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Flipping the Script: Redesigning the US Air Force for Decisive Advantage

TIMOTHY A. WALTON AND DAN PATT
CENTER FOR DEFENSE CONCEPTS AND TECHNOLOGY, HUDSON INSTITUTE

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Cover: Edited version of US Air Force, US Navy, and US Marine Corps aircraft along with US Army Patriot missile batteries line up on the runway for an elephant walk during a routine operational readiness exercise at Kadena Air Base in Japan on May 6, 2025. (US Air Force)

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EXECUTIVE SUMMARY

Despite the United States Air Force's (USAF) stellar performance in recent operations, a geriatric fleet of aircraft, low readiness rates, and dismal prospects in a potential future conflict with the People's Republic of China (PRC) mean the service could decline within a decade from invaluable to incapable. More importantly, a weak Air Force would face major challenges defending the homeland, maintaining strategic deterrence, and projecting power in support of the nation, which could increase the likelihood the PRC starts a war and defeats the United States and its allies.

The Air Force needs to adopt a new approach to shaping its force that addresses the changed character of warfare, most consequentially against the peer threat of the PRC, and creates the capacity and flexibility to address global demands. The US Air Force's traditional approach, involving expeditionary and serial power projection, is increasingly insolvent against the PRC for a variety of reasons: China can target in mass the gradual deployment of forces to the Indo-Pacific; forces are vulnerable at airfields once they arrive; the PRC could achieve its aims of aggression, such as invading Taiwan or seizing other allied territory, before US forces could roll back enemy defenses to attack the PRC's center of gravity; and if the conflict continued, the Air Force would struggle to replace its losses, much less grow in size.[1] Absent viable shifts, our analysis indicates that within a decade China could defeat the United States and its allies in a major campaign—even if the Air Force received additional funding for aircraft, weapons, or readiness.[2] This suggests that more of the same approach to designing and fielding an Air Force will not work well in the future.

The Air Force has tried to evolve. It has divested thousands of aircraft and cut other units—more force structure than any

Photo: US Air Force airmen prepare a UAV for takeoff at Melrose Air Force Range in New Mexico on June 21, 2023. (US Air Force) other US military service—in its attempts to modernize.[3] It is on track to cut even more, especially fighter and attack aircraft, in exchange for a smaller fleet of similar, largely short-range assets to offset rising operations and support (O&S) costs.

Instead of accepting its problems, the Air Force can flip the script and impose new challenges on the PRC while retaining the capacity it needs. Rejecting a one-size-fits-all approach, it can divide the force design attributes it needs among portions of its force and change its laydown to overcome operational problems and create dilemmas for the PRC. It can also introduce specialized systems that address specific operational problems and efficiently allow the service to retain appropriate levels of capacity.

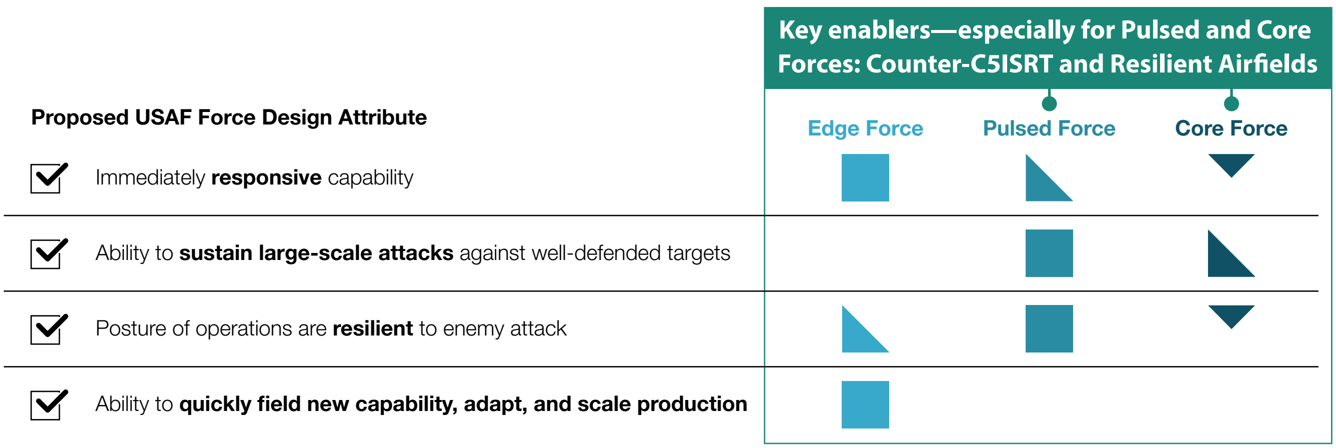
Building on the Air Force's nascent "One Force" force design, we propose an approach with three mutually reinforcing elements and key enablers:

1. **Edge Force** of forward-deployed, mobile runway independent capabilities. Attacking enemy forces, these units operate at a high level of risk-to-force and include truck-launched anti-ship munitions squadrons, air surveillance and targeting capabilities provided by stratospheric balloons and ground-based teams, and counter-air capabilities provided by very long-range surface-to-air missiles (VLR SAMs) and lethal or electronic attack uncrewed aerial vehicles (UAVs). The Air Force has referred to these capabilities as Mission Area 1.
2. **Pulsed Force** that generates episodic effects from range, leveraging less vulnerable and well-defended airfields. It consists of bombers, nuclear-armed intercontinental ballistic missiles (ICBMs), and other units, and the Air Force refers to it as Mission Area 2.
3. **Core Force** that operates from distributed airfields to generate effects, rapidly deploy forces, and ensure day-to-day US global presence. It includes theater-assigned and surging intelligence, surveillance, reconnaissance, and targeting (ISRT), counter-air, strike, mobility, and command and control (C2) capabilities. The Air Force refers to it as Mission Area 3.
4. **Key enablers, principally counter-command, control, communications, computers, cyber, intelligence, surveillance, reconnaissance, and targeting (counter-C5ISRT) and Resilient Airfields** that allow the mission areas to fight effectively. Counter-C5ISRT forces and capabilities degrade and deceive adversary sensing and sensemaking, generating broad area and local access for US forces and limiting the effectiveness of adversary forces. Resilient Airfields with infrastructure, logistics, passive defenses, and active defenses enable appropriate levels of access and sorties across environments and shape opponents' targeting problems. Rather than attempting to uniformly harden all operating locations, this force element would focus resources on a targeted set of key operating locations and forces (ranging from lightly defended temporary operating strips to heavily defended strongpoints) that enable mission area forces.

Leveraging access to forward allied and partner territory, the Edge Force would circumvent deployment delays, airfield vulnerability, and other difficulties by fielding ground-based mobile and low-signature capabilities that would be predominantly forward-deployed or stationed and would operate largely independent of fixed airfields. Customized to solve specific operational problems such as maritime strike, air surveillance and targeting in highly contested environments, and destruction of heavily defended high value enemy aircraft, its goal would be to provide new friendly kill chains and break enemy ones.

Simultaneously, Pulsed Force strikes would dismantle key nodes and targets, and Core Force capabilities would generate air superiority, conduct strikes, and sustain the continuous deployment and employment of forces from varied forward, intermediate, and distant Resilient Airfields. In this manner, the Air Force could retain the offensive initiative and not default to an approach

Figure E.1. Proposed Force Design Attributes



Note: Area of geometric shapes represents the approximate relative level of capacity to fulfill the desired force design attributes at the start of a challenging, large-scale scenario against the PRC. Other figures could depict the force design's capacity to address other scenarios, as well as capture how the contributions of assets could vary depending on the phasing of conflict.

Source: Authors.

of operating solely from "longer and longer ranges," which would sap its strength.[4] It would also provide new ways to generate air superiority. Rather than only attacking PLA aircraft at airfields or through aircraft engagements in the air, the specialized, ground-based units could conduct targeting and employ weapons that asymmetrically fight them from the ground.

