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Reclaiming Air Superiority: The Urgent Case for Air Battle Management in Near-Peer Rivalry

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Foreword

As an officer in the United States Air Force, I have witnessed the transition from post-Cold War era of assumed airpower supremacy to one where control of the skies must once again be fought for and won. For the past two decades, counterinsurgency operations in areas with permissive airspace allowed U.S. forces to treat air superiority—and the air battle management that enables it—as a constant. That time has passed. Near-peer adversaries, chief among them China's People's Liberation Army Air Force (PLAAF), now wield capabilities that challenge our air dominance, forcing us to revisit the foundational conditions of air control embedded in our doctrine. This paper explores a pressing need to reinforce one such condition—temporal air superiority. The sustained yet time-bound control that air battle management secures alongside combat aircraft is critical in today's contested environments.

My motivation draws from history: the Battle of Britain's exploitation of radar-guided air battle management and Operation DESERT STORM's demonstration of air battle management's decisive edge in an age of precision still hold valuable lessons for airmen. The importance of these lessons is apparent today as the U.S. Air Force faces a widening capability gap while adversaries like China outpace our modernization efforts. As of May 2025, critical air battle management platforms like the E-8 Joint Surveillance Target Attack Radar System (JSTARS) is retired, the E-3 AWACS barely holds on to tactical relevance, and the E-7 AEW&C is still years from full deployment. Meanwhile in the Indo-Pacific, China's advancing AEW&C platforms and anti-access strategies demand a robust, doctrine-driven response. Facing peer threats in the pivotal theater, the U.S. Air Force finds itself at a critical juncture.

This work is a rallying cry for the USAF, Congress, and our allies. It contends that air battle management remains the linchpin of air superiority. Systems like the E-3, CRCs, other emerging ground air battle management platforms, and soon the E-7 must pair with fifth-generation and future sixth-generation fighters like the F-47 to reclaim control when and where it matters most. In a time when the space domain is also coming into its own

as a new warfighting domain with threats to U.S. assets on orbit, U.S. terrestrial forces must avoid an overreliance on space-based solutions and adopt a layered approach for resilience. Above all, we must learn from our past and act on our present threat environment to secure the skies. Air supremacy is not a given, but a hard-won condition of victory against foes who contest our every move. This dialogue should spark discussion, sharpen focus, and propel the urgent air battle management modernization needed to prevail in the air domain of the future.

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Introduction

For twenty years, the United States Air Force (USAF) conducted counterinsurgency (COIN) operations in the permissive airspace of Iraq and Afghanistan, during which time air supremacy remained unchallenged, and the force-multiplying effect of air battle management was constant. That era has ended. In potential future conflicts with near-peer adversaries, particularly China's People's Liberation Army Air Force (PLAAF), the USAF can expect to face sophisticated integrated air defenses (IADs) and over 600 modern fighters. In these non-permissive environments, U.S. air forces will need to actively pursue air superiority through kinetic air-to-air engagements and layered air battle management across the air and space domains.[1] Fourth- and fifth-generation fighters rely upon the support of air battle managers on platforms like the E-3 Airborne Warning and Control System (AWACS), Control Reporting Centers (CRCs), other emerging ground-based air battle management capabilities, and soon the E-7 to successfully fulfill this mission. These professionals excel at managing air wars, but the Department of Defense's (DOD) decades-long focus on COIN has yielded the knock-on effect of diminishing these operators and their mission.[2] This atrophy in air battle management expertise now constitutes a legitimate impediment to U.S. air dominance in a conflict with China in the Indo-Pacific.

In the Battle of Britain, radar-empowered air battle management and the resolve of the RAF combat air forces over England repelled the Luftwaffe. In DESERT STORM, the same collaboration between air battle managers and coalition air assets enabled a coordinated precision-strike air campaign that yielded a decisive victory. Today, the synergy between combat aircraft and robust air battle management must evolve and better integrate space to counter emerging threats, or else the USAF risks losing the skies to a formidable peer-level foe. Air battle management entails the real-time direction of air operations within a commander's intent, which is distinct from command and control (C2) that provides structural authority for actions in the battlespace. Air battle managers deconflict joint fires, enhance situational awareness, and validate targets for the Joint Force Air Component Commander (JFACC).[3] Its four functions—force management (resource allocation), information management (data processing), integrated surveillance and identification (threat tracking), and continuum of control (dynamic orchestration)—work together with advanced combat aircraft to enable air superiority.[4] Unlike air supremacy, which assumes unchallenged dominance, air superiority reflects a dynamic, time-bound control tailored to contested environments. The U.S. Air Force must now take steps to modernize its systems and refocus on the

mission and the experts needed for air battle management. Failing these lines of effort, USAF combat forces will struggle to establish the air superiority it will need to enable all air and joint operations in a future conflict against a near-peer adversary in a contested environment.

Historical Foundations of Air Battle Management & Fighter Collaboration

For U.S. air forces to establish air superiority, collaboration between air battle managers and combat pilots is key. Air battle management platforms provide critical situational awareness over airspace that far exceeds fighter aircraft capabilities. The real-time coordination, control, and positioning of air assets that air battle management provides ensures that air combat platforms are in the right place at the right time.[5] This partnership traces back to the Battle of Britain, where rudimentary air battle management helped combat air forces defeat a numerically superior Luftwaffe. It reached maturity in DESERT STORM, where fourth-generation fighters like the F-15, paired with E-3 AWACS and the CRC, crushed Iraqi air forces. A consistent theme throughout these conflicts is the clarity air battle management contributed to air warfare through its key functions to distill the chaos of a vast battlespace into an actionable plan of attack to secure and maintain air superiority. Now, this partnership needs to adapt urgently to counter modern threats like China's technologically advanced air forces and growing AEW&C capabilities. Whereas air battle management's partnership with fourth-generation platforms created a war-winning synergy in DESERT STORM, it must now evolve its collaboration with fifth-generation platforms to establish the air superiority needed to secure victory in future conflicts.

The Battle of Britain: Origins of Modern Air Battle Management

The origins of utilizing modern air battle management to gain air superiority can be traced back to the Battle of Britain. Under the leadership of Air Marshal Dowding, the Royal Air Force (RAF) organized its defenses to counter the Luftwaffe using a rudimentary air battle management operations center. The RAF's Group Operations Room integrated data from the CHAIN HOME radar system, radio communications, human observers, and other basic "sensors." This synthesized data flowed to a plotting room where experts transformed the raw inputs into actionable directives, guiding the movements of scarce Spitfires and Hurricanes in the airspace.[6] Plotters updated a central large-scale map in the room's center with aircraft positions and monitored all six fighter squadrons' alert statuses on a blackboard. In this way, they could efficiently track which aircraft were airborne following a scramble, engaged, or returning to base.[7] The information that was analyzed and reported to the ops room resulted in battle management decisions that provided highly effective command and control (C2). In this way, the RAF's hundreds of aircraft could defend Britain's airspace and prevail against the Luftwaffe's thousands.[8] The RAF could not have maintained air superiority over Britain without these pioneering air battle managers. Air battle management enabled the RAF's combat air forces to win the Battle of Britain.

