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Major Theater War: Challenges for the U.S. Army

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- As currently organized, the Army is too small, at 10 divisions and 31 brigade combat teams, to engage in major theater war against near-peer competitors in more than one theater.
- With only 11 armored brigade combat teams, the Army lacks the heavy forces needed to deter or prevail against Russian or Chinese land forces.
- Deficiencies in fires, short-range air defense and electronic warfare represent key vulnerabilities that require urgent solutions.
- Opportunities exist to dramatically increase the combat power available to Army division and corps commanders by arming the assault helicopter fleet and by transferring the A-10 from the Air Force to the Army.
- Prioritizing future modernization at the expense of current readiness risks near-term defeat.

Introduction

The U.S. Army today can be rightfully proud of its status as a premier land force. Blooded by a generation at war, the Army has endured severe challenges and has remained a resilient and vital component of American national security. However, these virtues should not stop the Army from constantly examining how it can improve. Today, there are a number of areas that call into question the Army's readiness to fight and win in major theater war against near-peer adversaries. What follows is an objective critique, focused on how the Army can meet these challenges to prevail in the next great conflict.

The Army Is Too Small

Army endstrength is projected at 485,000 for the active force in 2022.¹ As the Army is currently organized, this yields a 10-division, active-duty force that cannot meet the requirements of two simultaneous major campaigns, even with substantial reserve component augmentation.² For deterrence to be effective, our allies around the world must be confident that America will be there, on the ground, early in the fight. Aggression on the Korean peninsula, for example, cannot mean the collapse of deterrence in Europe or the Middle East due to lack of ground forces. Nor can air or seapower offset an Army that is too small, as air and naval units cannot seize or control the land.³

Since the end of the Cold War, Army leaders have prioritized new technology over endstrength. Implicit in this thinking is the dangerous assumption that technology can compensate for a lack of boots on the ground.⁴ While both are critical, striking the right balance may be the difference between victory and defeat. Precision fires, improved C4ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance) and other technological advances are important and essential, but they cannot seize, hold and control the land. Nor can the reserve component fill the gap in come-as-you-are campaigns, as time is needed to

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mobilize and deploy substantial National Guard combat formations.⁵ Ten divisions are not enough. America needs a 12-division active Army to truly meet our national security requirements.⁶ This increase can be achieved by eliminating or downsizing redundant staffs and organizations, by increasing Army endstrength, or by a combination of both.⁷

The Army Is Too Light

In 2022, only 11 of the Army's 31 active maneuver brigades are heavy brigades.⁸ Thirteen of the Army's maneuver brigades are light infantry formations, ill-equipped to contend with Russian, Chinese or North Korean heavy forces and massed artillery. While cheaper and easier to deploy, the Army's many light units cannot realistically compete with today's threat (in fact, the Russian army has no light infantry for just this reason; even its airborne formations are fully mechanized).

Seven active Army maneuver brigades are Stryker formations, originally called the "interim armored vehicle" and intended to serve as a bridge until the future combat system could be fielded. From conception, Stryker units have suffered from doctrinal and conceptual confusion.⁹ Stryker units are wheeled, not tracked, and they carry more dismounts than Bradley units, which are intended to fight primarily mounted. But they have poor off-road mobility, are vulnerable to hand-held antiarmor systems, feature towed rather than self-propelled artillery, and they cannot survive when employed against armor, as shown in repeated National Training Center rotations.¹⁰ A better solution is to convert Stryker brigades into true heavy brigades, perhaps with the reconditioned M1 and M2 platforms that are now in storage.¹¹ Should Stryker brigades be retained, they should include an armor battalion, as the Russian army does.