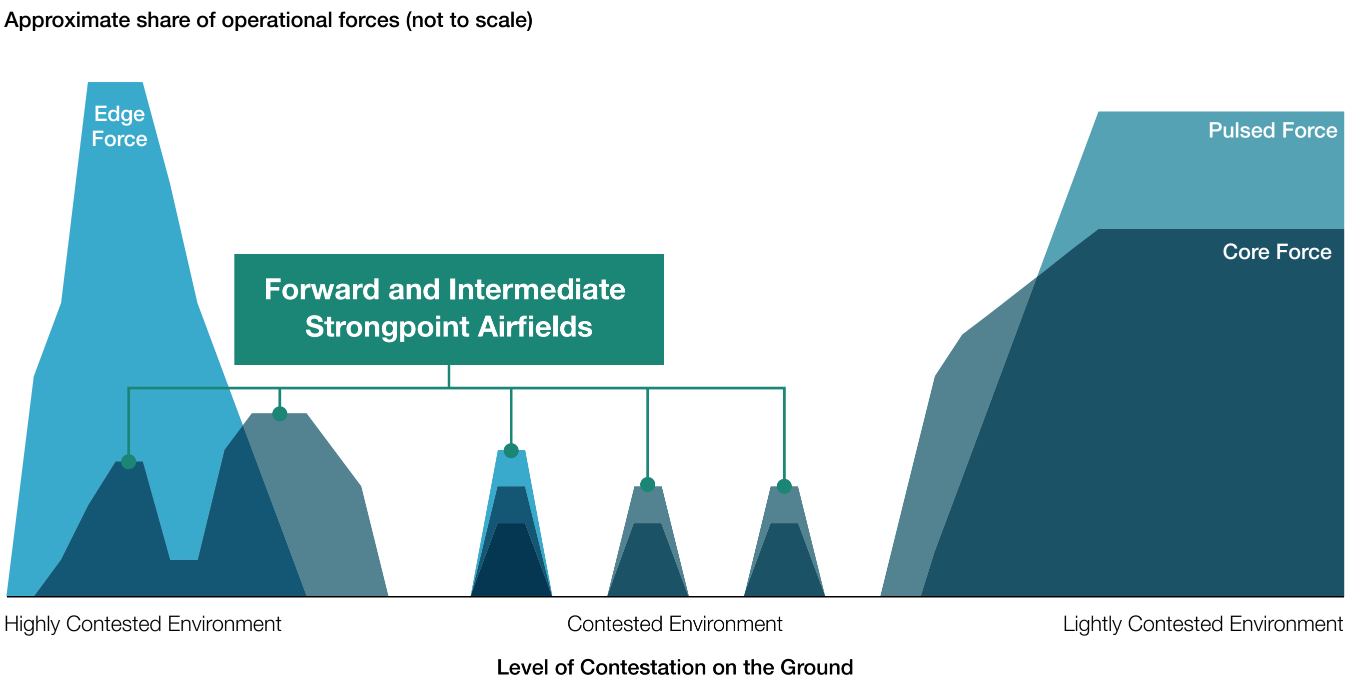
Collectively, this approach would improve the United States' ability to deny the initial aims of adversary aggression, and it would better posture US forces for protracted conflicts by preserving a large fraction of mainline forces and fielding new systems that could be mass-produced. It would also provide US commanders with a broader range of force employment options, which can not only enhance tactical and operational success, but also impose dilemmas on the PRC.

In addition to helping deter PRC aggression, this new approach to force design would generate capabilities applicable in different capacities and combinations to solve challenging problems in other theaters, such as in Europe or the Middle East. It would also help generate capacity and flexibility in the Air Force to continue addressing other national security priorities.

Figure E.1 describes key attributes of the force, and figure E.2 depicts a simplified laydown of these forces. Commanders could deploy the forces shown in figure E.2 to ensure each is able to generate effects against the enemy and operates at an acceptable level of risk. The Edge Force predominantly operates in the most contested areas at the left of figure E.2 to attack enemy forces with expendable and attritable systems, using camouflage, concealment, deception, and active defenses to survive. The Core Force deploys and employs forces from a mix of dispersed forward airfields, forward and intermediate well-defended airfields (referred to as "strongpoints"), and distant airfields. And the Pulsed Force generally operates far from the enemy, as well as from a select number of intermediate strongpoints, to conduct long-range strikes at scale.

The new force design's attributes make it more credible than today's Air Force. Adversaries and allies would recognize that

Figure E.2. Representative Laydown of Force Design Elements



Source: Authors.

the USAF could generate effects early and fight in new and unexpected ways. By embracing easily manufacturable assets and weapons, the force could also rapidly scale in production, allowing the USAF to field the Edge Force and other elements in large numbers within a few years and position itself to surge mass-production in a protracted conflict. It could also extend elements of the proposed force design to many of the United States' allies and partners, bolstering their own defenses. And lastly, the proposed design would be more affordable to design, procure, and sustain than today's Air Force.

Assessing Architectures in a Taiwan Scenario

To explore the relative performance of different force designs and employment concepts, we assessed them using theater-level simulations of a circa 2035 Taiwan invasion scenario. We tested four 2035 force architectures. Blue 1 is a baseline force that kept the US Air Force on its current plan. Blue 2 and Blue 3 force architectures invested an additional approximately $100 billion in research, development, test, and evaluation (RDT&E), procurement, military construction, and O&S costs over a decade in different ways. The Blue 2 ("More" Air Force) architecture added nearly 500 additional aircraft, more weapons, and boosted readiness, and the Blue 3 "Balanced" force adopted a balanced approach to force design with Edge Force, Pulsed Force, Core Force, and Resilient Airfields shifts, and additional RDT&E, munitions, readiness, and budgetary reserve investments. Blue 4 is a budget-neutral plan that, through a set of difficult trades, has around 200 fewer aircraft than Blue 1 in its inventory and prioritizes funding a limited set of the most impactful elements of the "balanced" force design. All force architectures operated from 40 airfields across the Pacific and contiguous United States.

Figure E.3. Simulation Results: Four Force Architectures

	Blue 1 Baseline Air Force	**Blue 2** "More" Air Force	**Blue 3** "Balanced" Air Force	**Blue 4** "Balanced," Budget Neutral Air Force
Percent (number) of Red amphibious vessel lifts to 322 threshold	**118% (380)**	**106% (341)** 0.9x	**43% (139)** 0.4x	**64% (205)** 0.5x
Blue denies successful Red lodgment?	**NO**	**NO**	**YES**	**YES**
Cost over Baseline		**+ ~$100B over a decade**	**+ ~$100B over a decade**	**+ ~$0B over a decade**
Percent of Red total aircraft inventory destroyed	**1%**	**1%** 1.0x	**22%** 22x	**9%** 9.0x
Percent of Blue total aircraft inventory destroyed	**14%**	**16%** 1.1x	**6%** 0.4x	**13%** 0.9x
Percent of Blue airfields operational for fighters at end of scenario	**45%**	**35%** 0.8x	**95%** 2.1x	**75%** 1.7x
Mean aggregate strike and counter-air shot capacity	**577**	**726** 1.3x	**1,319** 2.3x	**725** 1.3x
Mean total effects chains that force packages can generate	**715**	**896** 1.3x	**2,631** 3.7x	**1,148** 1.6x
Sorties requiring aerial refueling that receive it	**80%**	**51%** 0.6x	**149%** 1.9x	**93%** 1.2x

Source: Authors.

Figure E.3 summarizes key results from the simulations, comparing Blue 1's baseline with the alternatives. Both the baseline Blue 1 force architecture and Blue 2, which acquired nearly 500 more aircraft, failed to deny the PRC (Red) a successful amphibious lodgment and lost over 14 percent of their simulated aircraft inventories in the process, mostly due to airfield attacks.[5] The PRC defeated these force architectures.

Despite an additional approximately $100 billion for aircraft, weapons, and readiness, Blue 2's architecture performed similar to the baseline Blue 1 force, since its aircraft were also heavily attrited on the ground and outnumbered in the air. This suggests that simply buying more of the same aircraft, munitions, and readiness would bear little fruit.

In contrast, the balanced force architecture we proposed, Blue 3, denied a successful Red lodgment, suffered far fewer aircraft losses, and destroyed a large fraction of the PRC's aircraft fleet. The Blue 3 force architecture greatly outperformed the alternatives in terms of campaign success, level of losses, and other metrics, such as the percentage of operative airfields, offensive strike and counter-air capacity, the optionality resulting from the number of effects chains that force packages could generate, and the tempo that robust aerial refueling support enabled.[6] This outcome not only stopped the initial invasion but put Blue 3 in a favorable position to continue a protracted conflict or seek a favorable cessation of hostilities. Blue 4 also defeated the invasion and significantly improved performance over Blue 1 and Blue 2 across the board, but its smaller force suffered major aircraft losses.

Recommendations: Begin Implementation Today

The Air Force can pursue a new, viable force design and implement it. Neither practical levels of funding, nor personnel, nor technology, nor alliances and partnerships stand in its way. We recommend the Air Force, US Department of Defense (DoD), which President Donald J. Trump gave the secondary title of Department of War (DoW), and Congress start with the following steps.[7]