Today, the USAF confronts a parallel challenge: it has the smallest and least-ready force in its history, yet it faces ambitious adversaries with numerically and technologically superior air forces. A deliberate strategy that pairs air battle management with fifth-generation combat aircraft is essential. This time, it must be planned and cannot be a strategy improvised during a conflict, as it was for the RAF in World War II.[9]

RAF Legacy in USAF Air Battle Management

Today, the USAF's air battle management training relies on the foundational principles of the RAF's operations during the Battle of Britain. Building on their lessons learned, leadership can equip air battle managers to counter near-peer threats. The Battle of Britain showed that air battle management hinges on four primary functions. The first, information management, involves collecting and processing mission-critical data for tactical and operational decisions and is the genesis of the battle management process.[10] The force management function then drives iterative planning critical to force accountability, packaging, positioning, and resource management.[11] Integrated surveillance and identification is the next function, in which sensor data fuses with joint task force (JTF) commander rules for a common operational picture to attain a high level of situational awareness.[12] In the final function, air battle managers use this common operating picture to engage in dynamic battlespace orchestration to pursue air superiority. This is referred to as the continuum of control.[13]

The USAF historically follows these functions and organizes its air battle management capabilities into air and ground elements through the Theater Air Control System (TACS) for JFACC-directed counterair operations.[14] After the recent retirement of the E-8 JSTARS in 2024, the sole airborne element of the TACS is the E-3 AWACS. The ground element is the CRC and the emerging battlefield control center (BCC). The AWACS is a modified Boeing 707/320 commercial airframe featuring a mechanically scanned radar housed in its radome, a passive detection system (PDS), and an identification friend or foe system (IFF).[15] With an effective range of greater than 250 nautical miles (NM), combined with the IFF subsystem and PDS, the radar can detect, identify, and track aircraft across high, medium, and low altitudes while eliminating ground clutter, delivering broad and detailed battlefield information.[16] The CRC puts together a comprehensive picture of the battlespace in the air by integrating data from the AWACS and other land-based radars.[17] Its TPS-75 radar provides 360-degree coverage out to 240NM and persistent battle management capability for the JFACC. The emerging BCC will be similar to a CRC. However, it will be fixed and dedicated to a combatant command or theater, lacking an organic sensor and instead ingesting sensor feeds to provide air battle management effects.

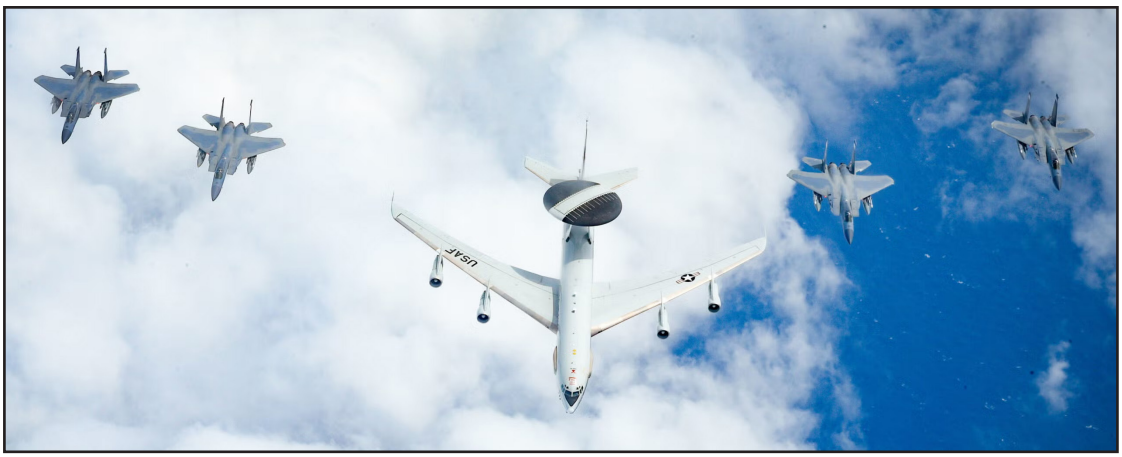

Figure 1: E-3 AWACS.
Credit: U.S. Air National Guard photo by Staff Sgt Wesley Jones.

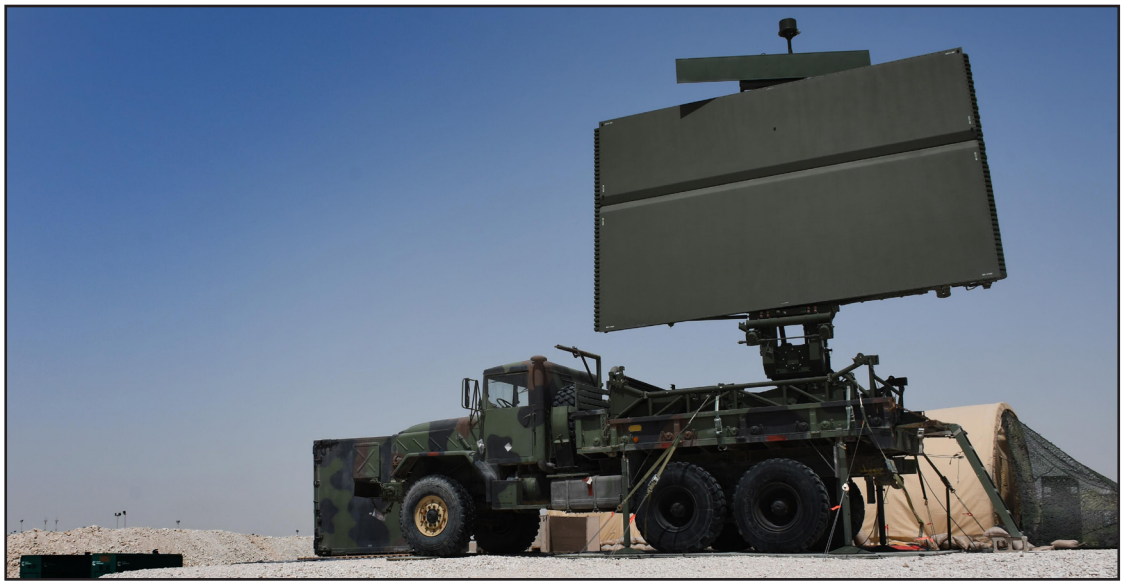

Figure 2: CRC TPS-75 Radar.
Credit: U.S. Air Force photo by Senior Airman Miles Wilson.

Evolution of Fourth- & Fifth-Generation Collaboration

The USAF clearly understood how air battle management aided the achievement of air superiority in numerous post-Cold War operations. These operations can be separated into two eras, characterized by fourth-generation and fifth-generation technological shifts. Fourth-generation aircraft—1970s and 1980s fighters and big-wing aircraft like the E-3 AWACS—used mechanically scanned array (MSA) radars, had large radar cross sections (RCS), and limited systems integration, relying heavily on surveillance and identification data and tactical control from the E-3 and CRC to counter air and ground threats. This partnership first saw extensive use in combat in Operation DESERT STORM in 1991 and persisted through the 1990s with Operations DELIBERATE FORCE and ALLIED FORCE and into the twentieth century with COIN operations in ENDURING FREEDOM and IRAQI FREEDOM.

