

SOURCES OF CHINESE THOUGHT ON SEAD

Three high-level conclusions can be made from a review of Chinese academic SEAD literature published from 2015-2025. 1) Research activity appears to be a general precursor for SEAD weapon development and deployment, as evidenced by the annotated Figures 2 through 4 below. 2) There is an abundance of work on UAVs; so many UAV papers exist that only those with explicit SEAD applications were included in this study. 3) The Chinese SEAD literature is heavily derivative of foreign work: researchers often synthesize Western developments, convert them into quantitative models or simulations, and then evaluate tactics through those models. Because of this, Chinese researchers have an intimate understanding of Western technology. For example, a twenty-minute video posted by a Chinese electronics professor dissects the circuits and logic board of an AGM-88 High Speed Anti-Radiation Missile (HARM), presumably captured from the Ukraine conflict.³

Figures 2-4 present Chinese academic publication trends drawn from China National Knowledge Infrastructure (CNKI), an academic database, organized by SEAD-relevant keywords, with major PLA weapons development milestones overlaid to provide contextual grounding. The temporal alignment between academic output and subsequent weapons fielding suggests that Chinese research activity frequently functions as an early indicator, or enabling precursor, of later capability development.

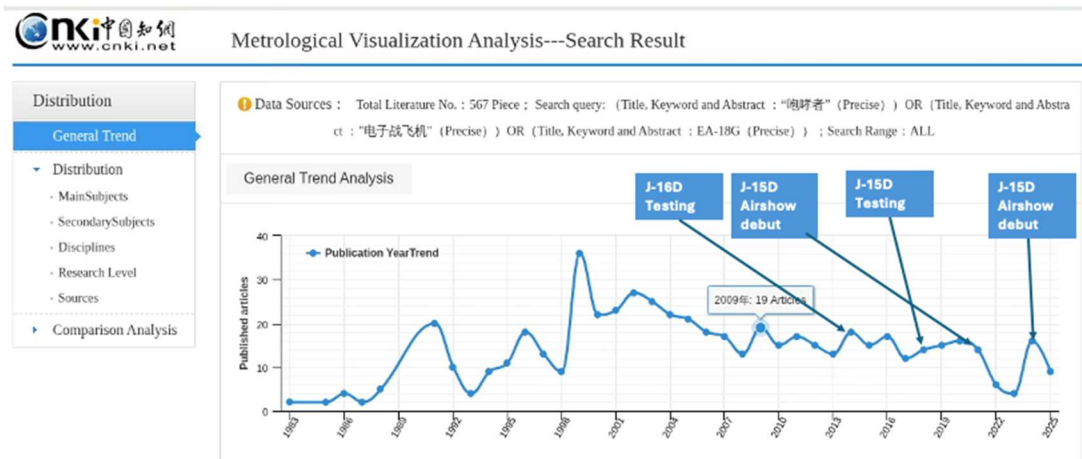


Figure 2: CNKI Academic Research over time of "Electronic Attack Aircraft."

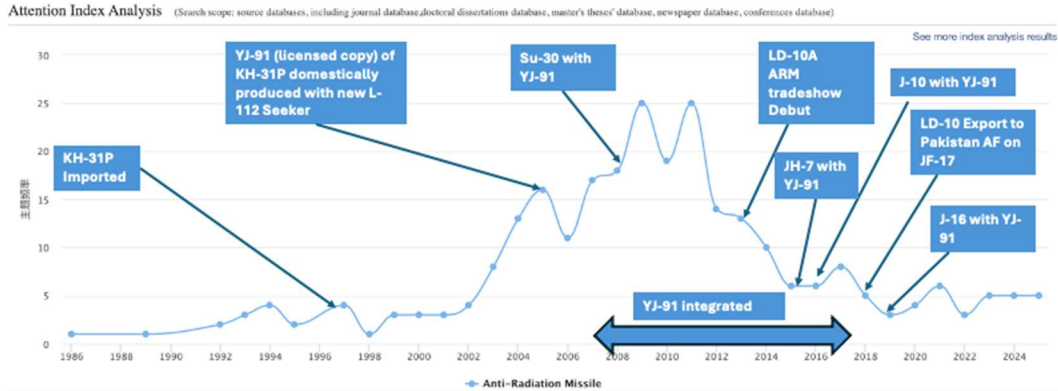


Figure 3: CNKI Academic Research over time of “Anti-Radiation Missiles.”

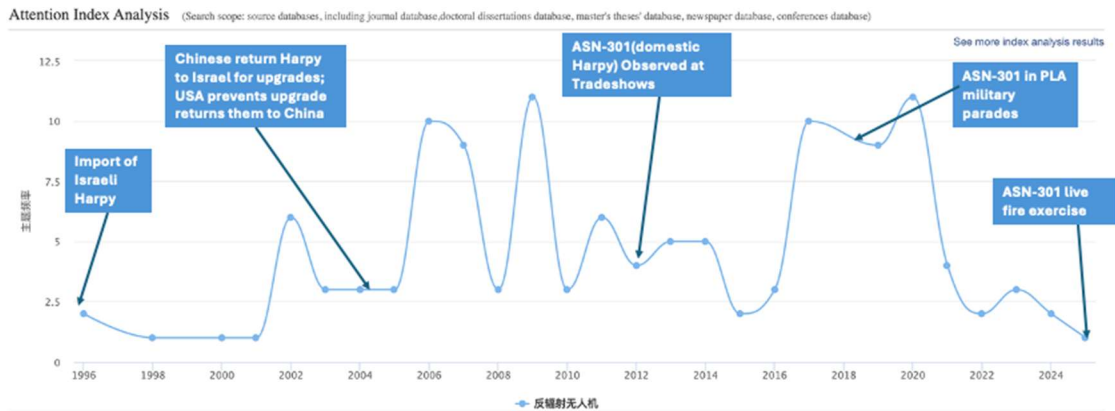


Figure 4: CNKI Academic Research over time of “Anti-Radiation UAVs”

For example, Figure 3 shows “anti-radiation missile” research rises sharply following the People’s Republic of China (PRC) acquisition of the Russian Kh-31P in the late 1990s. From approximately 1998 to 2012, CNKI records show a sustained increase in publications focused on anti-radiation guidance, seekers, and electromagnetic targeting, consistent with a period of reverse engineering and technical assimilation. After this large research effort occurs, the YJ-91 (domesticated improved version of Kh-31P) begins integration across multiple PLAAF aircraft. Additionally, after this large research effort the LD-10 missile, a smaller, newer variant of ARM is advertised at trade shows showing how PLAAF has gone from research-focused to weapons fielding. While the relationship between academic research and weapons development is not novel, these trends underscore the analytic value of CNKI longitudinal analysis as an early-warning signal for potential future PLA capabilities, particularly in SEAD-related domains.

The book *Joint Suppression of Enemy Air-Defense Systems: Electronic Warfare Application Theory and Quantitative Analysis* provides the best single-source authoritative text on Chinese thought about SEAD. This book was published in 2021 by China’s National University of Defense Technology, proves solid technical models, SEAD insight, and, most importantly, a domestic literature review. The authors suggest domestic scholarship on SEAD remains narrow. Foundational texts affirm suppression as essential

to bomber penetration, and later authors reiterate its strategic role.⁴ Yet substantive doctrinal innovation is scarce: only in 2005 does a master's thesis by a PLAAF officer explicitly formalize a preemptive-suppression concept in Chinese academic discourse,⁵ and much of the literature explicitly traces or borrows U.S. operational concepts rather than originating them. Chinese classifications—campaign versus localized suppression, and preemptive versus reactive timing—closely mirror Western taxonomies, reinforcing the view that open domestic research is still in a formative, catch-up phase rather than exhibiting independent doctrinal development.

DOCTRINE

A central challenge in assessing PLA approaches to SEAD is that Chinese military doctrine lacks a standardized or authoritative definition of the concept itself.⁶ The phrase most commonly used in translated discussions—“suppression of enemy air defense systems” (压制敌方防空系统)—appears frequently in Chinese analyses of Western airpower but is not formally defined in PLA military terminology. Reflecting this ambiguity, some Chinese authors use the English acronym “SEAD” in their writing, implicitly acknowledging that the Western term carries operational meaning not fully captured by existing Chinese concepts. The closest semi-agreed doctrinal construct in PLA terminology is “air suppression group” (防空压制群), which PLA dictionaries define as a temporary force grouping organized to conduct strikes against enemy air-defense targets. Notably, this concept describes a *unit organization* rather than an operational effect or campaign function. As a result, Chinese discussions of SEAD tend to frame suppression as a method of applying firepower against selected targets, often missile launchers or emitters, rather than as a dynamic effort to temporarily degrade an entire integrated air-defense system. This conceptual ambiguity helps explain why SEAD appears fragmented across multiple PLA campaign constructs and why Chinese force development emphasizes preplanned, effects-based strikes over adaptive, real-time suppression under contested conditions.

Two authoritative PLA texts—*Science of Military Campaigns* and *Science of Second Artillery Campaigns*—provide the primary campaign-level framework for how the PLA conceptualizes SEAD. Unlike U.S. doctrine, which treats SEAD as a discrete subset of offensive counter air (OCA) with centralized doctrinal ownership, PLA discussions of SEAD are embedded across multiple campaign types, including firepower campaigns, island seizure campaigns, air campaigns, and artillery campaigns.

To reflect this structure, the following analysis proceeds campaign by campaign, extracting SEAD-relevant concepts from each framework in turn. This approach preserves the segmentation inherent in PLA doctrine while providing conceptual underpinnings of Chinese campaign- and doctrinal-level SEAD thinking as they emerge across different operational contexts. A recurring feature of these texts is the repeated sequencing plan for SEAD attacks. First, the Chinese attack with joint firepower strikes, then electronic suppression, then UAV penetration and finally act with follow-on air penetration across multiple campaign types. This repetition is not incidental; rather, it reflects a consistent

doctrinal pattern that emphasizes preplanned system paralysis as the foundation of PLA SEAD thinking.

Firepower Campaigns

PLA firepower campaigns emphasize brief, high-intensity strikes, often measured in minutes, tightly integrated with electronic suppression, precision munitions, and joint tasks to achieve enemy paralysis. The PLA has cited OPERATION EL DORADO CANYON (U.S. bombing of Libya in 1986) and the Israeli strike on an Iraqi atomic reactor as examples of tightly compressed attack windows, often less than 8 minutes.⁷ It is also telling that they draw on lessons from the 1980s in a 2006 edition of *Science of Campaigns*. The PLA concludes firepower strikes “must be conducted in close coordination of electronic suppression to ensure campaign victory.”⁸ PLA thinking classifies firepower raids into three types: 1) long-range raids outside of enemy defense rings, 2) joint air raids, and 3) stealth sudden attacks.⁹

PLA analysis places particular emphasis on U.S. stealth operations, studying them both as threats to be countered and as models to replicate. In PLA doctrinal writings, stealth is framed less as a survivability measure and more as an enabling mechanism for penetrating defended airspace to strike critical, otherwise inaccessible nodes within an enemy’s air defense system. Chinese sources argue that such attacks can “paralyze enemy air defenses in one blow,”¹⁰ reflecting a belief that access to high-value targets, rather than attrition of the broader air defense network, is the decisive factor in SEAD.

For the Chinese, electronic warfare is consistently treated as an inseparable component of stealth employment, intended to facilitate access, suppress residual defenses, and amplify the effects of these strikes. In PLA assessments of OPERATION ALLIED FORCE, U.S. stealth aircraft losses are attributed not to inherent vulnerabilities in stealth operations, but to insufficient electronic warfare layering and the post-Gulf War reduction of dedicated airborne EW platforms.¹¹ This doctrinal pairing of stealth-enabled access and electronic suppression reinforces a SEAD conception focused on rapid, preplanned paralysis through selective strikes against key targets, rather than sustained suppression of adaptive air defense systems.