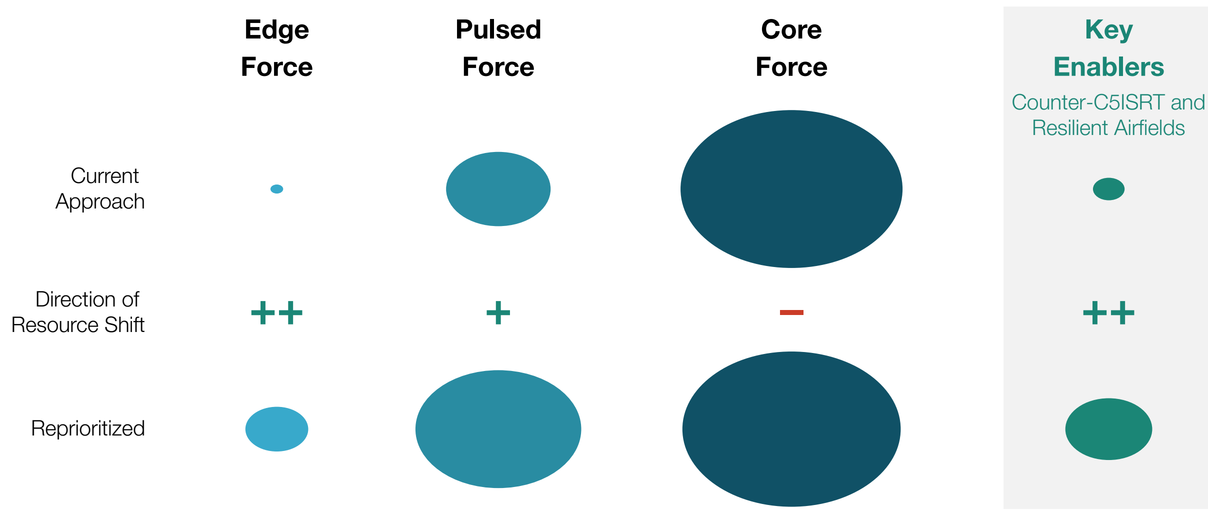
1. Pursue a force design that prioritizes Edge Force and Pulsed Force initiatives, and key enablers—especially counter-C5ISRT and Resilient Airfields.
2. Revise the initial force design, "One Force," to articulate the essential roles of the Core Force and key enablers, in particular counter-C5ISRT and Resilient Airfields.
3. Prioritize funding for the establishment of the Edge Force, a targeted set of counter-C5ISRT and Resilient Airfields investments, and the expansion and improvement of the Pulsed Force, all of which provided the greatest leverage in our scenario simulations. Then, direct additional funding to other areas, such as producing more and new types of munitions; hardening mobility aircraft with improved command, control, and communications (C3) and self-defense capabilities; developing and procuring a new medium-sized blended wing body (BWB) aerial refueling tanker; boosting readiness; and finally, procuring more uncrewed and crewed fighter aircraft.
4. Address acute gaps in joint support to Air Force operations, particularly Army air and missile defense and bulk fuels. Unless the DoW shores up these gaps, regardless of the changes the Air Force makes, it is reasonable to expect defeat in a major war.
5. Ensure Air Force Futures' new Chief Modernization Officer assesses Air Force logistics, engineering, and force protection activities and the nuclear enterprise.
6. Define opportunities for deeper operational, programmatic, and industrial collaboration with allies and partners.
7. Increase Air Force funding through the DoW and Congress to accelerate the transition to the new force design.

The Air Force is likely the service that currently has the most mature and promising concepts for defending the homeland, maintaining strategic deterrence, and projecting power, including to deny adversary aggression by the PRC. The National Defense Strategy should highlight this, and DoW leadership and Congress should steer additional funding to raise Air Force capability, capacity, and readiness.

Nonetheless, in a tight fiscal environment, the Air Force will likely need to make difficult choices to fund the new design, which it should pursue regardless of topline funding levels, in order to deter conflict and fight effectively. As depicted in figure E.4, the Air Force should prioritize its resources to achieve these goals:

- Create the Edge Force, which does not exist today.
- Substantially grow and enhance the effectiveness of the Pulsed Force.
- Transform the Core Force by retiring outdated fighter, attack, and support aircraft in the near term to free up resources for the Core Force's modernization, for mission integration and C3 across the force, and to fund the other elements of the necessary transition.
- Fund a targeted set of counter-C5ISRT and Resilient Airfields force elements to enable the other mission areas.

Figure E.4. Relative Resource Shifts Necessary to Implement the Proposed Force Design (Not to Scale)



Source: Authors.

As the recently passed One Big Beautiful Bill Act demonstrates, Congress and others will continue to add funding to the same familiar Air Force programs if the service's leaders do not explain their resource priorities based on a new force design. However, no realistic funding increase will allow the current force design to address the emergence of a peer adversary in the PRC, the proliferation of militarily relevant technology across all theaters, and growing challenges in maintaining and crewing the fleet.

As DoW and congressional leaders consider options for the Air Force, they should resist the siren song that tempts "a score more of the same aircraft, weapons, or flying hours each year will tip the scales." No, only through a major transformation of the Air Force's force design and commensurate architecture can the Air Force position itself to deter and defeat PRC aggression while retaining the flexibility and scale it needs to address other global demands. A balanced force design is viable and can achieve this.

1. INTRODUCTION

The United States Air Force (USAF) is increasingly essential to US national security. In recent operations, it rapidly projected power to support US interests across the globe, delivering arms and aid to embattled allies and partners such as Israel and Ukraine, transporting senior leaders to diplomatic negotiations, and conducting surgical strikes against terrorist groups and Iran. The Air Force continuously guards US airspace from incursions and deters nuclear conflict by operating two of the three legs of the nuclear triad. And it is postured to swiftly project power to deter and, if necessary, defeat large-scale aggression by adversaries, such as a People's Republic of China (PRC) attack on Taiwan. Although all military services would play important roles in a Sino-American conflict, the Air Force may be responsible for eliminating more than two-thirds of targeted enemy assets.[8]

However, despite its prolific pace of operations, the Air Force faces major force structure problems. Two-thirds of its aircraft types "had their first flight over 50 years ago," and multiple types are on track to reach the century mark.[9] Its fleet is approximately half as small as during the Cold War and continues to shrink; the Department of the Air Force's Fiscal Year (FY) 2026 budget proposes retiring 340 aircraft while purchasing only 76.[10] The readiness of its force has also fallen. Only 54 percent of its aircraft are available to fly due to funding and parts shortfalls, and the Air Force lacks around 2,000 pilots and additional ground crews.[11] Even more concerning, the proficiency of US pilots—long a source of competitive advantage—has declined. US combat pilots now average less than half as many flight hours as their Cold War predecessors

Photo: US Air Force crew chiefs from the 67th Aircraft Maintenance Unit await their cue to marshal an F-15 Eagle from the 67th Fighter Squadron during annual exercise Cope North on February 20, 2017, at Andersen Air Force Base in Guam. (US Air Force) and potentially about 60 percent of the hours that Chinese pilots fly.[12]

Furthermore, the Air Force faces a peer adversary in the PRC that not only has highly advanced technology and world-leading industrial capacity, but also fields operational systems designed to counter US air advantages. The PRC can destroy US aircraft at airfields, shoot them down in the air, and in general make them far less effective and efficient. Absent viable shifts, our analysis indicates that within a decade, China could possibly defeat the United States and its allies in a major campaign—even if the Air Force received additional funding for aircraft, weapons, or readiness.[13] This suggests that more of the same approach to designing and fielding an Air Force will not work well in the future.

In response, the nation needs more Air Force capability and capacity. It needs a ready Air Force that redresses gaps in wholeness and preparedness. But it also needs a *different* Air Force. Threats and technologies have evolved, and a new Air Force design can ensure that the service can continue to defend the homeland, maintain strategic deterrence, and project power. It can also allow the service to craft a force that focuses on its principal threat, the PRC, while addressing other national demands.

The Air Force has started to evolve.[14] In 2024 it published an unclassified summary of its new "One Force Design" document, which asserted that "the character of war has changed—the combination of network-enabled long-range fires, and mass quantities of agile short-range systems, challenges our preferred way of war. The Air Force must transform from what it is today to what it needs to be to compete."[15] It introduced three mission areas with attributes "to address the changed character of war":

1. Mission Area 1 (MA1) capabilities have attributes that allow them to live within and generate combat power from the dense threat area that will be under constant attack from adversary ballistic and cruise missiles or attack UAVs.
2. Mission Area 2 (MA2) capabilities have attributes that afford them the range to operate from the defendable area of relative sanctuary beyond the umbrella of most adversary ballistic and cruise missiles or attack UAVs and project fires into highly contested environments.
3. Mission Area 3 (MA3) capabilities have attributes that create the flexibility and mass to span a range of potential future crises and operate from the broader area that covers most of the world with positions resilient to limited adversary attack.[16]

This report finds the USAF design vector is fundamentally promising. The Air Force dissects operating environments and missions to compose forces that address specific operational problems in the most stressing and consequential scenarios and to generate advantage at a reasonable cost. Moreover, it rejects a one-size-fits-all approach to force design in which more of the same forces attempt to operate in all environments. Instead, it develops a tailored and adaptive portfolio of capabilities while retaining flexibility to address global demands.

The Air Force's unclassified summary of the force design, though, has drawn questions and criticism:

- What is the composition of MA1 forces?
- How will MA2 forces achieve an appropriate frequency and level of mass if they operate from range?
- How can the Air Force effectively employ MA3 forces in a high-intensity conflict, including in support of air superiority, strike, and mobility?
- Does the force design account for essential infrastructure, logistics, readiness, and munitions factors?

In response to the demand for a new force design and these questions and critiques, this study reconceptualizes One

Force. It proposes a mutually reinforcing approach to force design that rebrands and expounds on each of the Air Force's tripartite mission areas and establishes a firm foundation of key enablers, in particular counter-C5ISRT and Resilient Airfields with airfield infrastructure, logistics, and passive and active defenses. It subsequently assesses representative force architectures in a challenging Taiwan 2035 invasion scenario to identify valuable approaches to force design and employment and to review implementation pathways. The study concludes by offering actionable recommendations for the US Department of War (DoW) and Congress and by considering counterarguments.

2. THE IMPETUS FOR CHANGE

The Air Force needs to recapitalize and modernize its geriatric fleet of aircraft, but adding more of the same operational concepts and capabilities will be neither effective nor affordable. Instead, the Air Force should pursue a new approach to shaping its force that addresses the changed character of warfare, most consequentially against the peer threat of the PRC, and preserves the capacity and flexibility to address global demands.