Fifth-generation fighter technology features active electronically scanned array (AESA) radars, digitized systems, advanced fusion within the aircraft, and stealth, reducing dependence on external battle management platforms for a pilot's organic situational awareness. However, air battle managers are still vital assets collaborating with fifth-generation aircraft to secure air superiority through force management, integrated surveillance and identification, information management, and the continuum of control. The pilots of a four-ship formation of fifth-generation aircraft performing counter-air actions against a near-peer cannot perform all the battle management functions necessary to achieve air superiority. While the data processing capabilities of fifth-generation systems are impressive, an off-board capability is still needed to integrate various data sources and produce a more complete picture of the battlespace. The still-developing fifth-generation partnership with air battle manager assets emerged over the skies of Syria at the tail-end of COIN operations in the Middle East. Moving forward, any conflict with a near-peer power like China requires the maturation of the partnership between fifth-generation F-22 and F-35 combat aircraft executing missions with the support of the E-3s, CRCs, and E-7s implementing proven tactics, techniques, and procedures (TTP) codified during the era of fourth-generation partnership.

DESERT STORM: Proving the Partnership

The E-3 AWACS was already a proven system for airborne warning and surveillance and as an air control center conducting battle management of United Nations aircraft flying combat missions in theater, but DESERT STORM was the E-3's debut in a major air war, and it was the coalition's linchpin for managing the air campaign. In fact, the USAF and Saudi E-3s provided airborne control for 85 percent of all sorties flown during the war—over 90,000 sorties.[18] E-3 AWACS crews also facilitated 38 air-to-air kills out of the 41 credited to coalition aircraft.[19] Partnering with fourth-generation fighter aircraft, the E-3 shared airborne moving target indicator (AMTI) data via datalinks and tasked air interdiction missions against Iraqi air and ground targets. Air battle management from the E-3 supported the swift achievement of air superiority for coalition forces.

DESERT STORM was also an important proving ground for operationalizing and fielding the E-8 Joint Surveillance Target Attack Radar System. When General Schwarzkopf saw the results of the E-8 JSTARS flight tests in Europe, the platform's two prototypes were rushed to the Middle East five years ahead of scheduled fielding to join the impending conflict against Saddam Hussein.[20] The E-8 JSTARS, equipped with a mechanically scanned ground-moving target indicator radar, effectively characterized the Iraqi Army's armor disposition, amplifying the coalition's targeting precision. Based on their performance in the conflict, Air Force Chief of Staff General Merrill A. McPeak concluded, "We will not ever again want to fight any kind of combat without a Joint STARS kind of system."[21]

The CRC was the airspace control and surveillance node subordinate to the air operations center (AOC) during the campaign.[22] The CRC provided command and control and air battle management of air tasking order (ATO) missions, managed air defenses and refueling, and ensured force accountability. Ultimately, these battle management effects enabled forces operating in the land domain to swiftly dismantle the Iraqi air force and army.

In short, the sensors associated with air battle management platforms and the air battle managers leveraging the resulting data generated extended situational awareness

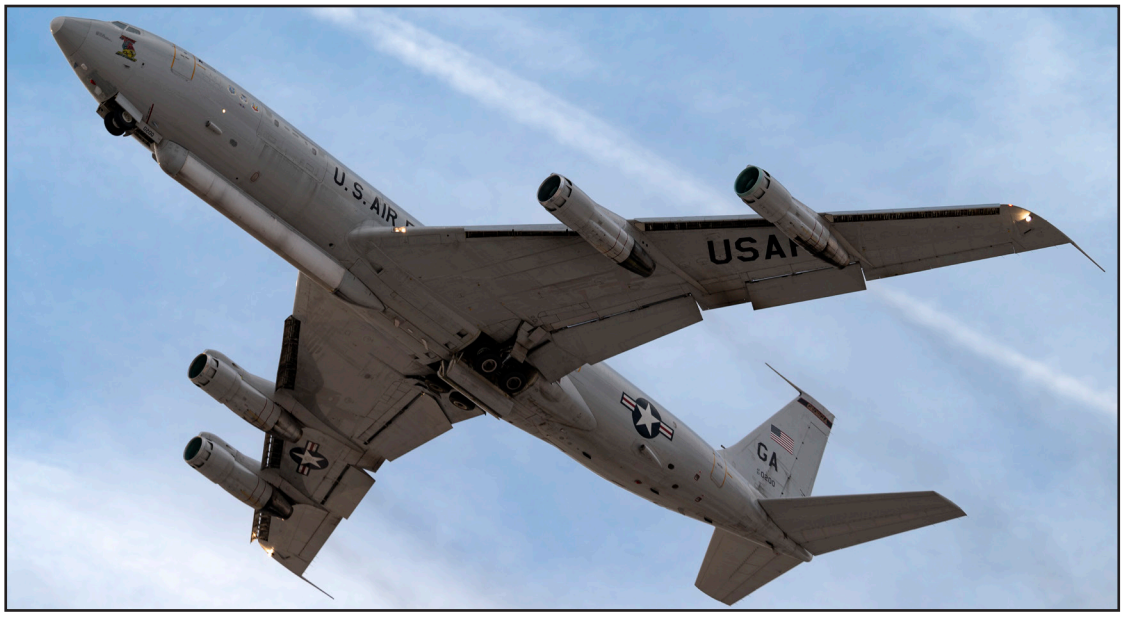

Figure 3: E-8C JSTARS.
Credit: U.S. Air Force photo by William Lewis.

beyond the ranges that fighters and strike aircraft could attain organically. Leveraging an extensive understanding of friendly and enemy capabilities, air battle managers also significantly broadened the understanding of the operational environment and helped manage information needed to execute the JFACC's intent.[23]

DESERT STORM displayed the rapid deployability and effectiveness of air battle management in supporting air campaigns amid security crises to achieve air superiority, underscoring its necessity in campaigns moving forward.[24] General Ronald Yates, commander of Air Force Systems Command during DESERT STORM, characterized air battle management and command and control as "a kind of calm, boardroom style of warfighting," adding, "The job of battle management and command and control is to pierce the fog and minimize the friction."[25] Air battle management and the efficiency of communication afforded by the TACS during DESERT STORM allowed Central Command to use a single Air Tasking Order across services for the first time.[26]

ALLIED FORCE: Reinforcing the Model

Operation ALLIED FORCE built on the foundation DESERT STORM established with its air battle management operations. During this campaign, E3 crews refined the principles of collaboration with fourth-generation aircraft: information management, force management, integrated surveillance, and the continuum of control. On ALLIED FORCE's first night, the North Atlantic Treaty Organization (NATO) flew 214 strike missions with 112 USAF combat aircraft.[27] The Serbs challenged air operations with a dozen MiG-29 fighters, but these were swiftly detected, identified, and their location and data relayed by the E-3 AWACS crews across the theater, resulting in four shootdowns within the opening days of the conflict.[28] Air battle management also aided in destroying 85 percent of Belgrade's modern fighter aircraft.[29] This success was bolstered by the E-3, flying 500 missions across 4,800 hours, proving its pivotal role. E-3s, working with fourth-generation fighters, helped maintain air superiority for the campaign's duration.[30]

Counter-Insurgency: Collaboration Erosion

The partnership between air battle management and fourth-generation combat aircraft endured into the opening phases of OPERATION ENDURING FREEDOM, IRAQI FREEDOM, and NEW DAWN in support of the Global War on Terror after the September 11, 2001, terrorist attacks. However, unlike DESERT STORM, the USAF did not need to establish or maintain superiority; rather, coalition forces enjoyed air supremacy throughout this conflict. Taliban and Iraqi forces lacked credible means to challenge American air power. This guarantee of air dominance marked the erosion of the air battle management partnership with fourth-generation combat aircraft. In addition to uncontested skies and an oversaturation of air battle management capability amassed over twenty-plus years in the Middle East created a historically unique sanctuary for USAF aircraft as fifth-generation F-22 and F-35 aircraft debuted in air combat.