The Army Is Undergunned

Army field artillery, formerly a powerful fiefdom, was reduced dramatically in the 1990s and further drawn down following 9/11. The field artillery community at the end of the Cold War comprised 218 battalions. By 1999, this had been reduced to 141 battalions. By 2011, only 61 tactical field artillery battalions remained on active duty.¹² The Division Artillery was disestablished while direct support artillery battalions were pushed down into "modularized" brigade combat teams, where their troops were often used as provisional infantry or transportation units, while their leaders manned "non-lethal effects" cells as information operations officers. Five "fires brigades" were retained in the active force, though seldom used in their primary roles.¹³ Even in a counterinsurgency environment, prominent maneuver commanders publicly decried this loss of capability.¹⁴

Today, Army divisions include only the organic cannon battalions found in the maneuver brigades, while each corps has a single artillery brigade equipped with the multiple launch rocket system. An entire generation of field artillery officers has limited experience in massing fires, while field artillery force structure remains atrophied.¹⁵

A quick comparison with the Russian army highlights this conundrum. Russian ground forces feature heavy artillery and plenty of it, in cannon, rocket and missile units, with rates of fire and ranges greater than our own systems. Russian maneuver brigades include not one but *three* artillery battalions (two cannon and one multiple rocket launcher), backed up by formidable fire assets at division and army level.¹⁶ There is no Russian counterpart to the M119 105mm towed howitzer which equips the Army's four light divisions; all Russian cannon units are 122mm or larger. Today, the U.S. Army is outranged and outgunned.

In recent years, Army leadership has addressed this problem, restoring the Division Artillery headquarters and supporting funding for future systems. The Army is transitioning from the M109A6 to the M109A7 155mm "Paladin" howitzer system, continuing the upgrade of this venerable system.¹⁷ However, the current focus is on fielding future technologies, above all a very long-range, precision-fires capability.¹⁸

Meanwhile, the active force needs more cannon artillery *now*, on the order of one general support 155mm battalion in each division and an additional cannon artillery brigade per corps. Advances in cheaper GPS technology, ISR, propellants, metallurgy and micro-explosives mean that field artillery can be on the cusp of transition from area to point fire, even against moving targets—a true revolution. These must come at prices that permit maintainability, training and replacement. Above all, field artillery in light brigades and divisions is dangerously outmoded, with poor lethality and obsolete towed systems that are unarmored, slow going into battery and difficult to displace—fatal weaknesses against our likely opponents.¹⁹

The Army Lacks Short-Range Air Defense

Like the Armor and Field Artillery communities, Army Air Defense became a bill-payer following 9/11 as the Army reorganized for the Global War on Terror (GWOT). While the high- and mid-altitude air defense community was protected,²⁰ Short-Range Air Defense (SHORAD) effectively disappeared as all divisional Air Defense Artillery battalions were eliminated. Army leaders “accepted risk” by assuming that the Air Force could take on this mission.²¹

Today, for a variety of reasons, this is no longer the case. Both China and Russia have invested heavily in anti-access/area denial (A2/AD) technologies that threaten our ability to achieve air dominance in many scenarios. Evolving hypersonic technology and the proliferation of low-flying cruise missiles and unmanned aerial systems complicates this picture. Most urgently, the Army does not have a good answer for drone swarms used to target maneuver forces, fire systems, command posts and the like.²² Additionally, both China and Russia possess advanced attack helicopters in quantity. Lacking an air-to-air capability in Army Aviation, and without SHORAD units, today’s Army divisions are sorely vulnerable.

Army leaders and planners acknowledge this problem and have proposed to reintroduce SHORAD battalions into the divisional structure, but on an indeterminate timeline.²³ Current plans project only four Active Army SHORAD battalions in the near future, with “Air and Missile Defense” ranking fifth of the Army’s six modernization priorities.²⁴ In time, legacy Stinger and Avenger systems will be replaced by the “Maneuver-SHORAD” system, planned to include the Hellfire missile, a 30mm gun and Stinger missiles on a Stryker platform. For fixed-site protection of high-value assets, the Army plans to field “indirect fire protection capability” units equipped with a land variant of the Navy’s Phalanx.²⁵

These moves will take years and depend on funding and successful acquisition that cannot be guaranteed. Meanwhile, the Army needs low-altitude air defense now. Reactivation of the Army’s divisional SHORAD battalions as a matter of urgency should be a top priority. They can be equipped with existing Avenger systems, armed with the FN Herstal .50 caliber heavy machine gun and the FIM-92J Stinger missile, while more advanced systems are developed.