The Changed Character of Warfare

Around the world, airfields are under attack. Combatants can strike airfields and the aircraft they host with a range of capabilities, from long-range missiles to short-range drones. Nations, militia groups, and criminal organizations are exploiting modern manufacturing and microelectronics to field these strike weapons with sophistication and scale that are difficult to counter. Increasingly, these threats will be able to target aircraft not only on the ground but also in the air at great ranges by employing long-range surface-to-air missiles (SAMs), other long-range weapons, and short-range weapons from forward-deployed launchers. Over the past few years, strikes against airfields have occurred across the battlefields of Ukraine, Russia, Israel, Iran, Yemen, Sudan, and Burma, and forces have flown threatening drones over and around US military airfields within the United States and at US and allied bases and airports abroad.

Photo: Members of the rocket force of the Eastern Theater Command of the People's Liberation Army PLA conduct operations during combat readiness patrol and military exercises on April 8, 2023, near Taiwan. (Getty Images)

Although "threats to aircraft at airfields are not new," what has changed is the "greatly improved precision with which combatants can target both aircraft at airfields and the complex, interdependent network of personnel and supporting airfield systems necessary to generate sustained air operations at scale."[17] This "precision mass" challenges the US Air Force's modus operandi of gradually deploying aircraft to forward, uncontested airfields, conducting operations at a time and pace of the United States' choosing, and countering small-scale attacks on airfields that do not interrupt the air campaign.[18] As the Air Force's unclassified summary of One Force asserted, "The character of war has changed—the combination of network-enabled long-range fires, and mass quantities of agile short-range systems, challenges our preferred way of war."[19] And no country challenges it more than China.

The Peer Threat of China

The PRC is a peer adversary. It is the only authoritarian nation with the will and power to attempt to overhaul the international system in its image, and Beijing's vision would move the international community "away from the universal values that have sustained so much of the world's progress over the past 75 years."[20] Compared to that of the United States, its population is four times larger; its gross domestic product is 15 percent larger in purchasing power parity terms; and it produces 66 percent more industrial output and 70 percent more exports.[21] In terms of technological development, China graduates more than six times as many engineers, files the most global patents, leads in many emerging fields, and excels at translating research and development into commercial products manufactured at scale.[22] Its international influence has grown through extensive trade, investment, and tourism; active participation in intergovernmental organizations; and sponsorship of strategic infrastructure and investment frameworks such as the Belt and Road Initiative and consultative fora such as BRICS (an organization with founding members Brazil, Russia, India, China, and South Africa). Lastly, its military power now rivals or exceeds that of the United States across many domains.

Over the past few decades, the People's Liberation Army (PLA) has transformed into a world-leading military. The Chinese Communist Party (CCP) has focused on developing dominant military forces to "deter and compel" other countries and project power, which aligns directly with its overall strategy of so-called national rejuvenation by 2049.[23] Its most recent defense white papers portray the development of the PLA as essential to "safeguarding national sovereignty" and "fighting and winning wars" against the "powerful enemy" (i.e., the United States).[24]

The PLA espouses an Active Defense Strategy that pursues operationally offensive actions in support of strategically "defensive" aims.[25] Moreover, the PLA views warfare as taking place in an informationized age that is increasingly intelligentized. A systems confrontation approach to warfare guides this view, envisioning confrontations between opposing operational systems.[26] Systems confrontation thinking is the most important concept guiding PLA force design and employment. The PLA identifies operational systems as consisting of five component systems: command, firepower strike, information confrontation, reconnaissance-intelligence, and support.[27] The PLA's "basic campaign guiding concept," directed by the National Military Strategic Guidelines for the New Era, calls for PLA operations to paralyze enemy operational systems with "integrated operations, key point strikes," gain the initiative through an active offensive approach, and compel enemy forces and leaders to acquiesce.[28] With a force-planning focus on the United States, the PLA has meticulously assessed US approaches to warfare and developed concepts and capabilities to paralyze and neutralize US operational systems, including those involving Air Force operations. As Michael Dahm has stated, the PLA aims to "render enemies deaf, dumb, and blind, and then pick off disconnected enemy forces with long-range precision fires."[29]

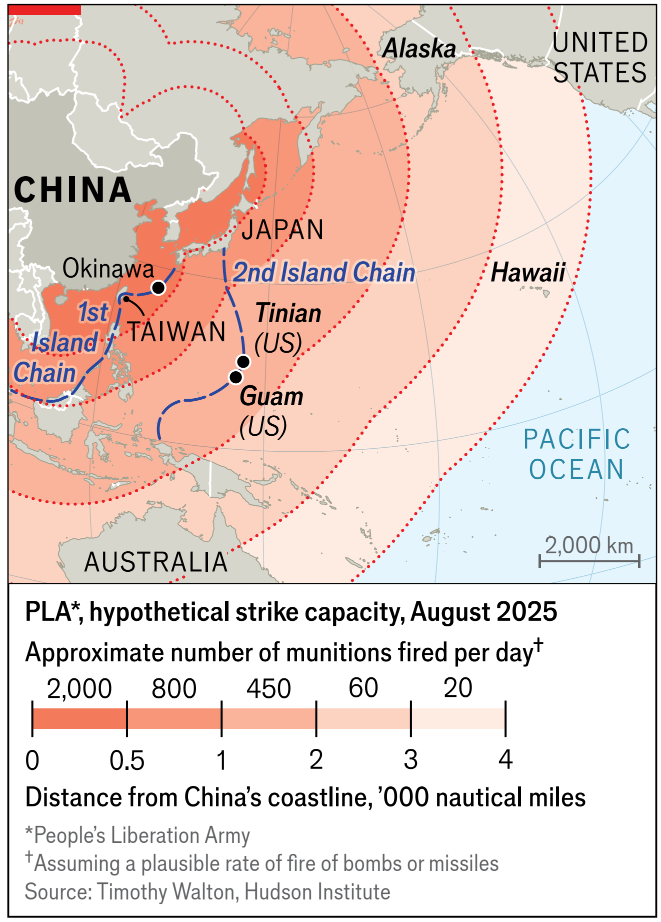
Neutralizing US Airpower on the Ground

Most prominently, the PLA has developed a robust, multifaceted approach to neutralize US airpower on the ground. Rather than engaging US aircraft directly in the air, its first line of effort aims to attack sensing and command, control, and communications (C3) hubs, aircraft, airfields, bulk fuel storage and distribution systems, and other key points on the ground. The PLA Rocket Force (PLARF) has the world's largest inventory of ballistic, cruise, and hypersonic missiles, which provide layered coverage throughout the First and Second Island Chains. It also boasts missiles such as the DF-27 that can engage targets as far as Alaska, Hawaii, and the northwestern contiguous United States. New intercontinental-range ballistic/hypersonic weapons and fractional orbital bombardment systems will likely be able to engage targets in the contiguous United States in numbers within the decade.[30] Massed salvoes of PLARF missiles with complex behaviors can overwhelm and penetrate air and missile defenses to precisely strike targets with conventional and nuclear warheads, including at airfields.

Progress in PLA Air Force (PLAAF) aircraft quality and quantity stands out as a central feature of the PLA's modernization. Aging platforms once overshadowed it, but now the PLAAF manages a substantial inventory of modern, high-performance fighters, bombers, and support aircraft. Fourth-generation aircraft receive support from fifth-generation stealth aircraft, which reflect indigenous research and development leaps in stealth coatings, low-observable designs, and advanced radars. The PRC uses its manufacturing and technology ecosystem to incorporate advanced mission systems and improved propulsion.[31]

The PLA is modernizing its fleet of strike aircraft, which can fire advanced standoff, stand-in, and direct-attack missiles and bombs. Specifically, it is modernizing its force of JH-7 fighter-bombers, delivering new H-6 bombers (resulting in a bomber fleet size that has surpassed that of the US Air Force) and a new generation of stealthy uncrewed aircraft systems (UASs). It is developing a stealthy regional combat aircraft (the J-36) and a stealthy intercontinental bomber (the H-20) that will be capable of striking Alaska, Hawaii, and beyond. Another major improvement is the YY-20 aerial refueling tanker that can extend the range of strike aircraft or allow advanced fighters to clear paths for them.

Figure 1. Estimated 2025 PLA Strike Capacity



Source: "America's New Plan to Fight a War with China," *The Economist*, August 14, 2025, https://www.economist.com/international/2025/08/14/americas-new-plan-to-fight-a-war-with-china.

As shown in figure 1, the PLA can already deliver numerous weapons a day far from its territory, and aircraft will likely deliver more than two-thirds of munitions in a notional 2025 campaign.[32] This suggests that approaches to defeating PLA strike aircraft—ideally before they release their munitions—are imperative in a conflict. Moreover, as the PLARF and PLAAF field longer-range and more numerous strike assets and weapons, this strike density will deepen.[33]

Lastly, China has other strike capabilities at its disposal. For shorter-range targets (such as in Taiwan), the PLA Army (PLAA) can fire numerous rockets. PLA Navy (PLAN) surface combatants and submarines can fire land-attack missiles, and PLAN carrier air wings are also capable of launching a mix of strike weapons. Additionally, China has a range of low-signature and covert assets to conduct attacks, such as those in the China Coast Guard and Maritime Militia, including commercial vessels. PLA special forces can also launch drone, missile, or sapper kinetic and non-kinetic attacks. In summation, the PLA would likely employ a wide range of capabilities against aircraft on the ground and their supporting systems.