As a result of this overwhelmingly assured air supremacy, Central Command's air component believed the F-22 and F-35 could "quarterback" an air war from a rear echelon.[31] However, the lack of an air threat never stress-tested this theory. Limits in radios, datalinks, and internet relay chat systems on fifth-generation aircraft demanded more airspace sanitization by big-wing battle management platforms like the E-3 AWACS, E-8 JSTARS, and the CRC. It was also evident that fighter pilots trained to execute counter-air operations were not proficient in core air battle management functions.

This assumption persists in today's air war planning—that fifth-generation aircraft can lessen the risk to air battle management platforms because they can partially, although inadequately, take on some air battle management roles beyond air combat. This premise is dangerously flawed, as air superiority requires a coordinated effort. History proves this. Dedicated platforms' comprehensive air battle management functions must operate in unison with fifth-generation fighter combat prowess. Splitting these roles apart undermines the collaboration vital to control the battlespace against a near-peer competitor.

Conclusions: Lessons from History

The fourth-generation partnership forged in DESERT STORM, honed in ALLIED FORCE, and refined in the War on Terror provides a blueprint for developing the future force that capitalizes on the synergy air battle management creates to attain air superiority. Information management, force management, integrated surveillance and identification, and the continuum of control enable air battle managers to create a common operating picture characterizing the airspace. Once characterized, air battle management platforms can direct an air battle with timely and precise control of fourth- and fifth-generation fighters to cooperatively neutralize enemy aircraft and ground forces challenging American air power, yielding air superiority.

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Long taken for granted over Afghanistan and Iraq, air superiority is a core condition that must once again be secured in future conflicts. Adversaries—especially China and Russia—seek to contest the air domain with robust A2/AD strategies. Efficiently employing an increasingly strained fighter force is imperative and demands air battle management.

Emerging Challenges to Air Superiority

U.S. forces can no longer assume air superiority in the event competition with China escalates to conflict, nor can they plan to fight with limited air battle management assets and experts. China, Russia, Iran, and North Korea form a loose and informal partnership that coordinates actions or exploits strategic opportunities to degrade the United States' geopolitical influence and U.S. alliances.[32] After witnessing the resounding success of DESERT STORM's integrated air campaign, the People's Republic of China (PRC) invested heavily in recapitalizing its air and rocket forces to counter the U.S. military. The United States must grasp how the People's Liberation Army Air Force (PLAAF) evolved to block American air domain access. Most notably, the PLAAF iterated multiple airborne early warning and control (AEW&C) platforms and equipped them with more advanced technology than the USAF currently possesses. Conversely, U.S. air battle management assets are aging and dwindling, primarily due to the Department of Defense's lack of support and delays to timely modernization and recapitalization.

Whereas America and its allies took air superiority for granted, the PLAAF aggressively modernized its air force into an entity capable of challenging USAF air primacy. The PLAAF's three primary efforts include developing next-generation AEW&C aircraft, fifth-generation aircraft, and A2/AD capabilities like sophisticated integrated air defense systems (IADS). Western nations neglected AEW&C in part because of the relative ease and rapidity with which air superiority was achieved in Iraq and Afghanistan.[33] As a result, the USAF still relies on aging E-3 AWACS and CRC battle management systems.

However, air operations in the Indo-Pacific pose very different challenges than those in the Middle East. The Pacific airbases from which U.S. air forces would operate lag behind their Middle Eastern counterparts in

terms of their readiness and ability to support the ops tempo needed for a major theater war. Most lack sustainment facilities and air defense systems, and geographically they are far more isolated than the well-connected network of bases on the Arabian Peninsula. Moreover, the distances between them are vast. All of these factors only complicate the air superiority mission.

China's AEW&C Advancements

After witnessing DESERT STORM, the PLAAF realized they needed to readjust their theory of victory. The Chinese strategy today centers on information dominance, for which the Chinese air battle management architecture fulfills an important function. PLAAF AEW&C aircraft use AESA technology, a vast improvement over the MSA technology used by radars associated with the U.S. E-3 AWACS and CRC. As a result, the PLAAF's AEW&C fleet outnumbers and outperforms its USAF counterparts.[34] The three most notable AEW&C variants, the KJ-2000, KJ-500, and KJ-600, are part of a modernized force that replaces the PLAAF's outdated MSA platforms with AESA radar technology.