Island Seizure Campaigns

In island seizure campaigns the PLA discusses timing of operations and reliance on high technology weaponry. The primary driver for the PLA in new weapons is increased accuracy. According to the *Science of Campaigns*, “hit probabilities of cruise missiles, anti-radiation missiles, and laser guided bombs are 75 percent, 87 percent, and 86 percent (respectively).”¹² Real-world radar tactics, such as emission control, can reduce anti-radiation missile hit probability significantly. This underlines how doctrine can be divorced from reality because of a lack of experience in warfighting. The PLA goes on to discuss other advanced weapons transforming warfare. Electromagnetic pulse (EMP) weapons can be used to destroy parts of command and control systems “within dozens of kilometers simultaneously.”¹³ The academic writing on EMP weapons appears in several places across PLA and academic literature and offers another method to suppress electronic networks. The island seizure campaign section calls for the development of “high technology

weapons,” listing anti-radiation weapons and EMP weapons as examples, both of which have SEAD applications.

With respect to campaign timing, PLA doctrine emphasizes a linear sequencing of operations across services and highlights the symbiotic relationships among the PLAAF, People’s Liberation Army Navy (PLAN), and People’s Liberation Army Rocket Force (PLARF) in executing SEAD missions. In a Taiwan scenario, targeting by these services is intended to enable the maritime crossing and landing of the main assault force.¹⁴ More importantly, PLA sources state that “air dominance should occur in the later stages of the integrated firepower strike or slightly thereafter,” suggesting that a large-scale joint firepower strike precedes sustained air and maritime penetration operations.¹⁵ This sequencing implies that the PLARF plays a role in shaping SEAD efforts comparable to that of the PLAAF. Both the *Science of Campaigns* and the *Science of Second Artillery Campaigns* doctrinal writings emphasize the symbiosis between PLARF deep strikes and the success of air and island seizure campaigns. Under this model, the PLAAF must conduct SEAD operations sufficient to permit freedom of maneuver over contested airspace, with SEAD occurring prior to the commitment of ground landing forces to enable air assault operations on islands. Island seizure campaigns therefore provide a clearer understanding of broader PLA campaign priorities.

Air Campaigns

This section outlines how a successful air campaign sequences pre-strike reconnaissance, concentrated electronic warfare, hard-kill suppression, and integrated penetration to create and exploit gaps in an adversary’s air-defense system.

Both the *Science of Campaigns* and the *Science of Second Artillery Campaigns* discuss mapping enemy locations *before* beginning operations. The Second Artillery publication emphasizes “first, employ electronic warfare reconnaissance means to engage in direction finding and positioning *vis-à-vis* the enemy’s electromagnetic radiation target.”¹⁶ Air Force campaigns emphasize that reconnaissance activities must acquire C2 systems, SAM and anti-aircraft artillery (AAA) guidance locations to create favorable attack conditions in the opening of a campaign.¹⁷ Considering the high amount of ISR assets the PLA deploys in gray zone campaigns around Taiwan and Japan, it is clear the PLA operational actions match doctrinal concepts. Cyber resources can also be used for reconnaissance to map out the cyber domain that enables enemy IADS.¹⁸ The PLA emphasizes collection across cyber, maritime and air domain to create an integrated picture that can be attacked.

Once a validated target set is identified, operations shift toward the application of electromagnetic effects to blind, confuse, and degrade enemy sensors. Jamming efforts emphasize early warning satellites, airborne warning and control aircraft, ground-based long-range radar, surface-to-air missile guidance radar, and broader C4ISR networks,¹⁹ creating favorable conditions for subsequent penetration and strike activities.²⁰ While electronic warfare is a core component of SEAD for all modern air forces, the PLA’s doctrinal emphasis, force structure, and sustained investment place electronic attack at a far more central position in its warfighting concept than in current U.S. practice.

Complementing electromagnetic attack, cyber network operations are designed to delete, deceive, or manipulate adversary networks, further paralyzing air defense operations.²¹ The combined application of kinetic firepower, electromagnetic effects, and cyber-attacks against an integrated air defense system is intended to enable follow-on air raids or penetration operations. Both PLA electronic warfare analyses and air campaign doctrine reinforce the PLA's affinity for electromagnetic warfare and its tight coordination with joint firepower strikes.²² Executing these operations requires synchronization across services, with the PLARF and PLAN providing early suppression fires to shape the battlespace.

Joint operations are continually discussed in the *Science of Military Campaigns* and *Science of Second Artillery Campaigns*. The PLAAF is expected to rely on the PLARF and the PLAN to suppress selected targets within the range of their respective weapons. *Science of Second Artillery Campaigns* even explicitly discusses the use of anti-radiation warheads to destroy enemy radar systems and outlines a sequencing model in which Rocket Force units provide advance firepower suppression, followed by anti-radiation UAV strikes and subsequent "on-call" firepower suppression.²³ What remains unclear, however, is which service retains ownership of UAV operations, particularly for SEAD-tasked unmanned systems. Taken together, these texts suggest a sequencing of operations in which initial firepower strikes are followed by unmanned attacks and then manned air penetration. While doctrinally coherent, this model reflects an ambitious and highly integrated joint SEAD concept whose execution would require precise coordination across services, an ability the PLA has yet to demonstrate under combat conditions.

PLA doctrine characterizes SEAD as the coordinated application of "hard" and "soft" suppression methods, with electronic attack constituting soft suppression and firepower attacks forming the core of hard suppression. Preferred firepower methods against integrated air defense systems are listed in order: anti-radiation UAVs, anti-radiation ballistic missiles, anti-radiation cruise missiles, and air-launched anti-radiation missiles intended to strike enemy electromagnetic targets.²⁴ These firepower attacks are envisioned to open gaps in the enemy IADS prior to the launch of strike formations, reinforcing the assessment that the Rocket Force and standoff munitions play a central role before manned air penetration.²⁵ During the penetration phase, high-performance fighter aircraft are expected to sortie in a concealed manner to conduct surprise attacks against enemy command and control nodes.²⁶ The platforms employed and the sequencing of these strikes differ markedly from U.S. approaches to SEAD: the United States lacks anti-radiation ballistic missiles, anti-radiation cruise missiles, and anti-radiation UAVs. This divergence marks a clear point at which PLA SEAD doctrine departs from Western models rather than replicating them.

The PLA has two types of airborne penetration attacks: stealthy and storming attacks.²⁷ Stealthy penetration, either low-observable aircraft or low-altitude approaches that minimize detection and can surgically strike critical nodes, and "storming" or storm-penetration, which fuses mass firepower quantities with concentrated EW to open one or more penetration corridors. Tactically, this means concentrating jamming and anti-

radiation weapons to create radar blind zones, using high-penetration strike elements to attack C2 and AWACS pre-strike, and leveraging the Rocket Force and naval/army fires to suppress airfields and major SAM sites.

Rocket Force in PLA SEAD Doctrine

Unlike U.S. doctrine, which treats long-range fires as a supporting element within an air-centric SEAD construct, PLA doctrine assigns conventional missile forces a central and often initiating role in campaigns to seize air dominance. This reflects both the scale of the Rocket Force and a doctrinal belief that air defense systems can be systematically paralyzed through massed, preplanned firepower. Within this framework, SEAD is conceived less as an adaptive contest between attacker and defender and more as a problem of sequencing, timing, and system disruption—one that can be optimized through analytical design rather than iterative combat experience.

When conventional missile forces participate in operations to seize air dominance, PLA doctrine assigns them three mutually reinforcing missions: advance firepower suppression, follow-on firepower support, and physical destruction of enemy information and early-warning systems.²⁸ Advance firepower suppression consists of segmented ballistic and cruise missile strikes against critical airfields, long-range sensors, and command-and-control nodes, often timed to coincide with or immediately follow anti-radiation UAV offensives at the outset of a joint campaign.²⁹ These strikes are intended to degrade sortie generation, disrupt C2, and suppress early-warning functions so that follow-on air and naval forces can conduct supplemental attacks against regional air-operations infrastructure. Follow-on firepower provides on-call strikes to exploit gaps created by initial shaping fires, while supplemental assaults consolidate control of the air by finishing degraded nodes.

PLA doctrine also emphasizes the direct physical destruction of air-defense information systems during the initial phase of air-to-ground fire penetration. Guidance calls for employing anti-radiation ballistic missiles against high-value electromagnetic targets, e.g. long-range early-warning radars, in deep penetration zones, followed by the use of EMP munitions or other hard-kill effects to disable air-defense electronic networks along defined penetration corridors. In parallel, anti-radiation cruise missiles, air-launched ARMs, and unmanned systems are tasked to attack radar sites, communication hubs, and critical radio infrastructure, while conventional precision-guided missiles, steered by radiation-source location systems, deliver hard kills against the most valuable remaining nodes.

Taken together, these doctrinal prescriptions portray missile forces not as a supporting enabler of air operations but as a structural pillar of PLA SEAD campaigns. Missile strikes are expected to initiate suppression, shape the battlespace, and create predictable conditions for follow-on air penetration, rather than dynamically responding to defender adaptation. This missile-centric conception of SEAD reinforces a broader PLA preference for preplanned, system-level paralysis achieved through massed firepower and analytical sequencing, a conceptual approach that sets the conditions for, but does not itself resolve, the challenges of execution, adaptation, and tactical integration examined in subsequent sections.

It is important to recognize that many PLA doctrinal texts are aspirational and do not necessarily reflect current capabilities or the existing force mix. Secrecy surrounding Chinese "assassin's mace weapons" (杀手锏), i.e. high-tech tools designed to help a weaker military defeat a stronger one through a surprise "trump card", further complicates efforts to assess the People's Liberation Army's maturity in disabling enemy air defenses. This is particularly true for specialized capabilities like anti-radiation ballistic missiles and electromagnetic pulse weapons that could suddenly paralyze an opponent's digital and radar systems. Nevertheless, the volume and consistency of Chinese academic and doctrinal writing on these systems, combined with their relative technological feasibility, suggest that the PLA could have limited EMP and anti-radiation ballistic missile capabilities.

Chinese sources frequently describe future concepts, such as EMP strikes, swarming anti-radiation UAVs, or massed standoff fires, as if they were operationally mature. In practice, however, the gap between doctrine and execution can be substantial. Russia, for example, fielded advanced Flanker variants and Kh-31P anti-radiation missiles, yet its efforts against Ukrainian integrated air defenses have been uneven and often ineffective. This precedent suggests that even if the PLA fields advanced SEAD-enabling weapons, their effectiveness in a contested and adaptive environment remains uncertain. Accordingly, this study treats PLA doctrinal texts as indicators of intent and conceptual direction, while acknowledging that actual employment may diverge significantly from doctrinal ambition, a gap that the following sections on platforms and tactics explore in greater detail.

SECTION III: PLA SEAD WEAPONS & PLATFORMS

PLA SEAD doctrine places extraordinary weight on advanced platforms, precision weapons, and unmanned systems as the means by which air defense suppression can be engineered through preplanned effects. Yet when assessed through the lens of force structure, observable deployment patterns, and scale, the PLA's SEAD platform ecosystem reveals a persistent imbalance: conceptual ambition and technical experimentation have outpaced operational mass and institutional maturity. This section therefore treats platforms not as ends in themselves, but as indicators of how PLA SEAD doctrine translates, or fails to translate, into executable capability.

To structure this assessment, the discussion proceeds across three enabling pillars of PLA SEAD: (1) anti-radiation weapons, (2) unmanned systems, and (3) dedicated airborne electronic attack aircraft. Detailed historical development, platform lineage, and unit-level attribution are intentionally minimized here and reserved for a companion study. Instead, the focus is on how current platforms support, or constrain, the doctrinal model outlined in earlier sections.

ANTI-RADIATION WEAPONS

The PLA is developing a diverse portfolio of anti-radiation weapons, ranging from legacy systems such as the YJ-91 to newer air-launched missiles and trade-show concepts

(e.g., LD-8A, TY-14). On paper, this inventory suggests rapid technological progression. In practice, however, the YJ-91, derived from the Russian Kh-31P, remains the dominant and most widely integrated anti-radiation missile across PLAAF and strike platforms.