Neutralizing US Airpower in the Air

In parallel, the PLA has developed approaches to systematically neutralize US airpower in the air. Its "anti-air raid campaign" is an "offensive-defensive integrated campaign."[34] Through offensive attacks, including against airfields, it seeks to "crush" the enemy's ability to conduct air raids and other air operations. Other offensive attacks include fighter sweeps targeting enemy aircraft, in particular aerial refueling and airborne early warning and control aircraft, which could cause enemy force packages to collapse. In support of this approach, the PLA is rapidly fielding a slew of long-range, low-observable crewed and uncrewed combat aircraft, such as the J-20, J-35, J-36, J-50, GJ-11, and FH-97 (see figure 2). It is also equipping its combat aircraft with long-range air-to-air missiles (AAMs), including ones optimized to engage high-signature aircraft at very long ranges, which support disaggregated kill webs. Another emerging class of offensive capabilities is very long-range surface-to-air missiles (VLR SAMs), which land- or sea-based launchers fire and offboard targeting directs. These weapons could engage aircraft—especially high-signature ones—at up to 1,000 nm or more.[35] They could snipe at enemy aircraft at great ranges, such as when US or allied aircraft are operating over allied territory, and conduct attacks to disrupt and destroy inbound enemy raids.

Figure 2. PLAAF J-35A

Source: Getty Images.

In terms of defensive capabilities, the PLA has developed an extensive integrated air defense system (IADS), which it has armed with passive and active sensors, electronic warfare jammers, counterspace weapons, surveillance and combat aircraft, ground-based air and missile defense batteries, and naval forces. This layered IADS grants the PLA overlapping coverage from the Western Pacific throughout inland zones and makes penetrating into PRC airspace challenging. The PRC has also hardened and buried many of its defense facilities and systems and adopted other passive defense measures that require an increase in the size and complexity of attacks against them.[36]

In support of offensive and defensive operations, the PLA has fielded overlapping networks of multi-phenomenology terrestrial and space-based intelligence, surveillance, reconnaissance, and targeting (ISRT) and C3 capabilities. This sensing and sensemaking capability generates real-time data on fixed and moving targets. It also integrates decision-making, which allows the PLA to detect movements of adversary forces and guide attacks against them.

Conversely, the PLA focuses on degrading and deceiving adversary sensing and sensemaking, thus decreasing the efficiency and effectiveness of adversary operations. PLA efforts in this area include extensive local- and broad-area electronic warfare, terrestrial and space-based counterspace capabilities, and an ability to sever and interfere with submarine cables and other internet traffic routes.[37] This ability to sense, degrade, and deceive adversary sensing can inform tactical or operational decision-making; it also can inform strategic assessments regarding when adversary forces are postured, or not, to counter PRC operations, thus potentially allowing the PRC to conduct opportunistic attacks. Overall, by achieving a decision advantage, the PRC aims to control the decision-making of other countries in its favor before and after the outbreak of hostilities.

A Fundamentally Different Class of Threat

The PRC poses a peer threat that exceeds the capability and capacity of the United States and its allies in multiple areas. One can synthesize its military capabilities as follows:

- An extremely large and highly advanced military
- Rapid deployment, fielding, and adaptation of capabilities
- An enormous industrial base that can mobilize and support a protracted conflict
- Extensive passive and active defenses surrounding military and industrial targets
- Ability to execute large-scale, short-notice operations that could outpace allied responses to establish a fait accompli
- Ability to accurately assess enemy dispositions to conduct numerous long-range key-point strikes on forces, infrastructure, and logistics on the surface and confront forces in the air

As a result, the PRC poses major operational and strategic challenges to the Air Force's traditional approach to operations. A review of some of them can illuminate pressing challenges that compel a revised USAF approach to force design and employment.

Chief among these challenges is the vulnerability of airfields and supporting logistics. The PRC can accurately assess USAF dispositions and conduct large-scale key-point strikes on aircraft at airfields, airfield infrastructure, and supporting systems. Recent analyses underscore how evolving threat capabilities have heightened the risk to US and allied air bases across the Indo-Pacific. These assessments find that long-range precision fires and improved surveillance are key enablers of the PRC's ability to disrupt air operations.[38] They also show that the Chinese military has systematically expanded its infrastructure to withstand or rapidly repair damage from missile or air strikes, all while aiming to deny the same flexibility to US and partner bases through integrated firepower strikes of air and missile attacks.[39]

Such developments pose an especially acute challenge for the United States, which has in recent decades relied on secure forward bases in Europe and the Middle East to conduct operations. In a potential high-intensity scenario with the PRC, large main operating bases in the First Island Chain, Second Island Chain, and beyond could quickly become priority targets for PLA strikes. Large salvoes of ballistic and hypersonic missiles armed with runway-penetrating submunitions, complemented by cruise missile and bomb strikes on fuel and munitions depots, C3 nodes, and personnel, could cause runway closures and substantial damage across critical logistics and command functions. In addition to the distant threat missiles and aircraft pose, special forces or other unconventional units could launch swarms of lethal drones or missiles and conduct electronic attacks or sapper raids. By targeting ground-based air and missile defenses early in a campaign, the PRC could facilitate subsequent attacks. Meanwhile, qualitative and quantitative improvements in China's surveillance and reconnaissance assets increase the likelihood that repeated follow-up strikes would hamper any single large-scale US buildup.

Mark Cancian of the Center for Strategic and International Studies (CSIS) led a wargame series of a potential contemporary war with the PRC. It found the United States could lose hundreds of aircraft, primarily short-range fighter aircraft operating from the First and Second Island Chains, and 90 percent of those losses would occur on the ground.[40] Building on this strength, the PLA continues expanding its quiver of conventionally armed short-to-intercontinental-range missiles and is developing and fielding the H-20 bomber and other strike aircraft capable of attacking distant US bases at scale. The Department of the Air Force's long-range forecast concludes that by mid-century, Chinese missile inventories will be large enough to saturate many forward locations, and there will be no reliable sanctuary anywhere.[41]

Within this environment, logistics shortfalls multiply the vulnerabilities confronting US and allied installations. Because many bases in the region were never engineered to sustain heavy incoming fire, they possess limited protective infrastructure and lack proven procedures for rapid repair and reconstitution. While Air Force engineers have refined methods such as rapid airfield damage recovery (RADR), shortages of pre-positioned materials and personnel specializing in ordnance disposal at multiple sites under near-simultaneous attacks still constrain these preparations. Despite ongoing force-wide initiatives, there likely would not be enough engineering and airfield repair teams in theater from Day 1—complete with the equipment and flowable-fill stockpiles necessary for repeated crater repair. The need to service large numbers of runways in parallel would magnify this gap.[42]

Another strain arises from bulk fuel storage and munition distribution systems. Even if engineers restored runways swiftly, forward flight operations would stall without reliable fuel. Hardened underground bunkers and dispersed fuel bladders can improve the resilience of air operations, but current facilities are often aggregated in unprotected tank farms that the PLA will very likely target early. The same principle applies to munitions stocks and critical spares. Attacking these high-value choke points undermines the US capacity for sustained sorties and could negate the benefits of runway repairs or distributed concepts.

Planners have also highlighted potential workarounds, such as partnering more closely with allies to increase base access. Dispersing aircraft across additional military and civilian runways increases the number of targets that the PLA must address. However, research shows that limited local approvals for wartime use, plus the need for specialized ground equipment and logistical support, complicate such distribution. Thus, while distributed operations under the Agile Combat Employment framework can mitigate some threats, implementation at scale is feasible only if the logistics enterprise can move supplies and personnel among a network of smaller airfields under duress.[43] Additionally, the PLA may be able to detect and rapidly engage even small groups of distributed aircraft, thus defeating US forces in detail.

For longer-range operations, the aerial refueling fleet's ability to enable long-range and distributed operations hinges on resilient logistics arrangements supporting both tankers and receiving aircraft. Indeed, tankers not only require a high volume of fuel but also must contend with the same infrastructure bottlenecks and political access constraints as the wider mobility enterprise.[44] Forward-based tanker units cannot function without well-protected storage sites, robust overland or over-the-shore fuel delivery methods, and sufficient runway length and ramp space. Additionally, forward-operating tankers reduce available ramp space and other resources that bases could devote to shorter-range combat aircraft. If KC-135 and KC-46A tankers must shift to rearward basing, this undermines their ability to offload large volumes of fuel forward. These tankers then also compete for available space and other resources with bombers and other assets. Consequently, a coupling forms between a comprehensive distributed logistics framework and force design and employment concepts, requiring a more systematic approach to operational systems, including logistics resilience.

The PRC also poses other major challenges. One is the dilemma of how to employ combat aircraft, particularly fighters. Given the PRC's extensive targeting and engagement capabilities, additional combat aircraft could produce marginal gains if the PLA destroys them on the ramp. It could also be difficult to deploy large numbers of short-range crewed and uncrewed fighters to forward and intermediate airfields on short notice, given the aerial refueling and other mobility requirements to do so and the possibility that the PRC could preventively attack airfields. However, operating with few fighter and ISRT aircraft forward may simplify enemy planning, expose airfields and other critical assets to close-range enemy attacks, and allow enemy forces to bypass forward defenses to attack intermediate and distant targets.