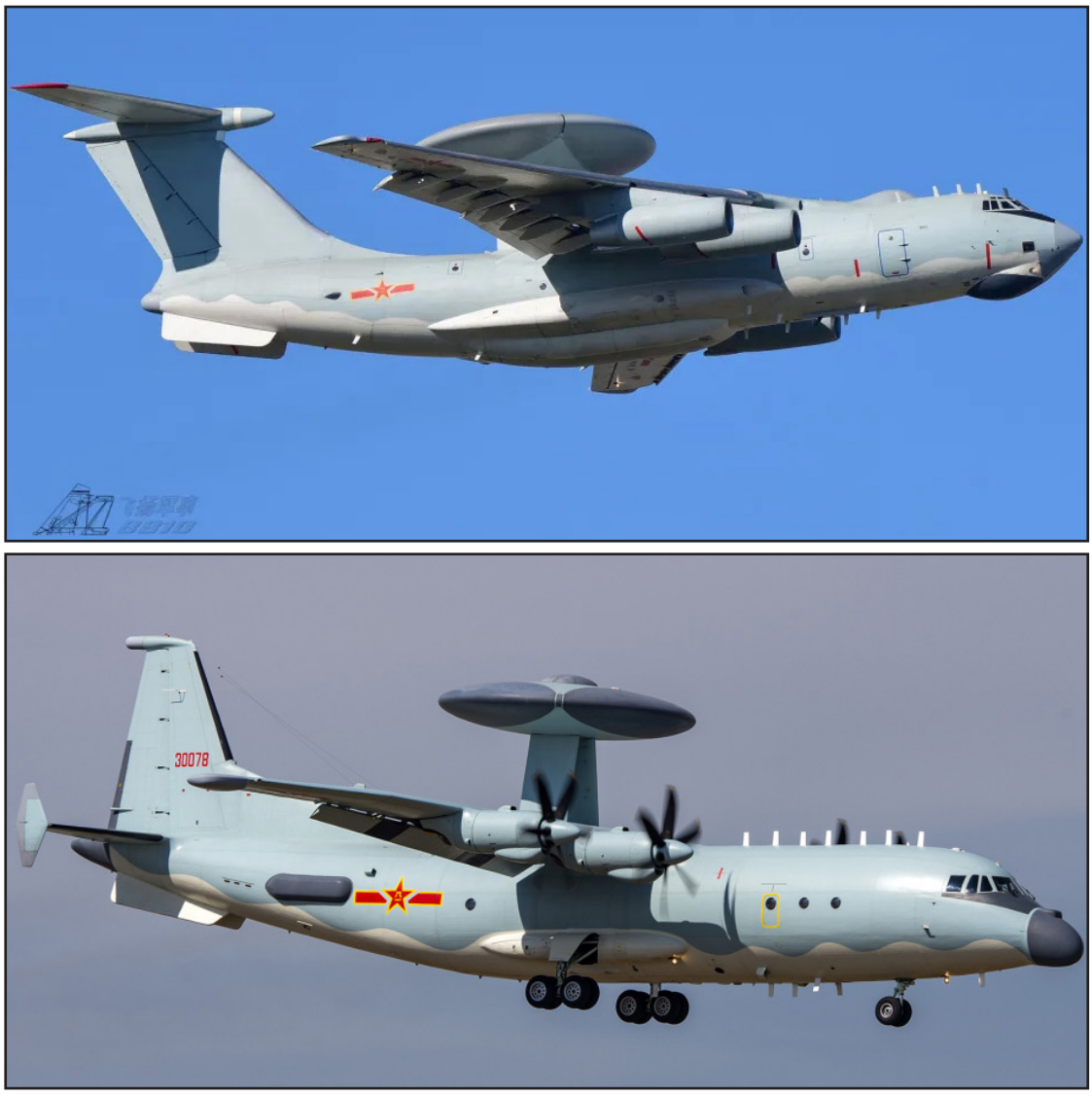

Figure 4: PLAAF KJ-2000 at the Zhuhai Airshow (top) and KJ-500 (bottom).
Credit: FYJS/via Chinese internet and FengJian Aviation Photos via Weibo user.

Figure 5: PLAAF KJ-600.
Credit: Via Weibo user.

Unlike MSA radars, AESA radars offer a faster target revisit rate, enhancing capability against swift targets like supersonic cruise missiles and aircraft.[35] AESA radars prove reliable because their thousands of individual transmit/receive (T/R) modules ensure resilience, even if hundreds fail, unlike MSA radars' mechanically prone, single-point failures.[36] Finally, AESA radars use beam forming technology for side lobe suppression, which reduces the probability of detection by hostile intercept or surveillance systems. It also makes electronic attack or jamming efforts against the radar more difficult.[37] The April 2024 defeat of more than three hundred Iranian cruise missiles and small unmanned aerial systems (UAS) by the Israeli, Jordanian, and U.S. air forces highlights the immense value of AESA technology on fighter aircraft, naval assets, and air battle management platforms.[38]

In addition to advanced radars, the PRC iterated multiple AEW&C platforms and technologies over the past two decades. The KJ-2000 Mainring is China's first indigenous AEW&C aircraft. A key feature of the Mainring, making it superior to the E-3 AWACS from a capability perspective, is the three AESA antennas fixed in a triangular configuration within the radome.[39] Due to the limited number of available IL-76MD airframes, only four KJ-2000s were produced. They are stationed in Jiangsu Province, aligned against PRC adversaries Japan and Taiwan.[40] The PLAAF is reportedly researching and developing a modernized version known as the KJ-3000, underscoring the PRC's priority on achieving an AEW&C advantage over the United States.[41]

China's premier AEW&C aircraft, the KJ-500, can help hinder and counter the USAF air superiority operations. It boasts an upgraded AESA radar within its 360-degree rotodome and likely houses additional radar antennas within enlarged nose and tail radomes.[42] The KJ-500 networking capabilities also allow it to link with the broader Chinese kill web established on the ground, on the high seas, and in space.[43] Particularly alarming is the PRC's effort to enable AEW&C launches from its new aircraft carriers. Presently, no such capability exists, limiting the range of China's carriers to the protection afforded by PLAAF combat aircraft and surface-to-air missile systems along the coast.[44] However, China's newest carrier, the Type 003 *Fujian*, is equipped with an electromagnetic catapult, allowing the launch of the KJ-500, which extends AEW coverage and overall People's Liberation Army Navy (PLAN) capabilities.

Supporting the PRC's pursuit of AEW&C carrier capability, the PLAN is developing the KJ-600, an eerily similar platform to the U.S. E-2 Hawkeye. Equipped with an AESA radar, the KJ-600 will undoubtedly have the systems

integration needed to support long-range fires.[45] Although few have been produced, mock-ups have been spotted on the Type 003 *Fujian*, indicating the PRC is implementing lessons from the USAF and USN on incorporating AEW&C in achieving air superiority.

The PRC is clearly and actively pursuing advanced AEW&C aircraft to provide air battle management to challenge the United States' ability to establish air superiority. Conversely, the DOD and USAF, complacent after more than two decades of Middle East operations with assumed air superiority and air battle management effects, have yet to recapitalize their AEW&C force to achieve air superiority in a near-peer fight. While China has progressed through the iterations of the KJ-2000, KJ-500, and KJ-600 and leveraged advanced AESA technology over the last twenty years, the USAF produced zero new generational capabilities for USAF air battle management AEW&C platforms.

USAF AEW&C Shortfalls

After years of deferred modernizations and little support for the air battle management portfolio, U.S. AEW&C capabilities lag far behind the PRC. The USAF acquired its E-3 AWACS aircraft between 1977 and 1984. Keeping these aging airframes aloft grows increasingly difficult, time-consuming, and costly.[46] While AWACS underwent various mission-system upgrades over the decades, the mission-capable (MC) rate fell from 75 percent to 59 percent between 2019 and 2022.[47] The dwindling replacement parts supply for the old 707 airframes is contributing to the worsening MC rate.[48] In 2022, the USAF contracted Boeing to acquire the E-7 as a replacement for the E-3. The E-7 provides an advanced air battle management aircraft boasting a capable multirole electronically scanned array (MESA) radar, next-generation systems integration, and enhanced communication capabilities, affording modernized air battle management actions to achieve air superiority.[49] Unfortunately, delivery timelines expected from Boeing suggest the USAF will not field sufficient E-7 units until the mid-2030s, at best.[50] In a Taiwan Strait conflict, this delay could leave an under sourced, numerically inferior USAF AEW&C force overwhelmed by the numerically superior PLAAF AEW&C force, crippling air battle management effects and risking air superiority over critical battlespace. Congress and the DOD must urgently allocate funding and speed up the acquisition of AEW&C platforms like the E-7.

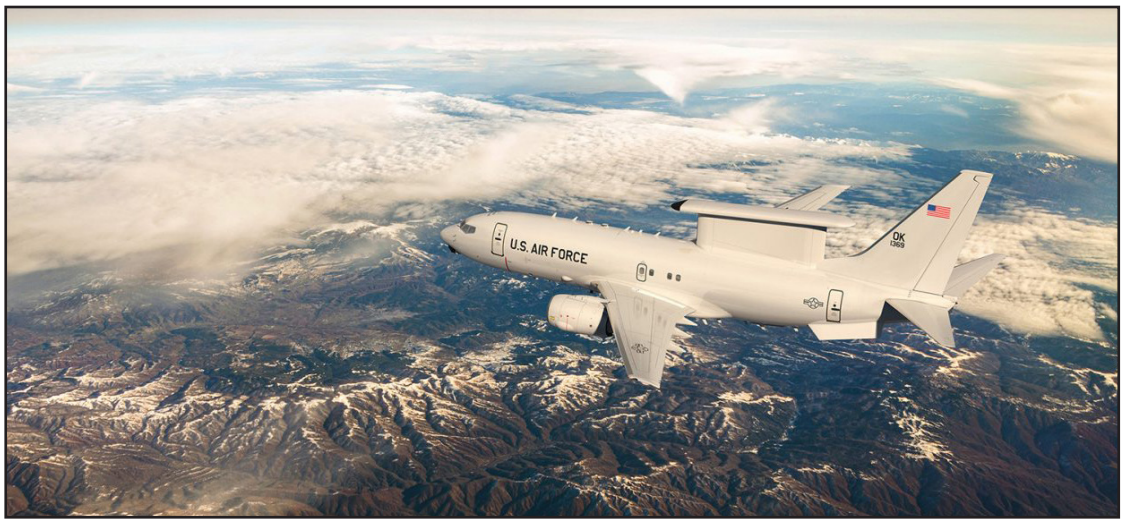

Figure 6: E-7 AEW&C.
Credit: U.S. Air Force illustration by Staff Sgt Nicolas Erwin.