Figure 5: YJ-91 Anti-Radiation Missile³⁰

Publicly available imagery collected of Chinese YJ-91 missiles in Appendix A indicates that YJ-91 integration has steadily proliferated since the mid-2000s across Su-30MKK/MK2, JH-7A, J-10, J-15, and most recently the J-16 aircraft. This breadth of integration supports the conclusion that the YJ-91 will remain the “workhorse” anti-radiation missile for PLA SEAD in the near to medium term, regardless of newer missile designs. By contrast, more advanced ARMs like the LD-10a or LD-8a appear either not yet fielded across front-line forces or only at trade show displays for export.

Crucially, the PLA does not appear to operate dedicated SEAD squadrons or brigades in the Western sense. American units traditionally concentrate SEAD weaponry at one particular base, like Shaw Air Force Base. The benefit of this is threefold; pilots can become experts in a specific mission set, the weapons can be maintained and concentrated at units which are most likely to use them, and supporting EW ranges for training can be built out close to the base. Instead, the PLA appears to treat SEAD as a mission set distributed across multi-role units, with pilots trained to employ anti-radiation weapons episodically rather than as part of permanently missionized suppression formations. This organizational choice reinforces a doctrinal preference for preplanned strikes over adaptive, continuously executed suppression. It could also be explained by the PLA model of training, where units rotate through all training missions and weapons in a given year to be well-rounded rather than specialize.

	(USAF- Comparison)						
Anti-Radiation Missiles	<i>AGM-88</i> ³¹	<i>TY-14</i> ³² 天鹰-14	<i>LD-8</i> ³³ 雷电-8	<i>LD-10</i> ³⁴ 雷电-10	<i>YJ-91</i> ³⁵ 鹰击-91	<i>CM-102</i> ³⁶	<i>CM-400 AKG</i> ³⁷
Range	48–150 km	100–150 km	70–160 km	80 km	150 km	100 km	240 km
Weight	360 kg	Unknown	130 kg	200 kg	600 kg	350 kg	910 kg
Warhead Size	65 kg	Unknown	30 kg	20 kg	90 kg	70 kg	150 kg
Guidance	ARH + GPS	ARH + IR	ARH	ARH	ARH	ARH	IR / TV / ARH
Seeker Band	--	Unknown	Unknown	Unknown	2–18 GHz	2–18 GHz	Unknown
CEP	--	Unknown	4 m	Unknown	8–10 m	7 m	5-10 m
Platform	F-16, F-18	CH-7 UAV	J-35/Wing Loong X	J-17	J-16, J-15, J-10, J-11	JF-17, JH-7A, WZ-700	JF-17
Operationally Deployed	Yes	No	No	Unknown	Yes	Unknown	Unknown
	(USAF- Comparison)						

Table 1: China's Anti-Radiation Missiles

UNMANNED SYSTEMS

Unmanned systems occupy a privileged position in PLA SEAD doctrine, but operational evidence paints a more constrained picture. Stockholm International Peace Research Institute and manufacturer disclosures indicate that Chinese defense firms have delivered hundreds of medium-altitude and strike-capable UAVs to foreign customers, while publicly available assessments do not document comparably large, itemized PLA inventories of equivalent systems, suggesting that export production has been at least comparable to, and likely exceeds, what can be substantiated for PLA procurement in open sources.³⁸

The backbone of UAV SEAD in PLA is the ASN-301 anti-radiation loitering munition. The ASN-301, a domestically improved version of the Harpy, appears to exist in limited numbers. Across two major PLA parades, approximately 54 ASN-301s were displayed.³⁹ PLA originally purchased 100 Harpys from Israel in 1995. It is unclear if those were modified into ASN-301s or if ASN-301s are domestically produced copies. Additionally, no clear evidence emerged identifying the service, brigade, or launch organization responsible for their employment. PLA writings discuss using UAVs to saturate air defense areas. Yet at the scale implied in doctrinal writing, the quantity of anti-radiation drones required would be by orders of magnitude higher than what is currently observed. Based on conservative suppression modeling for Taiwan, such a strategy would likely require at least one battalion-sized, and more plausibly one brigade-sized, organizational structure dedicated to one-way attack UAVs, including logistics, launch infrastructure, command-and-control, and replacement capacity. Based on analysis, achieving saturation of Taiwan's integrated air defense system as described in PLA doctrine would likely require on the order of approximately 2,000 one-way anti-radiation drones.



Figure 6: ASN-301 Anti-Radiation Drone⁴⁰

By contrast, the PLA appears to have made more tangible progress in the large-scale conversion of legacy platforms into expendable systems, particularly through the adaptation of retired J-6 airframes into the J-6W target drone series. Studies estimate the PLA may have 580 J-6W variants converted from decommissioned MiG-19-derived aircraft.⁴¹ While these systems lack sophistication, survivability, and adaptability, they offer quantity at scale. As such, J-6W-type drones could plausibly be employed in saturation roles, overwhelming air defense sensors, forcing emissions similar to USAF MALD-J. This approach reinforces a broader PLA preference for achieving effects through mass and preplanned saturation, even when individual systems remain technologically limited.



Figure 7: J-6W UAV Conversion⁴²

More advanced UAV platforms frequently cited in PLA doctrine and promotional materials, such as the WJ-700 or armed CH-5/CH-6 series variants, remain largely absent from routine operational activity in the Taiwan Strait. Taiwan ADIZ data from 2020–2024 show that UAVs account for less than four percent of total PLA air sorties,⁴³ and the vast majority of these UAV sorties are conducted by unarmed platforms such as the BZK-005 and BZK-007. Critically, UAV systems are not assessed to be equipped with anti-radiation missiles and appear to function primarily as intelligence, surveillance, and reconnaissance (ISR) assets rather than SEAD platforms.

BZK-005	116
BZK-007	20
CH-4	30
J-7 UAV	7
TB-001	25
Unspecified UAV	58
WZ-10	5
WZ-7	34
Total Sorties of all types of aircraft	7898

Table 1 PLA UAV Sortie Count in Taiwan de facto ADIZ 2021-2025⁴⁴

When the analysis is narrowed further to UAVs with credible anti-radiation capability, the proportion becomes smaller still. While the PLA has developed or displayed several unmanned systems associated with anti-radiation roles, such as loitering munitions derived from the Harpy and ASN-301 or platforms reportedly capable of employing weapons like the CM-102 anti-radiation missile, these systems appear in limited numbers and are not routinely observed in Taiwan Strait operations. If the PLA possessed the UAV-based SEAD force structure implied by its doctrinal emphasis on unmanned and distributed suppression, a substantially larger share of routine air activity, particularly in a high-priority theater, would be expected to involve UAVs configured for anti-radiation or electronic attack missions. Instead, current deployment patterns suggest that unmanned SEAD remains largely aspirational, with operational UAV employment focused on ISR rather than active suppression of air defenses.

Name	Year Released	Development status	Quantity	ARM capable?	Associated ARM munition
Harpy	1995	Deployed	100	ARM seeker integration	Kamikaze drone
ASN-301	2010s	Deployed	54+	ARM seeker integration	Kamikaze drone copy of Harpy
CH-5	2016 Zhuhai	Deployed	Unknown	Yes	AR-1 marketed w/ARH seeker option
CH-6	2021	Testing	Unknown	Unknown	Unknown
CH-7	2018	Late testing stages	Unknown	Unknown	Unknown
WJ-700	2018	Deployed	12+	Yes	CM-102 staged at airshow

Table 2 China SEAD Capable UAV Summary

Taken together, the UAV pillar of PLAAF SEAD reveals a familiar pattern: strong doctrinal emphasis, promising technical experimentation, but unresolved challenges of scale, organization, and sustainment.

ELECTRONIC ATTACK AIRCRAFT

The introduction of dedicated electronic attack variants, the J-16D and, more recently, the J-15D, represents a meaningful step toward aligning PLA force structure with its doctrine of electromagnetic dominance. These platforms signal recognition that continuous, manned electronic attack is indispensable for suppressing adaptive air defenses.

Available evidence strongly suggests that these aircraft remain fielded in very limited numbers. Moreover, the development cycle, from initial testing through public unveiling and production, has exceeded a decade. Production rates have remained low, signaling either persistent technical challenges or a comparatively low institutional priority placed on fielding tactical electronic warfare aircraft at scale.⁴⁵

The J-16D has appeared primarily in airshows, parades, and controlled exercises, with no open-source indication of large-scale serial production or routine deployment across multiple brigades. The PLAAF has at least 12 J-16D aircraft as of 2024.⁴⁶ The J-15D is even earlier in its operational lifecycle, with initial carrier-based deployments observed; only one J-15D has been seen across media reports.⁴⁷

Absent evidence of high-rate production or the emergence of dedicated electronic attack brigades, PLA airborne tactical electronic attack remains an important but niche enabler, not yet capable of fulfilling the doctrinal role assigned to it. The volume of official commentary and promotional reporting surrounding platforms such as the J-16D, often portraying them as transformative to China's airpower, underscores the PLA's perceived importance of electronic attack but also highlights a growing gap between rhetorical emphasis and observable capability based on scale and routine operational employment. While this gap may narrow over time, current evidence suggests that PLA airborne SEAD remains a capability to monitor closely rather than one that has already achieved doctrinal maturity.

A TRIAD WITH AN UNEVEN CENTER OF GRAVITY

Viewed holistically, PLA SEAD capability rests on a notional triad: Rocket Force strikes against fixed targets, UAV-based suppression and decoys, and manned airpower delivering anti-radiation weapons and electronic attack. Of these, the PLARF component is the most mature and scalable, particularly against static infrastructure. UAVs show promise at the low end (mass) and high end (concepts) but lack demonstrated organizational coherence. The airborne SEAD arm, especially manned suppression under contested conditions, remains the least developed.

Even if more advanced systems, such as the LD-8A or stealth-integrated anti-radiation missiles, are eventually fielded on fifth-generation platforms like the J-20 or J-35, they are unlikely to constitute the preponderance of PLA SEAD capability. This reflects force-structure realities and employment logic rather than technical feasibility. Fifth-generation aircraft are high-value, low-density assets optimized for counter-air and strategic penetration missions, and their routine employment in high-risk SEAD roles would impose disproportionate operational and signaling costs. Recent combat experience, including Russia's loss of Su-35s in Ukraine and the associated reputational and deterrence effects, illustrates how the attrition of marquee platforms can shape

external perceptions of military capability, an outcome the PLA is likely to consider in its own force employment calculus.

Observable deployment patterns instead suggest that the YJ-91 will remain the backbone of Chinese anti-radiation operations for the foreseeable future. The wide distribution of YJ-91 across PLAAF units indicates PLAAF views that every unit should do SEAD rather than take a specialized desired operational capability (DOC) statement mission set where specific units preform SEAD missions. Even though units like 98th Brigade in Chongqing show high levels of experience with YJ-91, units like this are exception not the rule. This organizational approach aligns with a model in which anti-radiation capabilities are added to existing strike units rather than institutionalized through purpose-built formations designed for sustained suppression of adaptive air defense systems.

In sum, PLA SEAD platforms reflect a force that is technically ambitious but structurally constrained. Weapons exist, platforms exist, and doctrine is clear, but the mass, integration, and training depth required to execute campaign-level SEAD against a resilient defender remain underdeveloped. While the PLA's SEAD capabilities are advancing quickly and narrowing the technological gap with Western air forces, the absence of comparable training depth and operational experience continues to limit their effective employment. The imbalance sets the conditions for the training and tactics gaps examined in the following section.

SECTION IV: TACTICS AND TRAINING – THE MISSING LINK

The PLA divides SEAD into two operational patterns: localized suppression and campaign-level suppression. Campaign-level suppression adopts a systems-warfare approach that seeks to paralyze an enemy IADS by striking key nodes. In its ideal world, the PLA would collapse an IADS by striking pre-planned nodes and there would not be a need for localized SEAD because the system would be paralyzed. However, the PLA defines localized suppression, what U.S. doctrine would call “tactical” suppression, as targeting a limited area for a defined period to protect an assault or strike formation. Tactical suppression typically begins by creating a “breakthrough route.” Campaign-level operations are driven by pre-planned strikes against known strategic targets, whereas localized suppression requires forces to react rapidly to dispersed, unlocated emitters, and suppress them on short notice.