Army Aviation has dramatic potential that should be leveraged. For speed, lethality and decisive influence on the land battle, Army Aviation is the Army’s crown jewel. Its principal platforms—the AH-64E, the UH-60M and the CH-47F—are proven, reliable and effective, able to operate day or night and in all weather. Army divisions today include a combat aviation brigade with 48 AH-64 attack helicopters, 30 UH-60 assault helicopters and 12 CH-47 heavy-lift helicopters. The combat aviation brigade also fields 8 UH-60s modified as command and control aircraft and 12 HH-60 medevac aircraft, as well as 12 RQ-7 and 12 MQ-1C unmanned aerial vehicles.

Given the decline in field artillery, Army attack aviation is the most powerful striking weapon available to division commanders. The division’s 48 Apaches can thus launch up to 768 fire-and-forget anti-tank missiles, each with a range of 8 km.²⁶ Operating at stand-off ranges, they are survivable and, with cruise speeds of 150 knots, they can be rapidly repositioned to engage and destroy massed enemy armor. The Apache can also integrate with and control the MQ-1C, which can also be armed.

In the 1980s, the Army Aviation Center experimented with an air-to-air capability for the attack helicopter, but the initiative died as the Cold War drew down. Today, both Russia and China field advanced attack helicopters with a demonstrated air-to-air capability.²⁷ Both also field dense and capable medium- and high-altitude air defenses as well as capable air forces, making air dominance for the United States, especially in the early stages of a ground campaign, problematic. For these reasons, the Army should move quickly to provide an air-to-air capability for its attack and assault helicopters.

Given its serious firepower deficit relative to near-peer competitors, the U.S. Army should also arm its assault helicopter fleet. Though currently equipped only with two 7.62mm door guns, the UH-60 platform was designed to accommodate a full complement of antitank missiles and rockets.²⁸ Using the ESSS (external stores support system), up to 16 Hellfires can be externally loaded, with another 16 carried internally, while both the GAU-19 .50 caliber or the M134 7.62mm mini-gun can be mounted. The aircraft can also be configured with 2.75-inch rockets and the Stinger anti-air missile. (In fact, the MH-60L Direct Action Penetrator aircraft flown by the 160th Special

Operations Aviation Regiment are configured with the Hellfire, as are the MH-60R helos flown by the Navy.) This change would dramatically improve the combat power available to division commanders, enabling them to mass lethal fires far more quickly than with ground maneuver units, while also retaining the capability to conduct troop-carrier operations when needed.

A more controversial proposal, but one that clearly merits serious consideration, is to provide the Army with its own fixed-wing close air support. Though considered by many to be a radical proposition, in fact it is not. The Army needs its own fixed-wing air arm for the very same reason that the Navy and Marine Corps do. It has its own unique needs, vital to its success in ground campaigns, that are not met by sister services or by appealing for more “jointness.”²⁹ These needs do not encompass air dominance, long-range interdiction or strategic bombing, classical Air Force missions.

Long before the Air Force separated from the Army, the Navy and Marine Corps established their own air arms, specialized for their own needs and missions. They retain them to this day. As long as the Army Air Forces were subordinated to the Army, its requirements for tactical air power were also met, even as an increasingly independent strategic Air Force evolved.

Today, the Air Force possesses only one airplane optimized for the close air support (CAS) mission, the A-10 Thunderbolt. All other fighter aircraft were designed for different missions and flight profiles. The Air Force has repeatedly attempted to retire the A-10 or, when faced with congressional opposition, to push it into the reserves.³⁰ In 2021, there were 281 A-10 aircraft in service.