Another challenge is how to generate enough mass from the bomber force. The United States currently has a historically small force of 142 bombers that sustain mission-capable rates of around 50 percent.[45] If bombers fly from distant airfields in the contiguous United States to the Western Pacific, then their daily sortie rates would be low and may be insufficient to defeat an attempted PRC invasion of Taiwan or conduct other large-scale operations. If, however, bombers are based forward to increase their sortie rates, then they would be vulnerable to attack, and it may be difficult to reload their munitions and sustain a large flow of additional munitions to airfields under attack.

The Air Force's current force design is heavily reliant on short-range fighters operating from forward airfields. This design predisposes an approach to force employment that commits a large fraction of US forces early in a conflict. Since the USAF relies heavily on its fighter fleet for both air superiority and strike, it requires rapid deployment of large numbers of those fighters to operate from forward airfields. Given that the airfields largely lack appropriate passive and active defenses, enemies likely perceive the combat aircraft as vulnerable to attack on the ground. Thus, depending on the effectiveness of airfield attacks and air combat, this all-in commitment early in a conflict could succeed spectacularly or fail catastrophically. For example, in CSIS's aforementioned wargame series, even though US and allied forces consistently defeated an invasion, they consistently lost hundreds of fighter aircraft, mostly on the ground.[46] Relying heavily on a particular approach to a campaign limits the scope of operational plans available to US commanders, which facilitates the PLA's preparations to counter US plans. Furthermore, such a binomial outcome is unlikely to instill confidence in US political leadership, which could discourage US leaders from deciding to conduct operations and thus encourage PRC aggression.

The current force design also aligns with a problematic paradigm that an early decisive battle—such as the initial denial of a PRC invasion of Taiwan—could decisively end the conflict. Although this scenario is possible, conflict involving superpowers and other countries could reasonably persist. Consequently, to prepare for and thus ideally deter such a war from breaking out, US forces need to not only position themselves to win the "first battle" but also succeed in a long war that achieves a favorable cessation of hostilities.[47]

The Air Force is unaccustomed to and ill-designed for suffering extensive losses on the ground or in the air, as it could in the opening stages of a conflict or a protracted war. In a long conflict, winning the first battle is necessary but insufficient. The ability to gain a decision advantage (politically, economically, and militarily, including in terms of geographic position) and establish a kill rate that outpaces the enemy's net generation rate is the more decisive measure. The Air Force's current force structure does not provide enough assets that can employ numerous weapons reliably at low risk or be mass produced in a protracted conflict. This undercuts strategic deterrence and affects tactical and operational employment options.

A Grim Assessment

Not since the War of 1812 has the United States faced such a powerful foe, and in a conflict in the Western Pacific, the United States would face a juggernaut with home-field advantage.[48] The United States would operate from its own Pacific states and territories as well as from and with allies and partners. But the fact remains that the locus of a large-scale war against China would likely be far from the continental United States, and US forces would face challenges deploying to and operating in the contested environment.

Recent assessments of the military outcome of a potential conflict with the PRC—usually involving an attempted PRC invasion of Taiwan—reveal either consistent US and allied success, but at a high cost, or US and allied defeat.[49] Although one should expect that conflict between superpowers could be ruinous to either or both parties, neither result is heartening for the United States.

Furthermore, regardless of US and allied prospects of success in the Davidson Window, the 2030s look worse still. By the mid- to late 2030s, without opposition the PRC will likely field a nearly omnipresent ability to sense and target high-signature adversary forces (to include airfields and the aircraft they host) while fielding new countermeasures or making its own assets more difficult to surveil and attack, such as by lowering their signature. It will also likely field even deeper and wider-ranging inventories of weapons and assets, including numerous uncrewed ones. These capabilities will likely allow the PLA to hold US and allied targets at risk, including within the contiguous United States, either through numerous long-range weapons or persistent operation of overt and covert short-range ones. Our simulations of a circa 2035 attempted PRC invasion of Taiwan find that, absent adjustments to programming and planning, US and allied forces could fail to defeat a PRC invasion and would suffer major losses.

In the past couple of years, Department of Defense (DoD) and DoW leaders, including some in the Air Force, and force design experts, such as David Ochmanek of the RAND Corporation, have discussed how, after a long streak of failures, recent wargames and simulations of future scenarios are finally finding US and allied success.[50] Victory, however, requires the United States not only to buy more and better systems but also to learn to fight differently.[51] Insights from these efforts are the tendrils of the Air Force's nascent One Force.

Preparation to deter and, if necessary, defeat PRC aggression today or in the future will need to involve approaches dramatically different from previous ones to counter "regional adversaries" or "near-peer" threats. This work should involve political, ideational, economic, intelligence, and military preparations to discourage and overcome PRC aggression across US society and the international community, and it will certainly require enormous effort within the Air Force. The question remains, however, should the service focus solely on the PRC and completely optimize its forces for the most consequential planning scenario(s) involving the PRC?

Moving Away from Just One Lever

The Air Force faces a paradox in twenty-first-century defense planning. It needs to focus on the PRC, yet how can it also address other homeland defense, strategic deterrence, and global demands? In response, the service should adopt a flexible force design that focuses on the PRC threat while retaining the multifunction capabilities, capacity, and readiness to address other demands.

The 2018 National Defense Strategy (NDS) identified the PRC as the principal threat to US security. The 2022 NDS affirmed this focus on the PRC, and the 2026 NDS will likely do the same. Chief among the planning scenarios guiding the size, shape, and posture of the force is likely to be a short-notice invasion of Taiwan, as it is "the most stressful, plausible case in which China could forcibly challenge a US partner."[52] In such a scenario, the PRC could rapidly bombard Taiwan and deliver enough assault forces to establish a successful lodgment that could be highly difficult to dislodge.

In response, the Air Force, as part of a broader joint force of US and allied forces, could attempt a conventional response by gradually deploying forces to secure forward bases, using uncontested supply lines, and serially rolling back air defenses to then attack invasion forces. However, such a response would likely fail. The PRC could preventively attack US forces and bases, denying the Air Force the chance to build up the necessary mass for conventional air superiority, and PLA air defenses are dense enough that the United States is unlikely to roll them back in time to allow destruction of a necessary proportion of the attacking forces. Additionally, even if US forces could poise themselves to counter an attack before the initiation of hostilities, they would face a PRC that has developed specific approaches to defeat US airpower operational systems. PRC forces could target the generation of airpower on the ground, disrupt the synchronization of effects, and detect, overwhelm, and defeat US forces at the limited, episodic points of attack US forces could generate. Clearly, the Air Force and US forces more broadly will need to adopt new ways to fight to overcome these weaknesses in a Taiwan invasion scenario (for more on other possible scenarios, please see the callout box).

Forward-Stationing Current Forces as a Solution?

Slowly deploying expeditionary forces cannot respond to PRC threats in time. To solve this problem, the Air Force could forward-deploy a large fraction of its forces. This would signal US commitment to its own security interests and to those of allied and partner countries in the Indo-Pacific and could deter aggression. But it entails drawbacks:

Vulnerability. Forward-deploying a large fraction of the Air Force would place a hefty proportion of the force in vulnerable positions. If the PRC considered these forces vulnerable, then the deployment could incentivize aggression rather than deter

Considering Other Planning Scenarios

As part of its defense planning process, the DoW will also likely examine a range of other future planning scenarios involving the PRC to assess how capability, capacity, readiness, and posture demands converge or diverge and to ensure adoption of an approach to force development that is effective across contingencies. The future rarely unfolds according to a single script in a planning scenario, and complex strategic dynamics mean adversaries may choose unexpected methods, locations, or time frames to challenge US interests. An overly specialized force might be vulnerable when reality diverges from a specific type of invasion scenario. Other scenarios involving the PRC could include a blockade of Taiwan, an attack on Philippines vessels or islands in the South China Sea, an attack on Japan's vessels or its Southwest Islands, or an attack on Republic of Korea forces involving a dispute in the Yellow Sea or in support of North Korean aggression. Other possibilities are confrontations involving the Republic of Marshall Islands, Federated States of Micronesia, Republic of Palau, or other treaty allies, such as Australia, New Zealand, and Thailand.

By rigorously examining (including with AI tools) force demands across scenarios, the DoW can avoid inflexibility and reduce the likelihood of surprise. It will also test these scenarios to assess their impact on other demands, such as ones involving homeland defense, strategic deterrence, and operations countering attacks by other adversaries, such as Russia, Iran, and North Korea. Such an effort will likely find variation in the capacity of different types of necessary forces. It will also likely find specific capabilities that have outsized impacts in particular scenarios or are necessary to address the eccentricities of a particular scenario. In general, though, because one confrontation or conflict with the PRC could vertically or horizontally escalate into a general war, much of the same portfolio of forces will likely need to be ready across scenarios. Additionally, regardless of the composition of forces, the assessments will likely reveal deficiencies in the capacity of US forces to address a PRC scenario or other scenarios while guarding against PRC aggression. As has been discussed, the Air Force will need to adopt new approaches to be prepared to fight the PRC.

it since the PRC could neutralize a considerable portion of US forces at the onset of hostilities.