Asset allocation follows the same distinction. Theater-level standoff jammers (e.g., Y-8GX-3 or Y-9LG) are held for campaign-level suppression because of limited resources and the need to operate outside enemy SAM engagement envelopes. Likewise, Rocket Force fires are primarily a campaign asset: it is impractical for Rocket Force units to fire in the same area while assault aircraft are penetrating. There can be sequential coordination, i.e. fires to shape the objective before penetration, but not fires during the penetration itself. For example, the *Science of Campaigns* directs that fire preparation for airborne assaults occur minutes to hours in advance and finish no later than when the advance echelon reaches the airspace above the landing area.⁴⁸ Achieving the breakthrough is therefore principally the responsibility of aviation, fighter-bomber and army ground-attack, units together with Rocket Force fires.⁴⁹

Chinese doctrine calls for campaign-level joint suppression to shape the battlespace first, prioritizing firepower strikes supplemented by electronic attacks, followed by multiple tactical-level suppression actions that prioritize electronic attacks supplemented by firepower; campaign suppression may suffice when friendly forces greatly dominate, but even when forces are evenly matched or the enemy is stronger, the campaign phase should still precede tactical strikes.⁵⁰ This notion largely explains why the Chinese perceive the J-15D and J-16D jamming aircraft as so important to their ability to achieve localized IADS suppression.

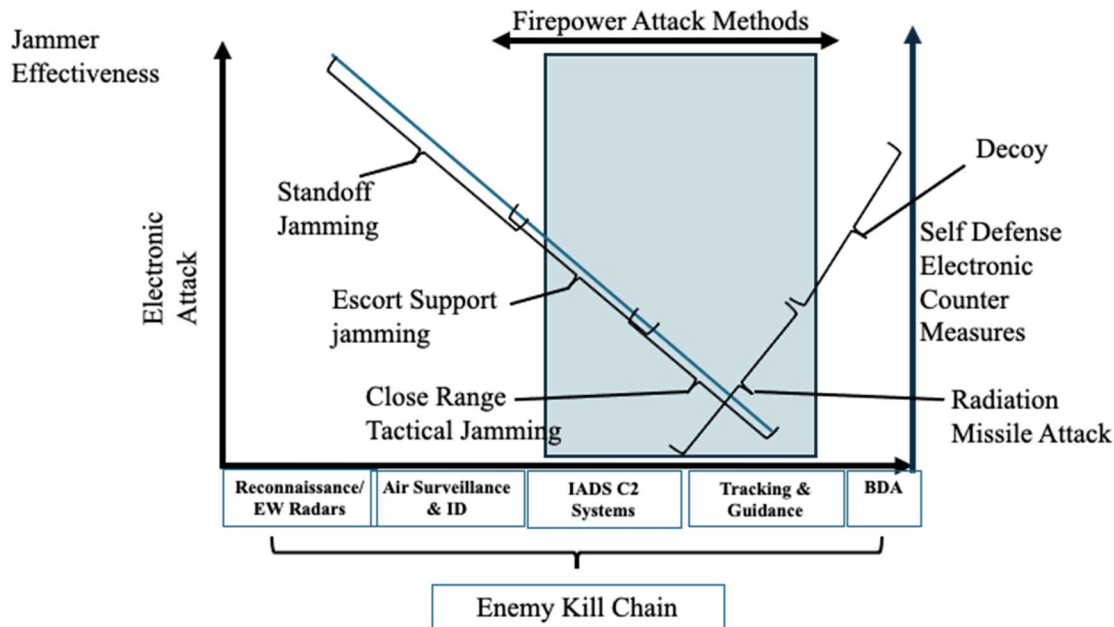


Figure 8: Diagram Illustrating the Relationship Between Tactical Joint Pressure Operations and the Enemy's Precision Air Defense Kill Chain⁵¹

Figure 8 is translated from *Theory and Tactical Analysis of Joint Electronic Countermeasures for Suppressing Enemy Air-Defense Systems*, and is arguably the clearest single visual of how Chinese thinkers conceptualize SEAD: not as two separate activities, i.e. EW supporting kinetic strikes, but as a continuous, layered spectrum of effects against a notional IADS. On the diagram, electronic attack and firepower sit on a single operational axis: long-range standoff jammers compress early-warning bubbles, escort jammers ride with assault echelons to hold local windows open, deception and decoys generate false tracks, and only after sensors and C2 are degraded do anti-radiation weapons and precision strikes execute target elimination. The chart therefore collapses “soft” and “hard” methods into a coordinated sequence intended to paralyze the enemy kill-chain, degrade detection, sever C2, and then consolidate with hard kills, rather than simply to protect an individual strike package for a short, discrete period.

That perspective departs from the U.S. emphasis on localized, time-critical suppression. American doctrine privileges reactive, ISR-driven engagements, HARMs and hunter-killer teams that respond to emitters in real time to protect an immediate striker. The PLA chart instead frames SEAD as campaign-level systems warfare: persistent EW effects shape the battlespace first and kinetic effects follow to consolidate collapse. This doctrinal difference also helps explain Chinese operational choices. PLA analysts note limited historical ARM effectiveness, e.g. Chinese Gulf

War studies reporting only ~15–20 percent hit rates across hundreds of ARMs,⁵² and therefore prefer more cost-effective, mass-scalable methods: expendable anti-radiation loitering drones like the ASN-301 and broad, continuous jamming.⁵³ In short, Chinese thinking treats EW not as an enabler of discrete kills but as the principal mechanism for producing systemic failure across the kill-chain. Moreover, they consider EW as an unlimited supply weapon rather than relying on brittle, high-cost ARM shots alone. However, if the PLA tests its mettle in SEAD conflicts, it may find that electronic attack is not a panacea in SEAD.

EW TACTICS

Operationally the PLA treats EW as an enabler with three linked objectives: 1) seize localized electromagnetic dominance to “blind” enemy early-warning and reconnaissance nodes, 2) compress and deny enemy detection windows through high-power suppression so friendly formations can penetrate, and 3) conduct saturation deception and prepare conditions for “target elimination”, coordinated hard-kill strikes on the remaining critical nodes.⁵⁴ These objectives translate into deliberate sequencing: first degrade sensor networks and C2, then sustain deception and protection during ingress, and finally enable precision destruction of hardened nodes with missiles or strike aircraft.

A particularly interesting case of standoff jamming involves a proposal for ground-based jammers to support stealth fighter operations (See Figure 9). The author of this study critiqued U.S. stealth losses due to a lack of electronic support packaging in the Balkans. The J-20 likely is not optimized for early warning radars. To offset this, the author proposes a novel concept to use ground-based jammers against a chaff cloud background to create false targets for early warning radars while a stealth aircraft flies above the cirrus clouds undetected.⁵⁵

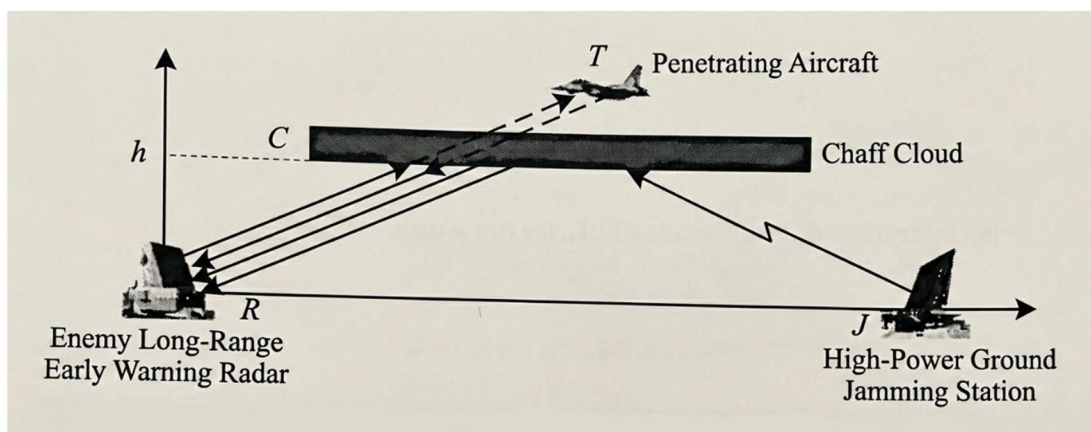


Figure 9: Schematic diagram of composite jamming implemented by a land (sea) based jamming station illuminating a chaff cloud⁵⁶

Though theoretical in nature, Figure 9 shows how seriously the Chinese take electronic attack in support of fighter operations. More importantly, Figure 9 reflects a Chinese assessment that U.S. stealth employment suffered from insufficient pairing with electronic protection and signals an intent to avoid what they perceive as an American shortcoming. From an operational perspective, this concept would not be executable. Fighter aircraft have a limited number of chaff bundles to dispense and cannot effectively have a chaff cloud below it for the hundreds of miles required to penetrate EW radar.

Chinese literature is explicit about tactics and targets of tactical airborne jamming platforms. Tactical jamming aircraft operate as close-in, highly maneuverable escorts that ride with or just ahead of air-assault echelons to provide immediate, localized electronic cover. They forward-deploy low, or in a high/low mix, with altitude separation kept small, i.e. typically within ~1–2 km, and fly in echeloned, V-formation, or parallel/crisscross patterns so jammers can place their main lobes on enemy emitters while the assault formation remains behind.⁵⁷ Their priority targets should be target-designation and fire-control radars, tracking/guidance radars, Identify Friend or Foe (IFF) and short-range command/relay links; tactically, they use individual frequency allocation, frequency-hopping and bias-directed jamming to saturate or deceive those sensors while using maneuver, emission control, decoys, and networked sensors for EW self-defense and survivability.⁵⁸

ARM EMPLOYMENT TACTICS

Chinese discussion of ARM employment tactics is notably sparse. Despite extensive PLA writing on SEAD-enabling technologies, particularly UAVs, electromagnetic environment modeling, sensor mapping, and seeker improvements, only a small number of academic articles between roughly 2010 and 2019 address ARM employment tactics directly. While it is possible that some tactical concepts remain classified, this explanation is unlikely to account for the breadth of the gap. PLA military culture treats warfare as scientifically analyzable and optimizable and Chinese doctrinal texts consistently encourage the publication of analytical and methodological work as a means of accelerating capability development. In this context, the absence of sustained, detailed discussion of ARM employment tactics more plausibly reflects genuine underdevelopment rather than deliberate concealment.

This pattern suggests a substitution of technical sophistication for tactical experience: an implicit assumption that possession of advanced weapons, sensors, and models is sufficient to produce combat effectiveness. Such an approach contrasts sharply with U.S. practice, where SEAD tactics are refined through repeated operational employment, live-force integration, and iterative learning under combat conditions. The PLA lacks this experiential foundation, and its reliance on theoretical modeling and technical optimization appears to compensate for, rather than replace, the tactical knowledge that emerges only through sustained exposure to real air defense opposition.

One of the best sources on employment tactics is Ma Yinghui's 2014 conference paper. He states there are three main ARM employment tactics. First, the standoff employment tactic, where the ARM can outrange the enemy air defenses, maximizing safety.⁵⁹ Second is the covert surprise attack, where one aircraft should go below the radar blind zone and rapidly climb to launch the ARM, then return to the blind spot.⁶⁰ Third is the "luring" tactic, where one aircraft maneuvers outside the air defense missile kinematic zone to bait the radar to turn on while the wingman shoots the ARM at the radar.⁶¹ While these descriptions represent the most explicit articulation of ARM employment tactics in Chinese open-source writing, they are likely synthesized from foreign concepts and remain relatively basic. Notably, this framework, arguably the most holistic treatment of ARM tactics available, underscores how underdeveloped and derivative PLA thinking on ARM employment remains, particularly when compared to the operational demands of integrated, contested air campaigns.