A reasonable proposal is to transfer the A-10—an aircraft the Air Force would prefer to cancel—to the Army. The current inventory will support one squadron of 24 aircraft in each division, leaving 41 for training.³¹ Though the Army’s attack helicopter community is vital, the A-10 is superior to the AH-64 in many ways, being more survivable, longer-ranged and faster, with a mighty weapons load. So configured, the Army could be its own primary CAS provider, though *in extremis*, it might still call on its sister services for assistance.³² The Air Force would of course retain primacy for air interdiction and strategic bombing.³³

The time may be right to make this move. The Army would gain flexible, rapid combat power that it badly needs. The Air Force would be relieved of a platform it has been trying to jettison for years. Inter-service rivalry would be eased. And national security would be enhanced.

The Army Is Not Well Prepared for Electronic Warfare

Electronic warfare (EW) represents another adversary capability that overmatches our own. Russian and Chinese EW is integral to their warfighting doctrine and aims principally to disrupt enemy C2 while protecting their own.³⁴ In the Russian army, EW units are found at every level, from the EW company in every maneuver brigade to the EW brigades found at army level. The Chinese approach is similar. Both Russian and Chinese planners have correctly identified our reliance on secure, satellite-based communications and navigation systems.³⁵ (Offensive cyber operations can also be conducted, but not principally against tactical formations.)

Here the Army lags well behind the adversary. The Army Program of Record is the Terrestrial Layer Intelligence System, or TLIS, which can combine signal intercept and jamming functions. An airborne EW pod for Army drones, called the Multi-Functional Electronic Warfare-Air, or MFEW-Air, is also in the works, as is the Tactical Electronic Warfare System (TEWS) for brigade combat teams.³⁶ All are still in the early stages of development.³⁷ Meanwhile, the U.S. Army today has only a minimal EW capability.³⁸ The Army should therefore accelerate fielding of capable EW systems in divisions and corps.

Conclusion

A close study of the Army in 2021 suggests that the transition from a land force optimized for the GWOT and one focused on major theater war with near-peer competitors is progressing slowly. Today, the Army is too small, too light and too weak in field artillery, short-range air defense and EW. In a ground war against China or Russia near their borders, the Army would be hard pressed to prevail—even with substantial help from allies and sister services.

None of this is new. The Army has been here before. Its roots run deep in the American experiment and its resilience and adaptability are defining features of an institution that is unique among the Armed Forces. As a flexible and forward-thinking organization, the Army is and should be constantly striving to improve its capabilities in a dangerous world. This review highlights areas of concern and suggests possible solutions. In an uncertain world, one thing is certain: The Army will be called upon again. Much will depend on its readiness to “fight tonight” and win. That, above all, is the true priority.