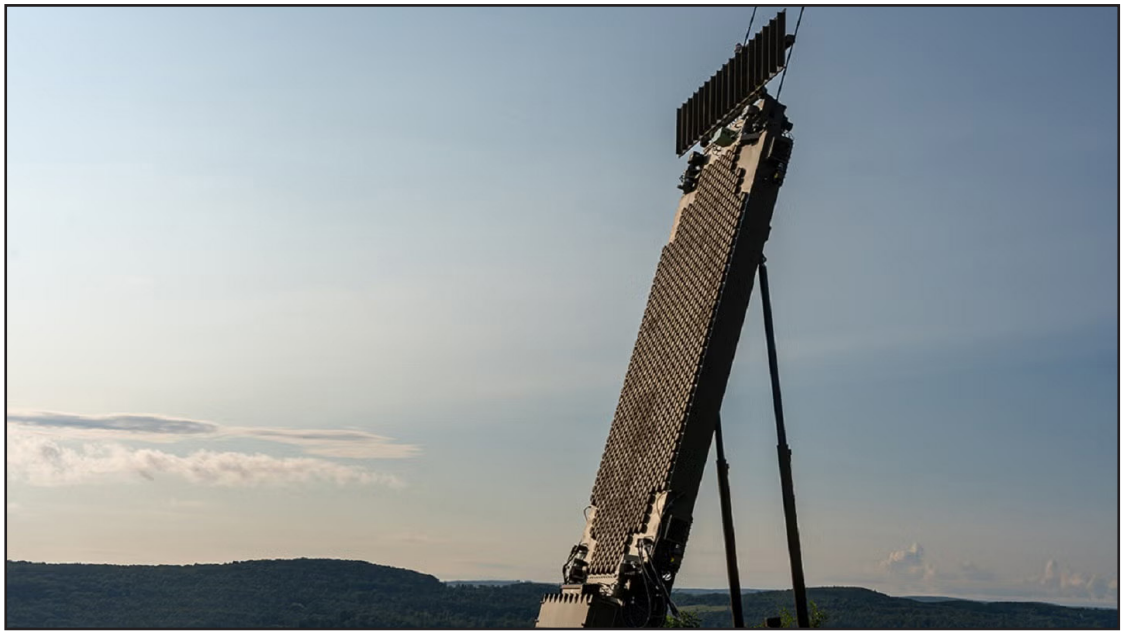

Figure 7: AN/TPY-4(V)1 3DELRR.
Credit: Lockheed Martin Corp/U.S. Air Force.

The USAF continues to rely on the AN/TPS-75 radar used in its CRCs since 1968 to detect air targets.[51] The CRC suffers from outdated, clunky equipment, which creates a bulky footprint. Although they are considered mobile, CRCs require six C-17s to deploy airmen and gear to an operating location.[52] Like the E-3 AWACS, it struggles with parts shortages. In February 2022, fifty-four years after the introduction of the TPS-75, the USAF selected Lockheed Martin's AN/TPY-4(V)1 Three-Dimensional Expeditionary Long-Range Radar (3DELRR) as a replacement capability, with plans to acquire up to thirty-five systems through 2028. Additionally, the CRC is transitioning to a Tactical Operations Center-enabled model, which significantly reduces the amount of airlift and logistical support required to employ, with as little as one C-130 pallet position required.[53] 3DELRR elevates the CRC to a modernized, ground-based battle management platform that will integrate seamlessly with the E-7 once fielded.

Conclusions: The Capability Gap

The USAF long ignored recapitalizing its AEW&C capabilities, and the DOD did not prioritize AEW&C capabilities because its primary operations (COIN in Iraq and Afghanistan) were conducted in uncontested airspace. Correspondingly, due to the shift in resources from the USAF to the Army during this timeframe (the Army received over $1.3 trillion more than the Air Force in the 20 years after 9/11), the USAF did not have the funds to recapitalize its AEW&C capabilities.[54] As a result of both, the U.S. ceded a significant advantage in air domain operations to the PRC. As the likelihood of conflict with China increases, the USAF must prioritize and accelerate its transition to a modernized AEW&C force. This modernization is essential for creating a seamless combination of fifth-generation fighters with a modernized AEW&C force. This partnership is required to achieve and sustain air superiority.

Without modernization, the USAF risks losing the ability to secure air superiority, leaving it unable to dictate the pace and

scope of air engagements against a proactive PLAAF. A modernized AEW&C capability will enhance situational awareness, integrate with cutting-edge aircraft such as the F-22 and F-35, and provide the dynamic air battle management effects necessary to excel in a contested battlespace. Failure to carry through or further delay to these modernization efforts risks operational paralysis, rendering air combat platforms ineffective due to a lack of coordinated situational awareness, which can lead to strategic failure in contested environments. This transition is vital for deterring aggression and ensuring the USAF can effectively counter and prevail against the PRC's expanding capabilities in the Pacific.

Strategies to Regain Air Superiority

Integrating advanced air battle management with next-generation fighters is vital to securing air superiority. The USAF must also balance its threat-penetrating air forces and stand-off forces to counter Chinese efforts to deny U.S. control in the Pacific. Well-defended bases are also essential to sustain the massing of airpower necessary to thwart China's coercive strategies and attain control of the skies.

Basing & Force Posture

Like the U.S. campaign against Japan during World War II, any war with the PRC in the Pacific demands multiple island airstrips for rapid massing and dispersing of forces to secure air superiority.[55] With this understanding, the USAF began clearing more than twenty million square feet of pavement at North Field on Tinian Island in 2023.[56] This effort to revive a strategic power projection position was once used to subdue the Japanese in 1945. Key additional sites include Palau, the Federated States of Micronesia, and the Marshall Islands. In 2023, the United States signed a $7 billion update to the Compacts of Free Association (COFA) with Micronesia, Palau, and the Marshall Islands, offering aid and services.[57] The COFA grants exclusive military access rights to these island nations' territories and waters, which is crucial to U.S. power projection in the Pacific against rising PRC power.[58] The COFA underpins the USAF's Agile Combat Employment (ACE) concept, which aims to frustrate potential PRC targeting of air power operating within the Pacific and secure sortie generation. Under the design, the COFA countries would likely be used as contingency locations (CLs) backing operations at enduring locations (ELs) at other U.S. and allied airfields.[59]

COFA bases are fixed and known locations to Chinese intelligence. Thus, the United States must field both offensive and defensive capabilities on each CL to boost survivability and ensure resilient combat sortie generation.[60] These airfields require radars that can provide AEW to support forward-deployed CRC units and create a surveillance network across battle management platforms. Options like placing TPY-4s on COFA islands susceptible to PRC targeting, using host country radar feeds, or adopting a new sensor are imperative to ensure each CL has an air surveillance radar for defense. Lastly, CLs need runways, parking, and hardened shelters capable of supporting AEW&C aircraft like the E-3 and E-7 and fighter aircraft. These measures will help preserve U.S. air superiority during disaggregated ACE operations.