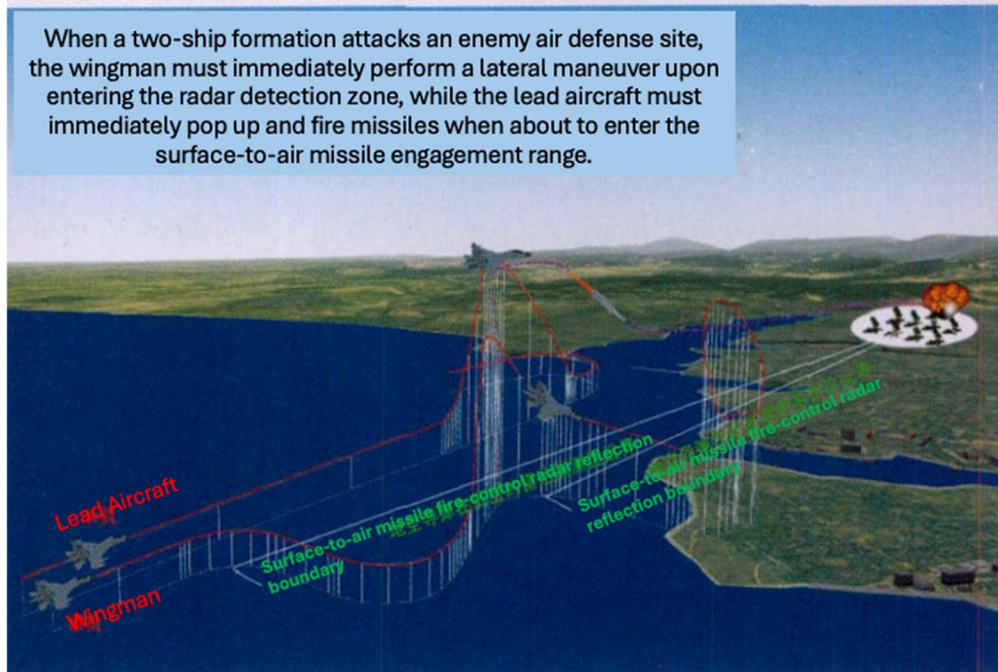


Figure 10: Chinese Lure SEAD Tactics⁶²

British SEAD concepts have likely influenced Chinese thinking on ARM employment. A 2010 *Ordnance Review* article recounts the author's visit to, and long-standing engagement with, a Royal Air Force (RAF) Typhoon fighter unit, demonstrating a detailed familiarity with Western SEAD employment practices.⁶³ Although the precise nature of the author's relationship with the RAF is unclear, the depth of tactical knowledge presented suggests direct exposure to British operational concepts, particularly those associated with British anti-radiation ALARM missile employment. The tactic illustrated in Figure 10 drawn from the 2010 article, later appeared in the film *Sky Hunter*, where fighter aircraft employ deliberate luring tactics. This portrayal underscores the extent to which British-derived air combat concepts have influenced Chinese popular and doctrinal representations of air warfare. Additionally, several graphics from the 2010 article reappear in Ma Yinghui's 2014 conference paper, indicating that Ma's treatment of ARM tactics draws, at least in part, on British-derived frameworks. The translated graphics reproduced below therefore illustrate not only Chinese conceptualization of ARM employment, but also the foreign intellectual lineage underpinning it.

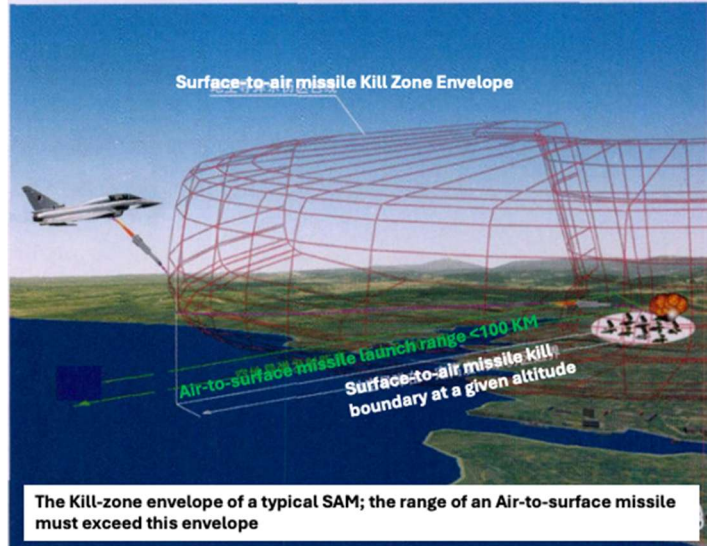


Figure 11: Typhoon Aircraft pictured in translated Chinese tactics graphic⁶⁴

Chinese tactical writing places disproportionate emphasis on low-altitude ingress and pop-up attacks as a primary means of enabling ARM employment, particularly for non-stealth aircraft. This framing contrasts with the evolution of Western airpower practice. While U.S. and allied air forces extensively employed low-altitude penetration tactics during the late Cold War, they gradually moved away from treating low altitude as a default solution due to accident risk, limited situational awareness, coordination challenges, and vulnerability to modern short-range air defenses. Western low-altitude tactics were not abandoned entirely, but relegated to specific, context-dependent scenarios rather than elevated as a central SEAD paradigm. By contrast, Chinese discussions often present low-altitude surprise as a broadly applicable solution to survivability and detection challenges, despite the significant range penalties imposed on anti-radiation missiles and the resulting need for aircraft to approach dangerously close to defended zones.

This preference is reinforced not only in technical and academic writings but also in official cultural messaging. The 2017 film *Sky Hunter*, widely viewed as an institutional showcase of PLAAF modernization, depicts J-10 aircraft conducting low-altitude ingress to suppress an SA-6 system using classic luring tactics: one aircraft induces radar activation while a wingman launches a YJ-91 anti-radiation missile.⁶⁵ The prominence of this vignette in a film intended to advertise advanced technology and future warfighting concepts suggests that low-altitude surprise and pop-up ARM employment remain central to how the PLAAF imagines successful SEAD, even as it seeks to portray itself as a modern, technologically sophisticated force. Taken together, both doctrinal writing and official media portrayals indicate a persistence of legacy penetration logic adapted to modern sensors, rather than a conceptual shift toward standoff-dominant, adaptive suppression in deeply contested airspace.

The Chinese see the main advantages of low altitude attacks as shielding the launch aircraft from enemy radar detection and minimizing risk to the aircraft. Low attacks fit into doctrinally referenced surprise attacks and provide non-stealthy aircraft like JH-7 a way to survive. The disadvantage of launching the ARM at low altitudes, if there is no pop maneuver, is range reduction

of the ARM. A 2019 *Ordnance Knowledge* journal article suggests Su-30 MKK releasing a KH-31P at 100 meters has only a 15 km range.⁶⁶ This underscores the limits of KH-31P and the ultra-low altitude approach; aircraft must come dangerously close to attack the enemy from ultra-low altitude. Another writing on tactics suggests selecting low altitude penetration when an anti-radiation missile's range is less than the air defense missile range.⁶⁷

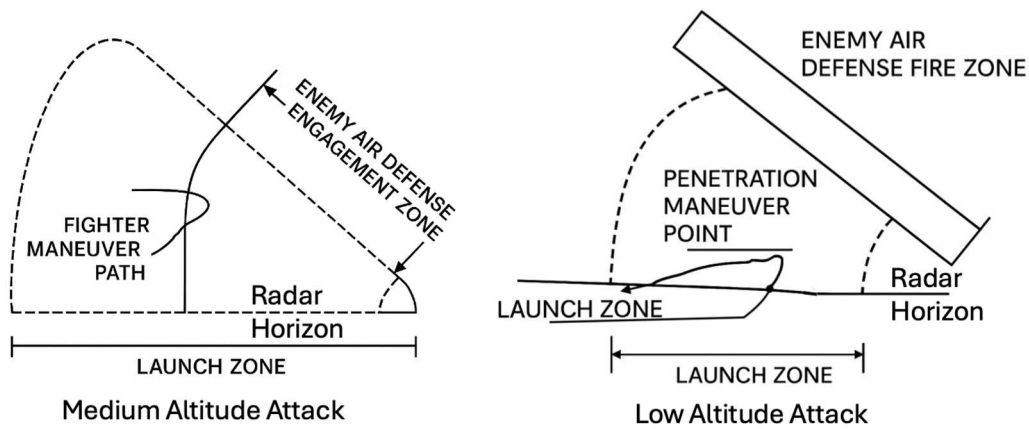


Figure 12: Low Altitude Employment Tactics⁶⁸

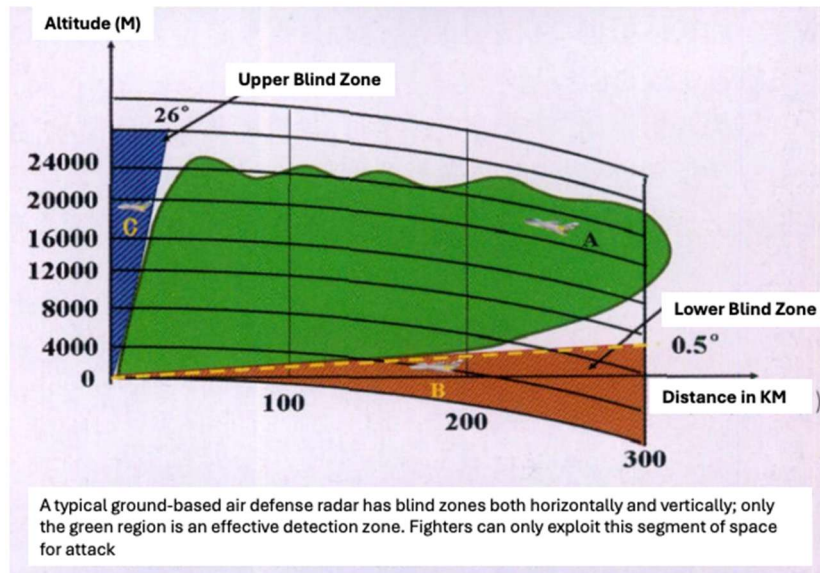


Figure 13: Low Ingress Tactics Exploring Radar Horizon⁶⁹

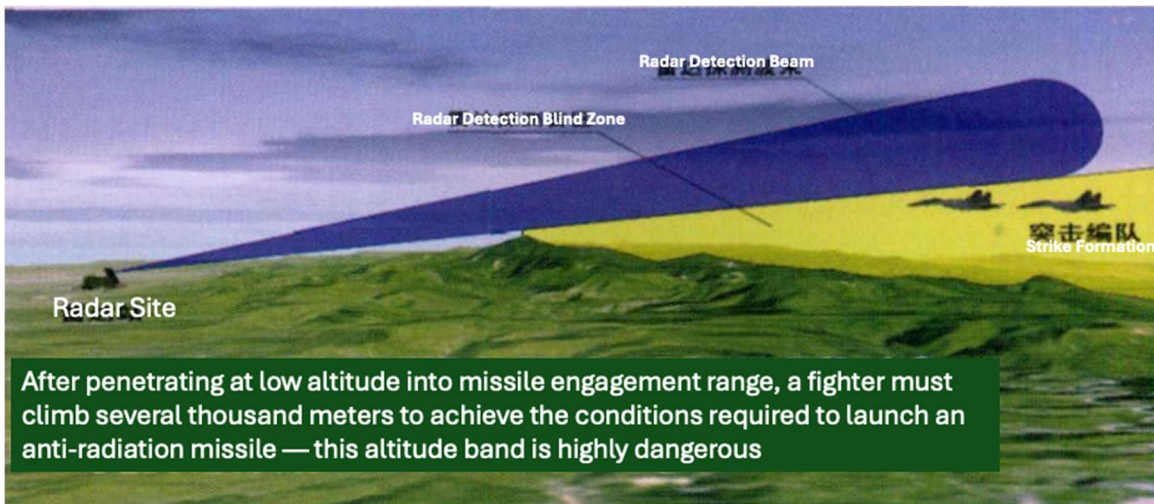


Figure 14: Terrain Masking Tactic for Low Ingress⁷⁰

Chinese researchers argue that medium-altitude ARM employment offers two primary advantages: increased weapon range and improved geolocation accuracy of enemy emitters. Several authors emphasize that flying straight and level is a prerequisite for certain geolocation algorithms, as it enables more reliable emitter localization. This is analytically significant because it implies that at least some PLA aircraft are expected to conduct organic search operations for enemy radars. Organic emitter location capability would give aircraft the ability to execute reactive localized SEAD suppression similar to U.S. aircraft. When the effective range of the ARM exceeds that of the opposing air defense system, Wang et al. advocate geolocating the emitter and then executing a feint attack just inside the air defense engagement envelope to induce radar activation before launch.⁷¹ In this construct, the aircraft itself functions as bait, trading increased exposure for targeting precision. While this discussion reflects a more advanced level of tactical awareness than many low-altitude approaches, incorporating range optimization, geolocation considerations, and risk management, it nonetheless remains rooted in preplanned geometry and cooperative radar behavior rather than adaptive suppression under contested conditions.