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Notes

- ¹ Assistant Secretary of the Army (Financial Management and Comptroller), *FY 2022 President’s Budget Highlights*, Headquarters, Department of the Army, May 2021, 10.
- ² This requirement, and how to meet it, is discussed at length in the author’s “American Landpower and the Two-War Construct,” *Land Warfare Paper 106*, Association of the U.S. Army, May 2015. See also “Providing for the Common Defense: The Assessment and Recommendations of the National Defense Strategy Commission,” *U.S. Institute for Peace*, 2018, vi.
- ³ For a more detailed discussion, see the author’s “Airpower in American Wars,” *Survival* 58, June 2016.
- ⁴ “In future wars, the United States must guard against its historical American predilection to assume technology or qualitative warfighting superiority can be a substitute for troop numbers.” Joel Rayburn et al., “The U.S. Army in the Iraq War,” *U.S. Army War College Strategic Studies Institute*, 2019, 616.
- ⁵ Many argue that the reserve component offsets any lack of active duty manpower. While an invaluable strategic insurance policy, reserve combat forces (almost all of which reside in the National Guard) cannot be used in the early phases of a major ground campaign. Though the Guard includes 27 combat brigades, “No large RC brigade combat teams (BCTs) or combat aviation brigades have deployed as full brigades in the first year of a global contingency in more than 50 years.” Joshua Klimas et al., *Assessing the Army’s Active-Reserve Component Force Mix* (Santa Monica, CA: RAND, 20 October 2013), 2.
- ⁶ Eric V. Larson, David T. Orletsky and Kristin J. Leuschner, *Defense Planning in a Decade of Change: Lessons from the Base Force, Bottom-Up Review, and Quadrennial Defense Review* (Santa Monica, CA: Rand, 2001), 25; General Eric Shinseki, Retirement Speech, 11 June 2003. The author’s “American Landpower and the Two-War Construct” provides a detailed analysis of landpower requirements for simultaneous land campaigns and explains in detail why airpower is a poor substitute.
- ⁷ By repurposing existing personnel spaces, utilizing existing cantonment space and facilities previously vacated in the drawdown of the 1990s and reconditioning major combat systems now excess and in storage, the Army can field two additional heavy divisions for under \$10B—about 1.5 percent of DoD’s Total Obligational Authority. Information provided by a senior Army Staff G-8 official.

- ⁸ The 82d Airborne, 101st Air Assault and 10th Mountain divisions are light infantry formations with three brigades each. The 25th Infantry Division has three light brigades (one of which is airborne) and one Stryker brigade. The 1st Infantry Division currently has two heavy brigades. The 1st Armored Division and 1st Cavalry Divisions have three heavy brigades each. The 2d Infantry Division has two Stryker brigades. The 3d Infantry Division has two heavy brigades. The 4th Infantry Division has two Stryker brigades and one heavy brigade. Non-divisional brigades include one airborne (light infantry) brigade in Italy, one Stryker brigade at Fort Hood Texas and one Stryker brigade in Germany. The Regular Army today thus consists of 13 light infantry brigades, 11 heavy brigades and seven Stryker brigades. Existing plans call for two light brigades to be converted to heavy brigades in the near term.
- ⁹ “The Stryker concept has been in a constant state of flux since its inception ... the Stryker formation does not have a unified concept. Multiple levels of leadership are pulling the organization in different directions.” Matthew D. Allgeyer, “The American Motor-Rifle Brigade: Issues with the Stryker Brigade Combat Team Concept,” *Military Review*, July–August 2017, 72.
- ¹⁰ James King, “Never Bring a Stryker to a Tank Fight,” *Modern War Institute*, May 2017.