Force Design & Allied Integration

The core of the fifth-generation partnership needed to leverage existing technologies to win air superiority consists of the F-22, F-35, E-7, AN/TPY-4(V)1 equipped CRC, and the emerging BCC capability. However, given the delayed delivery of an advanced air battle management capability, the USAF must develop tactics, techniques, and procedures (TTP) using the E-3 AWACS and AN/TPS-75 radar-equipped CRCs operating in short-duration Pacific exercises alongside

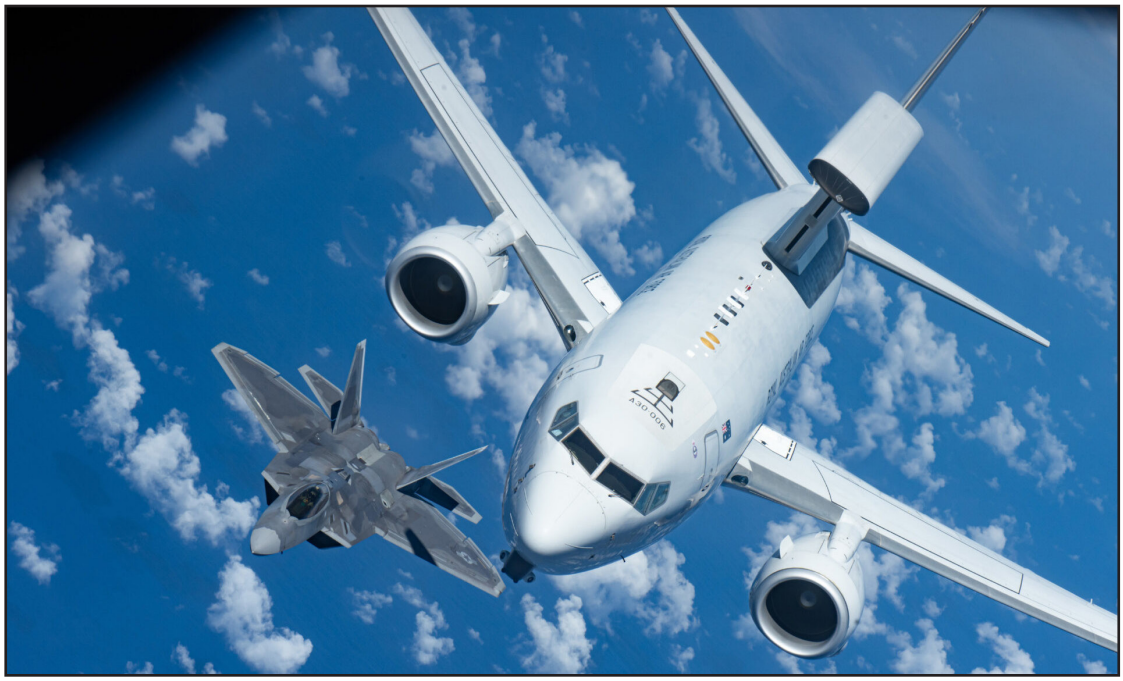

Figure 8: RAAF E-7A and USAF F-22.
Credit: Staff Sergeant John Linzmeier, 154th Wing Public Affairs, Hawaii Air National Guard.

the USAF F-22 and F-35. The strategic message of showcasing U.S. airpower in the Pacific is bolstered by "remaining predictably unpredictable," exercising regular yet sporadic aircraft rotations through various Pacific locations. This movement also complicates the PRC's planning and decision-making, creating enough uncertainty to deter aggression.

While these measures are important, the USAF must rely on its Pacific allies to help bridge the platform capability gap.[61] For example, in 2022, the USAF embedded air battle managers as exchange officers in the Royal Australian Air Force (RAAF) E-7A unit to speed up acclimation to the USAF E-7 acquisition.[62] The exchange program enabled the RAAF E-7A to participate in high-end USAF exercises, such as the USAF Weapons School's Integration Phase, marking the first time a non-U.S. nation joined a USAF Weapons School event.[63] Such events enable the E-7A, with integrated RAAF and USAF battle managers, to work with fifth-generation F-22 and F-35 operators to devise tactics for air superiority via advanced air battle management. The scale and complexity of a near-peer conflict necessitate increased use of joint and allied integration to offset capacity and capability gaps. Fully melding aircraft like the RAAF's E-7A Wedgetails and Japan's F-35s with U.S. deployment rotations and training exercises help the USAF prepare for major campaigns and strengthen deterrence.

Recapitalizing or upgrading air battle management platforms at a rate commensurate with fifth-generation fighters was an afterthought in the pursuit of air superiority over the past few decades. Fifth-generation fighters and modernized air battle management must be planned, procured, and exercised together to yield air superiority to the United States in any future fight. However, the DOD must consider that a future fight for air superiority may not be limited to the Pacific theater. Aggressors in Eastern Europe and the Middle East could take advantage of the distraction and seize control of the air in their respective areas of operations. Therefore, the USAF must acquire sufficient fighter and air battle management platforms to support two theaters simultaneously.[64]

Conclusions: Path to Preparedness

As in World War II, where the United States and its allies were forced to fight in two theaters, the current era of great power rivalry risks simultaneously devolving into conflict in the Pacific and Europe. Indeed, achieving air superiority supported by air battle management in multiple theaters must be at the core of any planning effort and acquisition strategy for the USAF and DOD. Dispersed and defended basing must be secured within the Indo-Pacific. An advanced partnership between air combat and air battle management capabilities must be realized. Allied fifth-generation capabilities must also be integrated into planning efforts. Fiscal fickleness may determine defeat if the U.S. fails to promptly acquire the necessary force to achieve air superiority.

Beyond Space-Based Reliance

Some argue that space-based systems alone can handle ground and air MTI, citing risks to aircraft from near-peer threats.[65] While space-based sensors deliver tremendous value, relying solely on them risks disaster in a conflict against a near-peer force wielding anti-satellite (ASAT) weapons. A balanced, layered strategy combining space-, air-, and ground-based moving target indication (MTI) offers redundancy and resiliency, reducing losses in coverage due to enemy attacks.

The United States Space Force (USSF) plans to replace legacy aircraft with more survivable space assets that can perform the functions needed to close long-range kill chains across the globe.[66] Private firms are slashing costs for low-earth orbit (LEO) satellites with ground and air MTI sensors.[67] More satellites may ultimately quench the demand for space-derived data from multiple combatant commanders to counter issues within their area of responsibility. Until that time, the USSF is also exploring potential partnerships with other governmental entities, like the National Reconnaissance Office (NRO), to tap into assets that can contribute to the MTI mission set.[68] In coordination with the National Geospatial-Intelligence Agency, the USSF established the Joint Mission Management Center (JMMC) to incorporate services, combatant commands, and other intelligence agencies and international partners.[69] The JMMC aims to allocate sensors among users, set priority, and decide on execution.[70]

However, the DOD is already voicing concerns about tasking and controlling space-based sensors, especially during a conflict. Most within the DOD believe military commanders, not intelligence officials, should control sensor tasking during conflicts.[71] Additionally, under NRO control, it is unclear how critical MTI information would flow to air battle management nodes in a timely manner to ensure the execution of core functions in support of air superiority operations.