Chinese tactical analysis of anti-radiation missile employment is most developed in the maritime domain, where several studies explore the timing of ARM shots. From 2000-2010 several Chinese authors write papers relating to maritime ARM employment tactics.⁷² One paper calculates a model for how to synchronize multi-wave attacks consisting of three waves: anti-ship missiles, followed by ARMs followed by more anti-ship missiles.⁷³ Another paper discusses the proper mix of ARM and anti-ship missiles to achieve a hit on a ship.⁷⁴

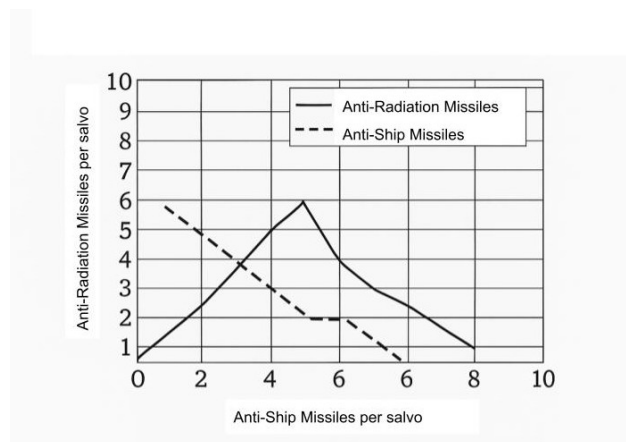


Figure 15: Relationship Between the Number ARM Missiles penetrating Defense and the Number of Conventional Anti-Ship Missiles Penetrating Defenses of Ships with Terminal Defenses⁷⁵

This maritime focus reflects both operational origins and strategic incentives. China’s initial exploration of anti-radiation missiles emerged as a response to a specific perceived threat: U.S. Aegis-equipped destroyers and their powerful naval radar systems. As a result, early Chinese analysis emphasized maritime applications, devoting disproportionate attention to electromagnetic interactions at sea, missile timing against shipborne sensors, and coordinated effects in counter-maritime strike scenarios. Imagery of PLAN Aviation Su-30MK2 aircraft carrying YJ-91 anti-radiation missiles suggests that these concepts progressed beyond theory, becoming embedded in training and force presentation. Over time, what began as a maritime-driven solution diffused outward, informing broader PLA Air Force applications rather than remaining confined to naval aviation alone.⁷⁶

What is notable, however, is what does *not* appear alongside this relatively sophisticated maritime analysis. Comparable discussion of ARM timing and synchronization is largely absent in Chinese open-source writing on land-based SEAD, particularly in support of escorting strike aircraft, protecting airlift platforms during airborne assaults, or enabling air-ground maneuver under contested air defenses. Historically, this makes sense because ARMs were originally examined as a solution to a maritime problem. Furthermore, there is little examination of how ARMs would be employed dynamically alongside manned strike packages, electronic attack aircraft, or airborne assault forces, contexts that demand continuous suppression rather than discrete, preplanned salvos. The contrast suggests that while PLA tactical thinking on ARM employment can reach a relatively advanced level when applied to tightly bounded maritime scenarios, it remains far less developed for the complex, adaptive demands of sustained land-based air campaigns.

UAV EMPLOYMENT TACTICS

UAV employment for SEAD remains aspirational rather than mature. The PLA discussed using unmanned systems for SEAD missions as early as 2004, but published and technical work suggests current Chinese anti-radiation drone capability is still relatively crude. Two PLA officers writing about anti-radiation drones in 2020 concede that, “at present, some small anti-radiation UAVs have completed the binding of relevant mission-planning parameters before launch, although anti-

radiation UAVs have advantages of EM silence, their time controllability is poor after launch.”⁷⁷ This limitation is consistent with the operational profile of systems such as the ASN-301—one-way attack drones that are largely “launch-and-forget,” following preprogrammed routes with limited ability to compensate for environmental effects like wind drift.

Despite these technical limitations, the PLA clearly aspires to make unmanned aerial vehicles a central component of its SEAD effort. Three principal drivers underpin this ambition. First, Chinese analysts have closely observed the U.S. Air Force’s sustained interest in unmanned SEAD concepts over the past two decades. Second, PLA assessments increasingly emphasize that highly contested modern battlefields may render certain airspaces too dangerous for manned aircraft. Third, UAVs are comparatively inexpensive and, if made more autonomous or “intelligentized”, can provide persistent suppression over extended periods. Reflecting this logic, *Science of Campaigns* identifies anti-radiation UAVs as a preferred weapon of choice in SEAD operations.⁷⁸ This stands in contrast to U.S. doctrine, which would certainly prioritize air-launched anti-radiation missiles as the primary means of radar suppression. The divergence underscores how the PLA envisions UAVs not merely as enablers, but as central strike platforms for suppressing enemy sensors.

Chinese literature prescribes an expansive set of tactics for anti-radiation UAVs, recommending “swarm attacks, comprehensive suppression, combining soft and hard measures, coordinated operations, luring enemy systems to activate, physical destruction, aerial ambushes, area suppression, linear suppression, corridor creation, and flexible, integrated application of multiple offensive tactics.”⁷⁹ Alongside these tactical prescriptions, PLA doctrine calls for integrated employment of reconnaissance, decoy, and anti-radiation drones to form an “integrated reconnaissance and destruction” UAV combat cluster, long-endurance electronic-reconnaissance UAVs coupled with anti-radiation strike UAVs.⁸⁰ In employment, these clusters would sweep complex enemy environments ahead of air-assault operations and then continue to provide coverage during the assault via low-power jamming or kinetic suppression as required.

When the IADS problem is simpler, for example, an isolated air defense network with known, fixed radar sites, the PLA’s solution is straightforward: employ anti-radiation UAVs to attack those sites.⁸¹ But for more complex, mobile, or dense defensive systems, Chinese researchers study swarm optimization: how many drones are required to suppress mobile SAM networks, how to route swarms to ensure coverage, and how to sustain mission persistence.⁸² A growing body of research addresses numerical optimization and route-planning methods for such swarms.

That research, however, can be misleading when translated directly into operational expectations. Laboratory or modeling studies sometimes use sanitized scenarios, for instance, analyzing a 20 × 100 km area to find 20 air-defense systems.⁸³ Such models are useful analytically, but they typically omit many real-world constraints: sensor ranges and fields of view, SAM engagement envelopes, mobility of systems, attrition rates, enemy air defenses and interceptors, logistics, and the need for sustained, round-the-clock suppression. Consider medium-range SAMs, commonly estimated at ~70–120 km, and long-range SAMs, ~150–250 km: the required SEAD footprint must extend to cover the maximum reach of all systems that can threaten friendly penetration zones. Clearing a narrow penetration lane does not eliminate the need to suppress any and every threat capable of reaching into that lane.

To illustrate the scale challenge, take Taiwan as an example. Taiwan's dimensions are roughly 394 km by 144 km; some PLA sources claim ranges for systems like the Taiwan military's "Tien Kung" family of SAMS as approaching 250 km. From imagery analysis, Taiwan has on the order of approximately 20 known SAM batteries.⁸⁴ Using conservative sensor-pattern assumptions, e.g., a 5 km search pattern field of view for a single UAV, some modeling estimates a requirement on the order of hundreds of drones in continuous flight to detect and track mobile SAMs within a tactical zone, and several times that number in expendable one-way attack UAVs once you factor in attrition, interception, and platform failures. This would require approximately 2,000 plus one-way attack drones to achieve that level of suppression. Those estimates underscore the immense scale required to accomplish the kind of suppression sweeps the PLA envisions; they also do not include the drones and supporting logistics required for continuous suppression, for example, a 24-hour combat air patrol equivalent.

Real-world scaling is nontrivial. The Russian Shahed-136 campaign in Ukraine shows that massing relatively cheap strike drones still requires a substantial industrial and logistical effort. When Russia introduced Shahed-type attacks, daily launchings were initially small, 10 per day; by July 2025 they reached hundreds per day and several thousand over a month.⁸⁵ Shahed strike success rates, after accounting for interception and system failures, have sometimes fallen well below ideal expectations. Two key lessons follow: 1) even "cheap" drones are resource-intensive to produce, field, and sustain in large numbers, they require launch fleets, transport/launcher vehicles, personnel, and unit structures which are all substantial, and 2) achieving the hundreds-to-thousands-per-day launch rates required to execute truly massed suppression across a large theater demands an industrial and organizational scale that takes time to build and that leaves logistical signatures. Applied to China, such a concept would imply the existence of a substantial industrial base and brigade-level organizations dedicated primarily to anti-radiation drones. At present, no such force structure or organizational footprint is clearly observed.

Translating PLA doctrine into operational reality, therefore, requires caution. The doctrinal preference for UAVs in SEAD, backed by prescriptive tactics, cluster concepts, and optimization studies, identifies a clear direction of effort. But material limits, e.g. onboard control and reprogramming; attrition; sensor ranges; logistics; and the industrial base to support high-rate launches, introduce a sizable gap between aspiration and present capability. Additionally, the scale required to launch initial suppression assaults and have drones in reserve requires at least a battalion-sized organization dedicated to anti-radiation drones in the PLA. In short: UAVs are at the front of the doctrinal list for SEAD, and the PLA is investing accordingly, but achieving the pervasive, persistent, autonomous suppression will require solving hard engineering, organizational, and industrial problems. We should continue to watch the development and growth of anti-radiation UAVs and track their autonomous traits.

PLA TRAINING

Taken together, available live-fire data, imagery collected and movie depictions of SEAD suggest that PLA training emphasizes platform certification and basic weapon employment rather than formation-level, missionized suppression under contested conditions. This pattern aligns closely with PLA doctrine, which prioritizes preplanned firepower strikes, pop-up attacks, and scripted suppression over reactive, real-time emitter prosecution, an approach consistent with a

force that lacks combat experience against adaptive air defenses. Chinese pilots appear qualified to carry and launch anti-radiation weapons, but there is limited evidence of routine multi-ship SEAD training, overlapping threat management, or sustained suppression against layered IADS. Even in PLA-sanctioned portrayals such as *Sky Hunter*, SEAD is depicted as the destruction of a single, isolated surface-to-air missile system. No modern integrated air defense system, by definition, consists of a lone SAM operating in isolation; effective air defense relies on multiple, mutually supporting sensors, shooters, and command elements. The absence of observable training for complex, formation-based suppression reinforces the conclusion that SEAD in the PLA remains oriented toward basic employment and certification, not the dynamic, friction-heavy execution required in modern combat.

Data remains limited on live fire tests of anti-radiation missiles, but three events have been observed. A JH-7 launched a YJ-91 verified by a mid-air launch photo around 2014.⁸⁶ In 2016, CCTV-7 program discussed J-10 firing live anti-radiation weapons during a RED SWORD exercise.⁸⁷ However, the video used what appeared to be file footage of a YJ-91 hitting a target and the J-10 carrying YJ-91 was pictured with captive air training munition (CATM) which is missing rocket propellant.