- ¹¹ Hundreds of earlier variants of the M1 Abrams, M2 Bradley and M109 self-propelled howitzer are stored at Sierras Army Depot in Nevada.
- ¹² Major Julian T. Urquidez, USA, “The King is Dead: The Current State of the Field Artillery, Core Competency Atrophy, and the Way Ahead,” Graduate Thesis, *U.S. Marine Corps College of Command and Staff*, 2011.
- ¹³ For example, the Regular Army 17th FA brigade headquarters was employed in Iraq in 2005 as the garrison command for the Victory Base Complex in Baghdad.
- ¹⁴ Colonels Sean McFarland, Jeff Snow and Michael Shields, all maneuver brigade commanders and future general officers, authored a well-known white paper, circulated within senior Army leadership, highlighting this concern: “The King and I: The Impending Crisis in Field Artillery’s Ability to Provide Fire Support to Maneuver Commanders,” white paper, 2008, <https://coinenirak.files.wordpress.com/2008/05/white-paper-field-artillery-mai-2008-sur-la-crise-de-lartillerie-en-coin.pdf>.
- ¹⁵ Colonel David E. Johnson, USA, Ret., and Lieutenant General David D. Halverson, USA, Ret., “Massed Fires, Not Organic Formations: The Case for Returning Field Artillery Battalions to the DivArty,” *AUSA Spotlight* 20-1, April 2020, 5. Currently, the active Army has no cannon units other than the direct support artillery battalions found in maneuver brigades. Each corps has a single artillery brigade equipped with the multiple launch rocket system.
- ¹⁶ In general, Russian artillery has greater range than comparable western systems and exists in much greater numbers. The standard Russian howitzer is the self-propelled 152mm 2S3, another legacy system found in most Russian maneuver brigades or regiments. (Airborne units are equipped with the 2S31 *Vena* 120mm self-propelled mortar as well as the dated D-30 122mm towed howitzer.) High-priority, first-line units are equipped with the 2S19 *Msta-S* howitzer, which has a higher rate of fire and greater range than its counterpart, the US M109 Paladin. The multiple rocket launcher battalion is commonly equipped with the venerable BM-21 *Grad* system, an area-fire system with a range of up to 45km. Artillery brigades found at higher levels feature larger systems like 240mm self-propelled mortars (2S4), 202mm SP howitzers (2S7M), 220mm rocket launchers (9P140) and 300mm rocket launchers (*Tornado-S*). These assets are used to weight the main effort in the offense and to disrupt or destroy deeper, high-value targets. See the author’s “How to Fight the Russians,” *AUSA Land Warfare Paper* 135, 30 November 2020.
- ¹⁷ The M109A7 variant provides incremental upgrades, including slightly increased ammunition storage, increased armor protection, reduced blast over pressure and the ability to fire the XM1113 Insensitive Munition High-Explosive Rocket Assisted Projectile now under development. However, its rate of fire remains one round per minute, and crew size remains unchanged at four.
- ¹⁸ “The Army has identified Long-Range Precision Fires as its No. 1 modernization priority,” Major General Cedric T. Wins, U.S. Army Research, Development and Engineering Command, 26 September 2018.
- ¹⁹ Options like the French *Caesar*, the Czech *Dana*, the Israeli *Iron Saber*, BAE’s *Archer* (in service with the Swedish Army), the South African *Rhino* and the German *KMW* Armored Gun Module, among others, all address this need. All are wheeled, self-propelled systems in the 152mm or 155mm range and are therefore more lethal and faster to emplace and displace, but optimized for light infantry formations. Where U.S. towed systems require crews of seven (M119) or eight (M777), these feature crews of three or four.
- ²⁰ The active-duty Air Defense Community today includes 14 pure Patriot battalions, two Patriot/Avenger battalions and seven Terminal High-Altitude Air Defense (THAAD) batteries, but only three SHORAD battalions. Seven Avenger battalions exist in the Army National Guard.