Limited operational flexibility. The Air Force could buttress forward airfield defenses to enhance the resilience of forward air operations. But even if it did, posturing a large fraction of forces forward would limit the operational flexibility commanders have to employ those forces in other ways, such as by conducting operations along other lines of advance or maintaining attrition reserves. This all-in commitment may increase the likelihood of success in a particular form of fighting but reduce the force's ability to execute other operations and respond to PRC actions. Given that the United States would be facing a superpower with the agency to choose where and how to conduct operations, the DoW will need to plan for capacity to respond proactively and reactively and husband a portion of its forces to employ at propitious times and places.

Reduced strategic options and influence. Forward-deploying a large fraction of forces to the Indo-Pacific would reduce the number of forces available to meet other homeland defense, strategic deterrence, and global demands. A major reduction in these forces would limit US strategic options, such as by improving an adversary's ability to threaten (potentially nuclear) homeland attacks to attempt to coerce the United States into passivity.

Similarly, a perceived major reduction in US forces that either operate from and with allies and partners in Africa, the Americas, Europe, and the Middle East or respond to threats in those regions could undercut the US role as a credible security guarantor. As David Ochmanek stated:

> Our whole national security strategy is predicated on our ability as a nation to organize, to foster, to lead a coalition of like-minded states, mostly democratically governed, in the pursuit of common objectives. . . . If our partners begin to doubt our will and/or our capacity to defend common interests, their motivation for cooperating with us in this whole range of international problems that face us as a nation is going to be undermined and called into question.[53]

Accordingly, a perceived major reduction in US presence or commitment in other regions may affect US influence in those regions (with attendant political and economic impacts on US prosperity and security) and limit US and allied options to discourage and respond to PRC aggression in the Indo-Pacific.

For example, suppose North Atlantic Treaty Organization (NATO) countries perceive a major US withdrawal of forces that the US has deployed and committed to collective defense against Russia in Europe. This may reduce US diplomatic influence and economic success with these countries, likely leading them to more closely align with the PRC. In a conflict, it may reduce the likelihood that European countries sanction the PRC for aggression in the Indo-Pacific. It may also make them less likely to allow the US to use bases in Europe (or, in the case of France and the United Kingdom, their bases in the Indo-Pacific) to deploy and employ military forces in an Indo-Pacific contingency. And it would likely make some of these countries reconsider serving as combatants against the PRC or allowing US military forces access to other capabilities, such as intelligence, communications, strategic sealift, or industrial capacity. These capabilities are necessary to US warfighting effectiveness or would greatly enhance it in the initial stages of a campaign, would allow US forces to sustain a potentially protracted conflict, and would pose horizontal escalation dilemmas for the PRC. Similarly, a seeming US departure from Latin America, Africa, or the Middle East could accelerate PRC political, economic, and military inroads, including PRC basing, in those regions. It would generate new sources of concern that would distract US attention from the Indo-Pacific and would ultimately make the United States more vulnerable.

Addressing Multiple Demands

Strategy is a matter of choices, and although trying to do it all is tempting, given resource limitations, choices are necessary. As the United States rightfully focuses on the PRC as a peer adversary, it will need to address its principal threat in the Indo-Pacific while adopting a nuanced approach that devotes appropriate forces to other regions and demands. This effort will foster and maintain relationships and access while also retaining capacity and readiness to respond to emergent global demands. Throughout the process, it will need to remember that military strategy is about not only achieving limited-scope operational denial but also setting the country up for strategic success, both in conflict and in the broader competition for international influence.

To resolve the competing demands of focusing on the PRC and addressing other theaters and missions, the Air Force could adopt three general approaches: repositioning forces rapidly, increasing existing systems, and developing specialized capabilities.

Rapid repositioning. Given the speed of aircraft, the Air Force can swiftly shift their position, such as from the contiguous United States to a forward theater or among theaters, then generate an effect and return the aircraft to its original laydown location. At the very least, such an ability relies on an extensive aerial refueling capability and, in some cases, prebuilt infrastructure and pre-positioned equipment. It is also easier for small-scale operations than for large-scale conflicts. Such conflicts require the employment of numerous forces, which in turn requires more mobility assets to support them. As aforementioned, enemies can interdict such deployments. Additionally, even though aircraft are fast, speed does not solve the problem of simultaneous capacity demands.

Buying more of the same systems. In response to capacity gaps, the Air Force could buy more multifunction aircraft. It could forward-deploy them to serve as a credible, ready deterrent force if it also fields appropriate airfield resilience capabilities. But such a strategy would be flawed. A major increase in programmed aircraft would be expensive to acquire and operate, and it would exacerbate current personnel gaps that will likely deepen in the coming decades given demographic trends.[54] Absent mobilization or significant restructuring, it may also be difficult to manufacture a major increase in current combat aircraft within the decade, and if the United States were involved in a conflict, increased production of these systems would likely lag.

Beyond the fiscal, personnel, and industrial challenges of such an approach, the strategy has two other weaknesses. The first is that it essentially aims to field more ready aircraft than the PRC in the PRC's own backyard. The PRC is likely to win this competition. The second is that it presents a similar challenge to the PRC. Even though US aircraft and crews are highly capable (and could be even more so if the DoW properly resourced their readiness), the PLA has diagnosed how to counter US airpower on the ground and in the air. More of the same systems would not impose new types of challenges on the PLA, and if the PLA has successfully developed ways to neutralize the operations of the programmed force, deploying more of it will likely lead to failure.

Developing specialized forward-deployed capabilities. A third approach is to develop specialized capabilities to solve specific operational problems and posture them forward. Unlike multifunctional aircraft that can address many tasks, a portfolio of these largely low-cost capabilities would narrowly focus on specific operational problems to achieve desired campaign objectives directly or enable the operational access and performance of other units. Groups of these ground-mobile units would operate wholly runway-independent or very-short-takeoff systems that avoid counter-airfield strike capabilities. The Air Force would forward-deploy them, providing a potent, ready force that could help deter aggression and defeat it.

Such capabilities are not without their drawbacks. Specialized capabilities have nonrecurring development costs even if their procurement, operations, and support costs may be low. Moreover, since they are intended to be easy to develop and limited in function, adversaries may quickly develop countermeasures to some of them. But if the Air Force does not fully reveal these capabilities, limits their exposure, and adopts creative concepts of employment, it can lengthen those capabilities' period of operational effectiveness. US forces can also continually field adapted or new versions of these systems, maintain uncertainty about how they function, and iteratively field novel tactics to outpace adversary countermeasure cycles, making the new systems difficult to counter.

Another factor is that these specialized missiles, uncrewed assets, and sensors could be rapidly expended or attrited in a campaign, so these capabilities may not have the staying power for sustained operations. However, the potent contributions of such a force may be sufficient during the early stages of a campaign, which would allow the overall force to defeat the initial aims of adversary aggression. Not every part of the force needs to be capable of fighting through every stage of a campaign. Moreover, leveraging commercial components and modular, easy-to-manufacture designs could make many of these systems mass-producible in a conflict, which would aid in a protracted war.[55] Nonetheless, given that many of these systems would have a short-to-medium range and forces would need to forward-deploy them, their mass production would not obviate the need to transport them into the theater in a protracted campaign, which could be challenging.

These systems alone are not a panacea for US or allied operational problems and, as will be discussed, do not obviate the need for the forward deployment and general operation of other capabilities. Our analysis does suggest, though, that a portfolio of these capabilities could pose asymmetric threats to key adversary capabilities and significantly improve the likelihood of US campaign success.

To reconcile the Air Force's competing demands and overcome its capacity limitations, it could adopt combined arms thinking at the force design level. Traditionally, combined arms is associated with integrating different branches (e.g., air, land, and maritime) during operations. But in the context of force design, combined arms can also mean a balance of various force elements—some specialized, some multipurpose—within the overall architecture of the Air Force.

In their 2024 Hudson Institute study, *Hedging Bets: Rethinking Force Design for a Post-Dominance Era*, Bryan Clark and Dan Patt proposed a hedge approach in which smaller specialized units focus on discrete operational problems on their own and complement a larger mainline force.[56] That study found that rather than dramatically expanding only the force of stealth bombers and fighter aircraft to handle the opening salvoes of a Taiwan crisis, the Pentagon could stand up a dedicated "hedge force," which much like US Indo-Pacific Command's proposed Hellscape initiative, would be designed to counter Chinese amphibious assaults. Such forces might be predominantly uncrewed and cost-effective, allowing the DoW to posture them in-theater without crippling its operational flexibility and global capacity.

This study builds on *Hedging Bets* and the Air Force's nascent One Force to propose a multi-part design for the Air Force. The design fields forward-operating specialized units; mainline units that operate from forward, intermediate, and distant locations (and retain the flexibility and capacity to operate globally); and other capabilities that surge to conduct attacks, all supported by a foundation of counter-C5ISRT and airfield resilience enablers. Initially, these specialized units would focus on specific operational problems involving the PRC, but the DoW could extend the same approach to other tailored forces operating in other theaters, such as Europe or the Middle East. This mutually supportive design adopts combined arms thinking, accommodates uncertainty and the need for "deep adaptability" in force planning, and resists the temptation to absorb the entire force into one operational paradigm.[57]

This study is also informed by insights from a series of wargames that Hudson Institute facilitated in which networks of broad area sensors, low-cost and largely uncrewed assets serving as pickets and screening forces, and long-range strike systems collaboratively created persistent sea denial effects across significant areas and limited the attrition of major crewed assets. A complementary Hudson Institute wargame focused on air combat and revealed areas of convergence with and divergence from the maritime warfare paradigm and informed the framing of this project.