Figure 16: CCTV 7 footage from 2016 of J-10 conducting YJ-91 live fire⁸⁸

The only known live fire test of ASN-301 anti-radiation drones occurred on October 27, 2025.⁸⁹ Obviously, the Chinese are not publishing every time a live fire exercise occurs, but it does provide key points that illustrate China's intent to demonstrate a new capability or practice of a capability. This is a notable milestone; the PLA traditionally uses firepower demonstrations like this to prove a system is fielded to the global community.



Figure 17: ASN-301 Live Fire Footage⁹⁰

For comparison, a typical USAF fighter squadron conducts live weapons employment several times per year, but most units only fire full-scale munitions during the annual Weapons System Evaluation Program (WSEP). These events are limited because they require specialized ranges, instrumentation, and, in the case of anti-radiation missiles, purpose-built radar targets that are consumed after a single shot. WSEP itself is conducted at only two locations in the United States for this reason. China likely faces similar constraints. The PLA can probably conduct live anti-radiation missile testing only at the Dingxin Test and Training Base, the country's premier range complex with the necessary radar targets and instrumentation. This makes it highly likely that the widely circulated 2016 footage of J-10 and JH-7 YJ-91 launches was recorded during a unit deployment to Dingxin.

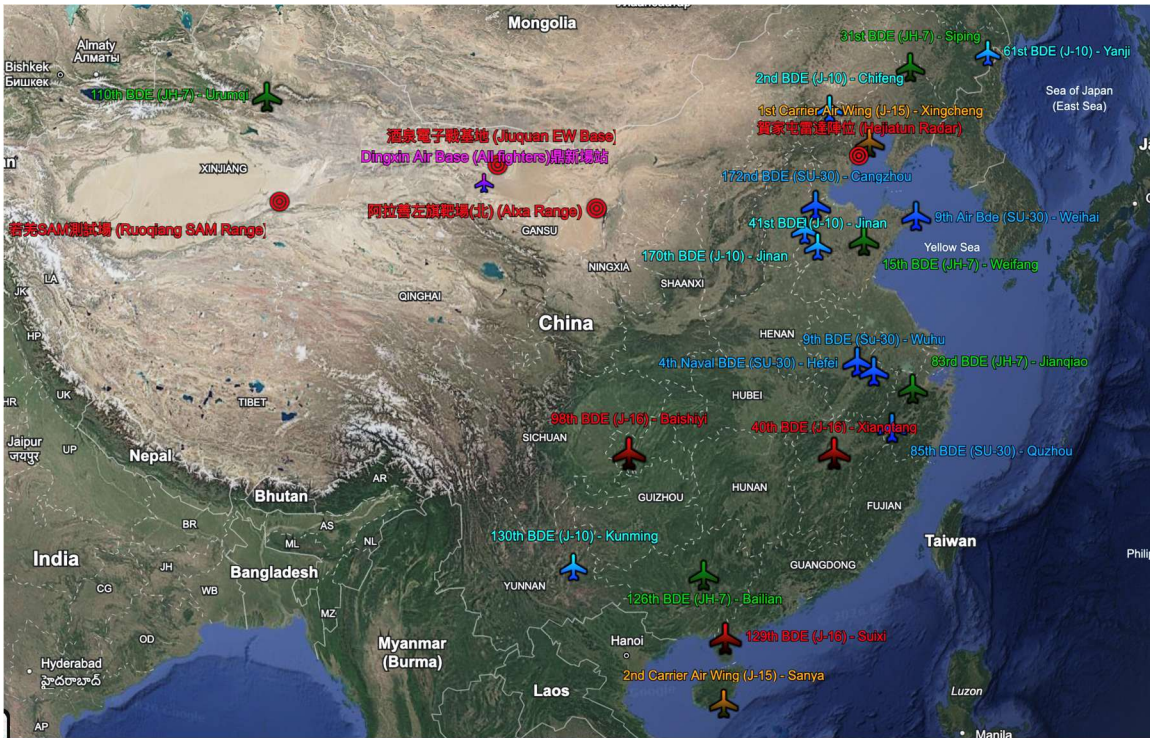


Figure 18: Overlay of PLAAF bases with YJ-91 and known EW training ranges

IMAGERY ANALYSIS OF SEAD TRAINING

A curated imagery dataset of PLA aircraft carrying the YJ-91 anti-radiation missile was assembled as the empirical foundation for this section, with full details of each photograph cataloged in Appendix A. The dataset comprises 75 photographs representing 54 distinct events between 2009 and 2025. This imagery collection provides a critical window into how the PLAAF employs and trains with anti-radiation weapons, allowing assessment of missile proliferation across units, identification of platform-weapon integration patterns, and evaluation of relative unit familiarity and experience with SEAD-relevant capabilities. While individual insights are examined in detail throughout this section, they are collectively derived from systematic analysis of this imagery rather than from isolated or anecdotal observations.

The dataset reveals notable patterns in training behavior. SEAD training spikes heavily in August and September, corresponding with the PLA’s summer training band and major events such as Red Sword. A striking feature, however, is the rarity of formation-based ARM training. Very few photographs show multiple aircraft carrying YJ-91s simultaneously, and only three images indicate formation SEAD training. Figure 15 below shows one of the three pictures of formation SEAD training.



Figure 19: PLAAF SU-30 Formation Training with YJ-91⁹¹

Several explanations for scant formation practice are possible: intentional messaging choices, a single aircraft with a YJ-91 is sufficient for deterrence signaling, CATM scarcity, or a part-task training model in which each pilot conducts periodic SEAD familiarization sorties rather than participating in fully missionized multi-ship suppression packages. Regardless of cause, the lack of observed two-ship or four-ship ARM employment stands in contrast to U.S. Air Force practice, where formation-level training is routinely photographed. If aircrews are not training together with the weapons they are expected to employ, coordinated, preplanned or time-sensitive SEAD, particularly synchronized missile shots and reactive suppression, would likely be limited, suggesting that SEAD is treated as a discrete skill rather than a fully missionized, integrated combat task.

Loadout patterns further reinforce non-missionized training approach of PLAAF SEAD units. Most PLAAF aircraft can carry two YJ-91s, yet 80 percent of training events involve only one missile, and just 14 percent show aircraft carrying two YJ-91s, the remaining 6 percent show missiles staged next to aircraft. SU-30s can supposedly hold 6 YJ-91s, but this aircraft type has only been observed in a 2009 Su-30 static display during the initial acquisition period. The scarcity of dual-missile training profiles suggests either CATM limitations or a lack of institutional emphasis on flying in full combat configurations. Smaller aircraft, such as the J-10, experience significant flight-characteristic degradation when fully loaded, making the limited training with full SEAD loads particularly important. Airshow displays, by contrast, frequently feature two-missile combat loads, a pattern not mirrored in operational training. This underlines that the operational forces may not be as prepared to carry out full combat operations with SEAD loadouts.



Figure 20: Su-30 with Six YJ-91s⁹²

Despite these gaps, the unit-level picture shows clustering of SEAD experience. Although 35 percent of photos lack identifiable unit markings due to tail obscuration or cropping, some identifiable units do appear repeatedly. The 85th Air Brigade (Quzhou) and 9th Air Brigade (Wuhu) appear most frequently across the dataset, reflecting their long-term operation of the Su-30MKK and their deep-strike mission sets. From 2019 onward, the most active SEAD units are J-16 brigades, particularly the 98th Air Brigade (Chongqing) and the 129th Air Brigade (Suixi), which appear repeatedly with operationally realistic YJ-91 configurations, multi-ship taxi sequences, and recurring seasonal activity. In contrast, JH-7A units, once central to Chinese ARM employment, appear less frequently after 2020, mirroring the type's gradual drawdown in service. The J-10 continues to appear with YJ-91s across several brigades, though mostly in airshows or single-ship training; its limited range, smaller radar, and small payload likely constrain its role to opportunistic or supplementary SEAD missions rather than primary suppression.

These platform-level findings align with seasonal patterns in the PLA's four-band annual training construct. Winter (December–February) shows minimal ARM activity, consistent with force reset and Spring Festival stand-down. Spring (March–April) marks the reemergence of ARM sorties as units refresh weapons proficiency. Summer (June–August), particularly July, shows the highest SEAD activity, often with multiple brigades across different theater commands conducting YJ-91 events within short time spans, suggesting centrally coordinated, high-intensity training. Autumn (September–November) transitions into evaluation, certification, and larger joint-firepower exercises. Taken together, these patterns indicate a deliberate, doctrinally sequenced SEAD training cycle, not ad hoc execution.

Chinese analysis of Russian airpower operations in Ukraine further illuminates how PLA analysts conceptualize SEAD effectiveness, and failure. Multiple Chinese scholars criticize the Kh-31P's outdated technology and the absence of modernized anti-radiation missile variants,

arguing that Russia's limited ARM inventory proved insufficient to suppress Ukraine's numerous surface-to-air missile systems.⁹³ These commentators also fault the Russian aerospace forces for treating SEAD as a secondary or ad hoc task rather than as a dedicated, continuously rehearsed mission set. In practice, Russian strike packages often relied on individual aircraft to sporadically attack SAMs, employing rudimentary tactics such as launching drones to stimulate radar emissions, followed by Kh-31P shots against active radars. Chinese analysts conclude that Russia's immature ARM technology and underdeveloped SEAD training contributed directly to its failure to achieve effective air defense suppression.

The reality not understood by the Chinese is that SEAD is a hard human endeavor. SEAD cannot simply be a collection of technical capabilities, the SEAD system must be operated by humans that can sense their environment and react to changes. Coordination amongst elements of SEAD, firepower attacks and intelligence assessing effectiveness of remaining IADS must constantly communicate. Furthermore, Chinese critiques are notable not only for what they say about Russia, but for how closely China echoes the same structural features of Russia. For example, PLAAF emphasis on basic weapon employment, limited formation-level suppression, and reliance on scripted engagements rather than sustained, adaptive execution.

Taken together, PLA tactics and training reveal the central vulnerability in Chinese SEAD development: a force optimized to execute preplanned suppression, but not to adapt dynamically under combat conditions. Doctrine assumes that early firepower and electronic effects will sufficiently paralyze enemy air defenses, reducing the need for sustained, formation-level suppression or real-time emitter prosecution. Training patterns, focused on platform certification, seasonal weapon employment, and limited multi-ship SEAD integration, reinforce this assumption rather than stress it. The PLA appears to recognize, at least analytically, why Russian SEAD failed in Ukraine, yet its own training practices exhibit many of the same structural limitations. This gap between doctrinal ambition and practiced execution constitutes the missing link in PLA SEAD capability and frames the question of whether improved platforms or weapons alone can compensate for the absence of combat-hardened, adaptive suppression proficiency.

CONCLUSION: A DISJOINTED EVOLUTION-BRIDGING THE GAP BETWEEN DOCTRINE AND FORCE

This study argues that the PLA is developing a concept of SEAD grounded in systems warfare, electromagnetic dominance, and preplanned suppression, but that this effort remains unevenly translated into operational capability. Chinese SEAD doctrine is sophisticated, internally coherent, and technically ambitious. It emphasizes long-range fires, persistent electronic attack, and unmanned systems to paralyze an enemy IADS before manned aircraft are exposed. Yet across platforms, weapons, and training, the same pattern recurs: conceptual clarity has outpaced force structure, operational scale, and experiential maturity.

This imbalance is not accidental. The PLA approaches SEAD as an engineering problem, one to be solved through modeling, preplanned effects, and technical substitution for combat experience. In the absence of real-world suppression campaigns, Chinese analysts have sought to optimize the electromagnetic environment in advance rather than fight dynamically within it. That

worldview explains the heavy emphasis on electronic attack, anti-radiation UAVs, and scripted suppression sequences, and also helps explain why reactive, formation-level SEAD training remains limited in observable practice.