- ²¹ Lieutenant Colonel Gary W. Beard United States Army, “Maneuver Air and Missile Defense in an AntiAccess/Area Denial Environment,” Graduate Thesis, *U.S. Army War College*, 2018, 6. In a half-hearted effort, the Army provided Stingers to infantry and armor units for employment by Soldiers as an additional duty following the disbandment of divisional SHORAD battalions. The attempt was a failure.
- ²² Drone swarms have been used with effect in Ukraine, Syria, Libya, Yemen and Nagorno-Karabakh in recent years. The Russian military is known to be developing and fielding both systems and operational concepts for employment of drone swarms, as seen in *Kavkaz 2020*, a large-scale exercise conducted in Russia’s Southern Military District. See Ridvan Bari Ucosta, “The Revolution in Drone Warfare,” *Journal of European, Middle Eastern and African Affairs*, Fall 2020, and Roger McDermott, “Russia’s Interest in UAV Strike Capability Gathers Pace,” *The Jamestown Foundation*, 16 November 2020.
- ²³ “The re-emergence of great-power competition has left our maneuver forces and key assets vulnerable to enemy air surveillance, targeting and attack from aerial platforms.” Lieutenant General James H. Dickinson, USA, “Army Air and Missile Defense Vision 2028,” *U.S. Army Air and Missile Defense Command*, March 2019, 10.
- ²⁴ “U.S. Army Short-Range Air Defense Force Structure and Selected Programs: Background and Issues for Congress,” *Congressional Research Service*, 23 July 2020, 2.
- ²⁵ Gary Sheftick “Army Rebuilding Short-Range Air Defense,” *Army News Service*, 3 July 2019.
- ²⁶ Based on maintenance and availability, a realistic estimate of aircraft operational readiness is 75 percent, or 36 Apaches, yielding an ability to launch 576 missiles.
- ²⁷ Both the Chinese Z-10 medium attack helicopter and the Z-19 light attack helicopter are equipped with the TY-90 air-to-air missile. The Russian *Havoc* can be armed with the R-73 air-to-air missile while the smaller *Hokum* uses the AA-11 anti-air missile.
- ²⁸ In 2019, Sikorsky, a subsidiary of Lockheed Martin, completed a six-year development and qualification program for weaponizing the UH-60M with the Hellfire missile, Hydra 70 rockets and various gun systems. This process involved two years of live firing trials conducted at Yuma Proving Ground in Arizona. The armed UH-60 is in use or on order by Singapore, Columbia, UAS and Tunisia. David Donald, “Armed Black Hawk Completes Qualification,” *Aviation International News*, 6 February 2018.
- ²⁹ One measure of priorities is casualties. No jet pilot has been killed in action by enemy fire since 9/11. In contrast, hundreds of Army helicopter pilots and aircrew have been lost.
- ³⁰ Oriana Pawlyk, “Lawmakers Move Once Again to Rescue A-10 Warthog from Retirement,” *Military News*, 12 June 2020.
- ³¹ In 2021, there were 281 A-10 aircraft in service. The U.S. Congress approved funding in 2019 for a \$1B service-life extension program that will keep the A-10 flying through the 2030s. *A-10 Program Review*, Northrop Grumman Corporation, 2020.
- ³² Alternatively, the Army could seek to develop its own fixed-wing close air support platform.
- ³³ Defined as “air operations conducted to divert, disrupt, delay, or destroy the enemy’s military surface capabilities before they can be brought to bear effectively against friendly forces, or to otherwise achieve objectives that are conducted at such distances from friendly forces that detailed integration of each air mission with the fire and movement of friendly forces is not required.” See *Joint Publication 3-03*, Joint Interdiction, September 2016, GL-4.
- ³⁴ See “Military and Security Developments Involving the People’s Republic of China,” *Office of the Secretary of Defense Annual Report to Congress*, 2019, 64; and, Lester Grau and Charles Bartles, “The Russian Way of War,” *U.S. Army Foreign Military Studies Office*, 2016, 289–290.
- ³⁵ “The PLA, in line with the Chinese historic understanding of information as the key to victory, has focused on countering American C4ISR systems through GPS jamming, Joint Tactical Information Distribution System countermeasures and synthetic radar jamming. These capabilities would be coordinated with computer network attack tools for a more holistic and complete attack against an adversary’s command networks.” Mark Pomerleau, “Breaking Down China’s Electronic Warfare Tactics,” *C4ISRNet*, 22 March 2017. See also Zi Yang, “PLA Stratagems for Establishing Wartime Electromagnetic Dominance,” *The Jamestown Foundation*, China Brief 19, no. 3; and, Madison Creery, “The Russian Edge in Electronic Warfare,” *Georgetown Security Studies Review*, 26 June 2019.
- ³⁶ Sydney J. Freedberg, “Boeing & Lockheed Vie For Cyber/EW/SIGINT System,” *Breaking Defense*, 17 August 2020.

³⁷ “Most of these systems, however, are still being developed. While the Army has deployed some to a small degree in response to urgent needs, the technologies still await mass fielding to units, meaning most EW soldiers still lack equipment.” Mark Pomerleau, *C4ISRNet*, 18 August 2021.

³⁸ “The US Army has almost no EW capability,” Creery, 1.



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