The NRO is pushing to transition to only space-based surveillance capabilities, citing the inability of air and surface platforms to penetrate PRC threat systems. This approach ignores the ability of the PRC and Russia to threaten space with multiple counterspace capabilities.[72] Moreover, the U.S. Space Force and NRO lack an inherent near-real-time air battle management capability. Budget constraints also ostensibly favor space over air-based platforms, but this overlooks the operational necessity of real-time air battle management effects, which space assets alone cannot fully replicate. Ultimately, the United States needs both space-based and aircraft-based MTI capabilities to feed air battle management activities.

Like the air domain, our adversaries also contest the space domain, and their capabilities are constantly increasing. The Chinese and Russians have demonstrated anti-satellite (ASAT) capabilities and the ability to use legacy jamming techniques to deny

access to space-based assets. For example, the Russians conducted cyber and radio frequency (RF) jamming attacks to block Ukraine's access to satellite communications, preventing a synchronized response early in the Russo-Ukrainian conflict.[73] Undoubtedly, the USSF is more capable of defending and exploiting the space domain than Ukraine. However, it is naïve to believe our adversaries cannot impact U.S. access to space-based systems in a near-peer conflict.

Layering military effects across domains historically proves successful, while relying on a single domain introduces vulnerabilities to one's adversary. The Peloponnesian War famously pitted the land-dominant Spartans against the naval-focused Athenians. Each tried to exploit their strengths to subdue the other and claim victory. However, it was not until the Spartans developed a capable navy to layer with the land-superior hoplite army that they achieved victory over the Athenians, who never developed an equal land force to match the Spartans.[74]

A more modern example using a U.S.-led coalition force is the attempt to defeat the Islamic State in Iraq and Syria (ISIS) from 2014 to 2019. An air campaign was the initial game plan to deter and defeat ISIS because air supremacy was assured, and ISIS could not effectively counter the coalition air force. The coalition also had a plethora of ISR capabilities, which allowed for significant target saturation, development, and targeting, enabling critical strikes against key ISIS nodes. However, without the assistance of the Syrian Democratic Forces (SDF) to act as a ground force for clearing operations, it is highly likely that ISIS could not have been defeated by airpower alone.[75]

The USAF and USSF cannot afford to make a similar mistake. For example, in a potential Pacific conflict, a reliance on space-based MTI alone would yield no ability to holistically use AMTI and GMTI to conduct air battle management in the pursuit of air superiority. A layered approach consisting of both space-, air-, and ground-based assets providing redundancy and resiliency is the mix needed to maximize U.S. combat potential. This layered approach ensures air battle management can deliver air superiority, adapting to disruptions in any single domain to maintain control when it matters most. Most importantly, making U.S. air battle management a cross-domain capability provides a much-needed edge in its pursuit of air superiority.

Final Recommendations & Conclusions

Should competition with China in the Indo-Pacific escalate to conflict, U.S. air superiority and air battle management are not guaranteed. This capability gap is the consequence of atrophied air battle management skills and technology. The USAF must act now to fully integrate the E-7 and CRC with the F-35, F-22, and eventually the F-47 Next Generation Air Dominance (NGAD) fighter. The fifth-generation air battle management partnership will ensure our future force can establish air superiority at any time and place. Achieving air superiority through air battle management must remain a paramount objective of the USAF.

Without this focus, the paradigm of paramount air superiority and air battle management will vanish, and the consequence of atrophied air battle management skills and technology could complicate victory. The USAF must act now to advance the partnership of E-7, CRC, F-35, F-22, and eventually the F-47 Next Generation Air Dominance (NGAD) fighter to achieve air superiority at any desired time and place.

China is iterating battle management aircraft much more rapidly than the USAF, gaining an edge in technology and capability to counter the USAF's attainment of air superiority. The United States can no longer

cede the high ground to the PLAAF without risking the loss of our air battle management advantage in the Western Pacific.

The United States must solidify its basing plan in the Western Pacific to support both fifth-generation fighters *and* advanced air battle management platforms. These locations must also be defended to ensure survivability in the face of a PRC attempt to launch attacks against U.S. air operations in the region. To maximize battle management effects, these locations should also be outfitted with the TPY-4 radars associated with CRCs or other AEW radars, creating a web of surveillance coverage capable of providing targetable information for co-located air domain awareness and defensive counter-air capabilities.

The USAF must also rotate combat aircraft and AEW&C platforms throughout the Pacific to demonstrate capability. The constant movement of these capabilities sends a clear message to the PRC while remaining predictably unpredictable. Until the E-7 and TPY-4 acquisitions are complete, current E-3 AWACS and CRC units can help develop and refine TTPs for these operations. The USAF should likewise coordinate these events with our allies like Japan and Australia to incorporate JASDF F-35s and RAAF E-7As and F-35s.

Finally, the USAF and USSF must develop a layered approach to providing MTI to air battle managers, ensuring that the suppression and contestation of one domain do not result in the inability to achieve air superiority and air battle management effects. The resiliency and redundancy of having space-based capability paired with the more flexible air- and ground-based capability of the E-7 and TPY-4-equipped CRC will better support air superiority operations during conflict. Despite competing budgetary demands, air battle management platform modernization remains a non-negotiable investment to secure air superiority.

Final Synthesis

The United States Air Force must refocus on establishing air superiority—a mission that fell to the wayside while the nation's military was engaged in an area of operations that enjoyed uncontested access to the air. Historical examples such as the Battle of Britain and DESERT STORM demonstrate that air superiority has always depended on the collaboration between air battle management and air combat platforms. This collaboration must be re-established by integrating advanced AEW&C platforms like the E-7, CRC, and emerging BCC with the F-22, F-35, and eventually the F-47 NGAD fighter. The current delays in modernization have allowed adversaries like the PRC to close the gap in AEW&C capabilities, and further inaction will only increase their advantage. Delays in recapitalization risk leaving fifth-generation fighters unsupported, task-saturated, and unable to maintain air superiority.

Overreliance on space-based MTI without sufficient redundancy of layered air- and ground-based capabilities could reveal critical vulnerabilities that adversaries, particularly China, can exploit through anti-satellite and jamming attacks. A robust basing plan must be solidified to counter this threat, ensuring that locations throughout the Indo-Pacific are defensible, well-equipped, and capable of supporting offensive and defensive operations. These locations should host advanced AEW&C platforms and ground-based radars to create a web of surveillance coverage essential for real-time air battle management. Finally, allied integration is indispensable. Aircraft like Australia's E-7s and F-35s and Japan's F-35s must be fully incorporated into rotational deployments and training exercises to enhance readiness and deter adversaries.

Achieving air superiority in the contested skies of the Pacific will require more than advanced technology—it will demand a well-coordinated, adaptable force built on the lessons of the past and prepared for the challenges of tomorrow. Air superiority is also a capability at risk without immediate attention. The USAF must revitalize its air battle management capabilities and foster the partnership with fifth-generation combat platforms. Without timely modernization, strategic foresight, and unified action, the United States risks ceding control of the air—an outcome that would diminish its global influence and jeopardize its ability to win future conflicts. ✪

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