A Taiwan contingency would be the first true test of this model. Against fixed, well-characterized targets, the PLA's approach may prove effective. Rocket Force strikes, preplanned electronic attack, and long-range suppression could severely degrade known radar sites and communications infrastructure early in a campaign. However, once defenses begin to move, radars emit intermittently, or exploit deception, the PLA would be forced into a regime it appears less prepared to fight: adaptive, time-critical suppression under uncertainty. As the Russian experience in Ukraine illustrates, the gap between technical theory and operational reality can become apparent very quickly once a defender refuses to behave as modeled.

Taiwan's challenge is to endure through the first wave of PLA SEAD operations, preserving enough sensors, shooters, and decision-making capacity to prevent suppression from becoming paralysis.

During the first wave of airborne attacks, ostensibly from anti-radiation UAVs it will be critical to identify type of targets at range to preserve SAM magazine depth. Taiwan should avoid shooting down anti-radiation drones with million-dollar PAC-2 interceptors. The ASN-301 is a low-altitude, slow-moving target with no known infrared countermeasures, making it ideal for engagement by shoulder fired stinger weapons. Taiwan's geography and force structure create natural advantages here. A small team on Taiwan's offshore islands, for example, or even civilian-pattern fishing boats positioned in the strait with FM-92 Stingers, could intercept an entire wave of ASN-301s well before they approach the main island. Given the drone's relatively slow cruise speed, roughly 200 km/h, such teams could destroy ten or more drones with minimal risk while remaining dispersed and difficult to target. In this sense, Taiwan's archipelagic geography becomes a force multiplier: anti-radiation UAVs launched from the mainland must cross open water under perfect visibility conditions, presenting ideal engagement opportunities for short-range air defense units.

Even when drones do approach the island, Taiwan can still operate radars selectively. Taiwanese crews can employ short, intermittent radar bursts, just long enough to acquire a target and fire, without exposing themselves to attack. Radar units could exploit the slow speed of the ASN-301 by turning off the radar before the drone has time to fly to the target. From a speed perspective radar units could radiate for roughly 20 seconds before a drone flying 10 kilometers away could reach it. This undermines the PLA's expectation that saturation alone can produce sustained suppression. As a result, massed ASN-301s generate pressure, but pressure is not paralysis.

Another important implication is that anti-radiation UAVs lose most of their value once they have passed overhead. If a UAV overflies its intended target while the radar is silent, it becomes essentially harmless. In its current form the lack of high-resolution onboard sensors or man-in-the-loop cuing means it cannot re-attack, maneuver to a pop-up emission behind it, or prosecute fleeting targets. A patient Taiwanese defender, simply waiting for the drones to cross before reactivating radars, can conserve munitions and preserve most of the IADS structure. The result is a series of timed suppression windows rather than a continuous suppression environment.

For the United States, the challenge is more acute. Unlike Taiwan, U.S. forces in the Indo-Pacific would be operating an away game: dispersed across vast distances, reliant on long-haul communications, datalinks, satellite connectivity, and airborne C2. The PLA's emphasis on electromagnetic dominance, if realized even partially, targets precisely these dependencies. Based on observable trends in PLA force development, U.S. planners should assume that China is on track to contest the electromagnetic spectrum aggressively at the theater level. Hardening networks, reducing EM dependence, and restoring the ability to fight through sustained jamming and deception are therefore not optional refinements, but prerequisites for credible force protection. The U.S. dependence on datalink networks like Link-16 will be challenged in conflict and forces must implement TTPs that operate in contested datalink environments.

At the same time, this study highlights a growing standoff-penetration inversion in SEAD competition. The PLA appears strongest in long-range, preplanned suppression, Rocket Force strikes, standoff jamming, and attacks against fixed or well-mapped emitters. The United States, by contrast, remains strongest in close-in, reactive SEAD: escort suppression, real-time ARM employment, and human-in-the-loop decision-making under threat. That advantage is rooted in combat experience and institutionalized training, but it risks erosion as U.S. operations increasingly shift toward standoff concepts that reduce opportunities to apply it.

The strategic challenge for U.S. airpower, therefore, is twofold. First, it must blunt China's long-range SEAD efforts by adapting force protection and command-and-control to survive sustained electromagnetic attack. Second, it must preserve, and deliberately design pathways to exploit, its advantage in adaptive, close-in suppression. This may require developing complementary long-range suppression capabilities while ensuring that U.S. forces retain the ability to close the distance when necessary and impose a SEAD fight the PLA is least prepared to win.

In the end, the central finding of this paper is not that the PLA cannot conduct SEAD, nor that its doctrine is misguided. Rather, it is that Chinese SEAD is optimized for a particular vision of war: one in which suppression can be engineered in advance, systems behave predictably, and uncertainty can be minimized through modeling and mass. Whether that vision survives first contact with a resilient, adaptive defender remains an open question, and one that may be answered faster than Chinese frontline units are ready for.

APPENDIX A. TABLE OF CHINESE AIRCRAFT CARRYING YJ-91s

Platform	Unit/Location?	Air Base	Confidence Level of location/unit	Activity Type	Qty of YJ-91	Carrying ECM Pod?	Formation ARM training	Date
SU-30	9th Air Brigade	Wuhu Air Base	High	Airshow	2	0	N	2009
SU-30	4th Naval Aviation	Hefei-Feidong	Medium	Training	2	0	N	7/1/09
SU-30	9th Naval Air Brigade	Feidong/Huangyan	High	Live fire	1	0	N	5/11/12
SU-30	9th Air brigade	Wuhu	Low	Training	6	0	N	8/10/12
SU-30	9th Naval Air Brigade	Feidong/Huangyan	High	Training	2	0	N	4/19/14
JH-7	16th naval Aviation regiment	Dinghai	Low	Live fire	1	0	N	5/4/14
JH-7	Combined Flight Test Center	Xian	Low	Training	1	0	N	11/1/15
SU-30	172BDE	Cangzhou	High	Training	1	0	N	12/7/15
SU-30	172BDE	Cangzhou	High	Training	1	0	Y	12/7/15
J-11B	PLAN AVIATION Training Unit	CV-16 Liaoning	High	Airshow	1	0	N	1/2/16
JH-7	83rd Air Brigade	Hangzhou Jianqiao	High	Training	1	1	N	11/28/17
J-10	41st Brigade	Qihe	Medium	Training	1	1	N	5/15/18

J-10	61st Air Brigade	Chaoyangchuan	High	Airshow	1	1	N	8/28/18
J-10	41st Brigade	Qihe	Medium	Training	1	1	N	9/4/18
J-10	61st Air Brigade	Chaoyangchuan	High	Airshow	2	0	N	11/11/18
J-10	41st Brigade	Qihe	Medium	Training	1	1	N	1/23/19
SU-30	9th Air brigade	Wuhu	Medium	Training	1	0	N	2/20/19
JH-7	85th Air Brigade	Hangzhou Jianqiao	Medium	Training	1	0	N	8/26/19
J-10	61st Air Brigade	Chaoyangchuan	High	Airshow	2	0	N	10/17/19
J-10	61st Brigade	Chaoyangchuan	High	Airshow	2	0	N	10/17/19
J-10	130st Air Brigade	Luliang	High	Airshow	1	0	N	11/13/19
J-15	PLAN AVIATION Training Unit	Huangdicun	High	Training	1	0	N	11/15/19
J-15	PLAN AVIATION Training Unit	Shandong CV-17	High	Airshow	1	0	N	12/1/19
J-15	PLAN AVIATION Training Unit	Shandong CV-17	High	Airshow	2	0	N	12/20/19
J-15	PLAN AVIATION Training Unit	Shandong CV-17	High	airshow	1	0	N	12/30/19
SU-30	85th air brigade	Quzhou	High	Training	1	0	N	8/2/20
JH-7	15th Regiment	Weifang	High	Training	1	0	N	3/23/22

J-10	130th Air Brigade	Luliang	High	Training	1	0	N	4/20/22
J-16	NA	NA	NA	Training	1	0	N	12/7/23
JH-7	110th Air Brigade	Urumqi	Medium	Airshow	2	0	N	1/29/24
J-15D	Unknown	Huangdicun	High	Airshow	NA	NA	NA	11/14/24
SU-30	85th Air brigade	Quzhou	High	Training	1	0	Y	1/4/25
J-16	129th Air Brigade	Suixi	High	Training	1	0	N	2/1/25
J-10	2nd Air Brigade	Chifeng	High	Airshow	1	1	N	4/24/25
J-16	98th Air Brigade	Chongqing	High	Training	1	0	Y	7/6/25
J-16	98th Air Brigade	Chongqing	High	Training	1	0	N	7/6/25
J-16	40th Air Brigade	Xiangtang	Medium	Training	1	0	N	7/13/25
J-16	98th Air Brigade	Chongqing	High	Airshow	1	0	N	7/14/25
SU-30	6th Air Brigade	Suixi	Medium	Training	1	0	N	8/1/25
SU-30	85th Air Brigade	Quzhou	High	Training	1	0	N	8/28/25
J-16	98th Air Brigade	Chongqing	High	Airshow	2	0	N	8/30/25
J-16	98th Air Brigade	Chongqing	High	Airshow	2	0	N	9/3/25
J-16	98th Air Brigade	Chongqing	High	Training	2	0	N	10/4/25
SU-30	85th Air Brigade	Quzhou	Medium	Training	1	0	N	11/20/25
SU-30	85th Air Brigade	Quzhou	Medium	Training	1	0	N	11/20/25

APPENDIX B. IMAGERY COLLECTION OF CHINESE AIRCRAFT CARRYING YJ-91S

Photos sorted chronologically. Aircraft type and date shown below each image.



Su-30 | 2009



SU-30 | 2009-08-30



SU-30 | 2009-11-15



Su-30 | 2011-09-02



Su-30 | 2012-05-11



Su-30 | 2012-08-10



SU-30 | 2014-04-19



JH-7 | 2014-05-14



JH-7 | 2015-11-1



SU-30 | 2015-12-07



SU-30 | 2015-12-07



J-11B | 2016-01-02



J-10 | 2016-8-11



SU-30 | 2016-08-26



SU-30 | 2016-08-26



JH-7 | 2016-12-02



JH-7 | 2017-02-11



JH-7 | 2017-04-16



J-8 Dual YJ-91 | 2017-07-16



JH-7 | 2017-07-16



J-10 | 2017-09-17



J-10 | 2017-09-17



J-10 | 2017-09-23



Su-30 | 2017-11-28



JH-7 | 2018-03-02



J-10 | 2018-04-10



J-10 | 2018-05-18



J-10 | 2018-08-28



J-10 | 2018-09-04



J-10 | 2019-1-23



J-10 | 2019-01-24



SU-30 | 2019-02-20



J-15 | 2019-05-25



J-10 | 2019-07-19



J-10 | 2019-8-8



J-10 | 2019-10-17



J-10 | 2019-10-17



J-10 | 2019-11-13



J-15 | 2019-11-15



J-15 | 2019-12-20



J-15 | 2019-12-30



J-10 | 2020-02-17



J-16 | 2020-05-29



SU-30KK | 2020-08-02



JH-7 | 2022-03-23



J-10 | 2022-04-20



JH-7 | 2022-04-22



J-16 | 2023-05-01



SU-30 | 2023-05-26



J-10 | 2023-07-23



J-16 | 2023-09-19



J-16 | 2023-12-07



J-10 | 2024-1-17



JH-7 | 2024-01-29



J-15 | 2024-11-09



Su-30 | 2025-01-25



J-16 | 2025-03-22



J-10C | 2025-04-25



Su-30 | 2025-05-07



J-16 | 2025-07-06



J-16 | 2025-07-08



J-16 | 2025-07-13



J-16 | 2025-07-14



SU-30 | 2025-08-01



SU-30 | 2025-08-01



J-16 | 2025-08-19



SU-30 | 2025-08-28



SU-30 | 2025-08-28



J-16 | 2025-08-30



J-16 | 2025-09-03



J-16 | 2025-10-4



SU-30 | 2025-11-20

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