The Urgency to Change the Force Design

A key question arises: Why is this multi-lever, combined arms mindset urgent now rather than at some future inflection point? Much of the answer lies in accelerating geopolitical threats and continued technological diffusion. The PRC poses an immediate threat in the Western Pacific, where early denial of access could have an outsized strategic impact, and increasingly beyond. Unless the Air Force (and broader joint force) radically changes its approach to fighting, it could face defeat in a major conflict against the PRC within the decade. Meanwhile, as advanced weapons systems proliferate, even smaller states or nonstate actors can exploit precision-strike technologies to threaten large platforms and bases.

Moreover, the United States faces a fiscal and industrial ceiling. Simply buying large numbers of the most advanced platforms could lead to crippling operating costs and insufficient capacity for routine global engagements. Specialized, agile, and cost-effective hedge forces offer a more sustainable solution. They leverage relatively mature and commercially derived and autonomous systems to fill key operational gaps without undermining the rest of the Air Force's missions. By discreetly introducing novel drones, missiles, and sensor phenomenologies at meaningful scale—while keeping public disclosure to a prudent minimum—the Air Force can force the PLA to continuously adapt, thereby imposing costs and complicating adversary planning cycles.

Uncertainty shapes strategy, and politics often yields crises that break neat assumptions. Force designs need to be flexible enough to handle "deep uncertainty" while also maintaining a laser focus where the stakes are highest.[58] A redesigned Air Force should therefore treat a Taiwan invasion as the core stressor that highlights the need for new operational constructs, while also testing force designs against other scenarios. By adopting a combined arms approach that includes specialized hedge forces alongside a robust mainline force and counter-C5ISRT and airfield resilience enablers, the United States can prepare for contested fights in the Indo-Pacific without unduly compromising air operations elsewhere. This more sophisticated method, taking inspiration from both historical lessons and emerging technological possibilities, allows the Air Force to move away from having "just one lever." It can sustain airpower that is highly effective in the most consequential contingencies, yet as broad and adaptable as global realities demand.

3. A FOUR-PART FORCE DESIGN

The Air Force needs to adopt a new approach to shaping its force that addresses the changed character of warfare, most consequentially against the peer threat of the PRC, and creates the capacity and flexibility to address global demands. The service's traditional approach, which involves expeditionary and serial power projection, will be increasingly insolvent against the PRC for several reasons:

- China can target in mass the gradual deployment of US forces to the Indo-Pacific.
- US forces are vulnerable at airfields once they arrive.
- The PRC could achieve its aims of aggression, such as invading Taiwan or seizing other allied territory, before US forces could roll back enemy defenses to attack the PRC's center of gravity.
- If the conflict continued, the Air Force would struggle to replace its losses, much less grow in size.

In response, the Air Force could attempt to grow in capacity to forward deploy more forces, yet these units would also be susceptible to attack, and the PRC would also likely continue to greatly outnumber them in the air. Another approach is to limit forward exposure and fight from range. However, this would likely fail to generate sufficient strike capacity given long flight times. And leaving forward and intermediate locations open to air attack would not only lead to the destruction of critical assets in those locations, but also could damage the USAF's ability to generate enough supporting tanker sorties from those airfields to sustain the long-range strikes.

Instead of accepting these current problems, the Air Force can flip the script and impose new challenges on the PRC.

Photo: US Air Force F-22 Raptors, E-3 Sentrys, C-17 Globemaster IIIs, C-130J Herculeses and C-12F Hurons at Joint Base Elmendorf-Richardson in Alaska on May 5, 2020. (US Air Force photo)

Rejecting a one-size-fits-all approach, the service can divide the force design attributes it needs among portions of its force and change its laydown to overcome operational problems and create dilemmas for the PRC. Building on the initial One Force strategy, we propose a force design with four mutually supporting elements:

1. **Edge Force** of forward-deployed, mobile ground-based or -launched capabilities. Attacking enemy forces, these units operate at a high level of risk-to-force and include truck-launched anti-ship munitions squadrons, stratospheric balloons and ground-based teams that provide air surveillance and targeting capabilities, and VLR SAMs and lethal or electronic attack UAVs that provide counter-air capabilities. The Air Force has referred to these capabilities as MA1.
2. **Pulsed Force** that generates episodic effects from range. It consists of bombers, nuclear-armed intercontinental ballistic missiles, and other units, and the Air Force refers to it as MA2.
3. **Core Force** that operates from distributed airfields to generate effects, rapidly deploy forces, and ensure day-to-day US global presence. It includes ISRT, counter-air, strike, mobility, and command and control (C2) capabilities. The Air Force refers to this force as MA3.
4. **Key enablers** of counter-C5ISRT forces and capabilities that would degrade and deceive adversary sensing and sensemaking, generating broad area and local access for US forces and limiting the effectiveness of adversary forces. Resilient Airfields with infrastructure, logistics, passive defenses, and active defenses that enable appropriate levels of access and sorties across environments. Rather than attempting to uniformly harden all operating locations, Resilient Airfields would focus resources on a set of key operating locations (ranging from lightly defended temporary operating strips to heavily defended strongpoints) that enable mission area forces.

Leveraging access to forward allied and partner territory, the Edge Force would circumvent deployment delays and difficulties and airfield vulnerability by fielding ground-based mobile and low-signature capabilities that the Air Force would predominantly deploy or station forward and operate largely independently of fixed airfields. Customized to solve specific operational problems such as anti-ship attacks, air surveillance and targeting in highly contested environments, and destruction of heavily defended high value enemy aircraft, the Edge Force would provide new friendly kill chains and break enemy ones. At the same time, Pulsed Force strikes would dismantle key nodes and targets, and Core Force capabilities would generate air superiority, conduct strikes, and sustain the continuous deployment and employment of forces from varied forward, intermediate, and distant Resilient Airfields. Counter-C5ISRT forces and capabilities would degrade and deceive adversary sensing and sensemaking, generating broad area and local access for US forces and limiting the effectiveness of adversary forces.

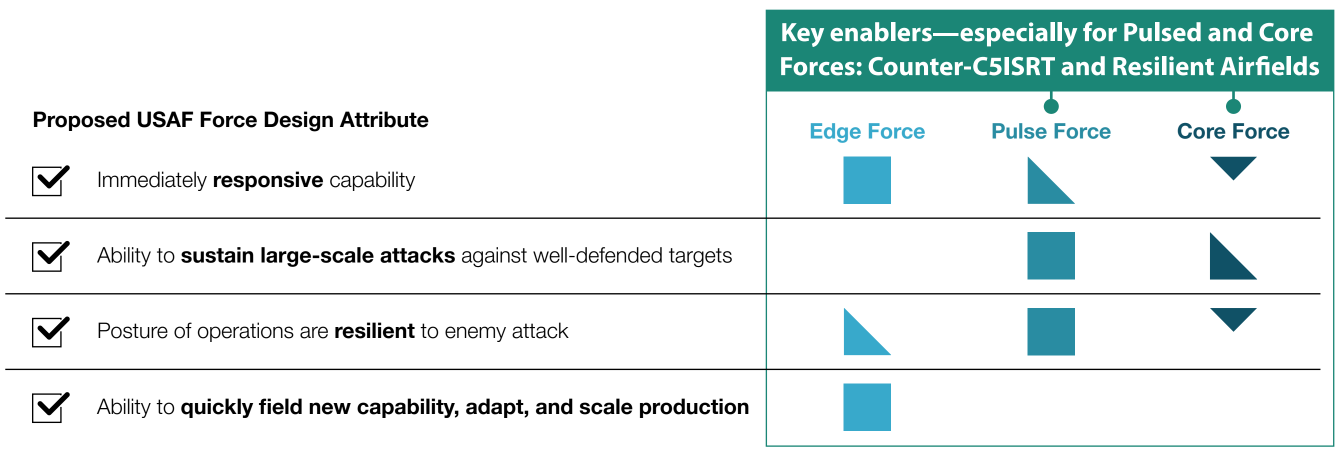
In this manner, the Air Force could retain the offensive initiative and not default to operating solely from "longer and longer ranges," which would sap strength from the force.[59] It would also provide new ways to generate air superiority. Rather than only attacking PLA aircraft at airfields or through aircraft engagements in the air, the specialized ground-based units could conduct targeting and employ weapons that asymmetrically fight them from the ground.

Collectively, this approach would improve the United States' ability to deny the initial aims of adversary aggression, and it would better posture US forces for protracted conflicts by preserving a large fraction of mainline forces and fielding new systems that can be mass produced. It would also give US commanders a broader range of options to employ the force, which can not only enhance tactical and operational success but also impose dilemmas on the PRC.

In addition to helping deter PRC aggression, this new approach to force design would generate capabilities that the DoW could apply in different capacities and combinations to challenging problems in other theaters, such as in Europe or the Middle East. It would also help generate capacity and flexibility in the Air Force to be able to continue to address other national security priorities.

Figure 3 describes key attributes of the proposed force design for the USAF. The following sections describe the force elements in greater detail and expound on how the DoW could employ the Air Force differently. Although counter-C5ISRT enablers are critical, their roles and impact are not detailed within this report.

Figure 3. Proposed Force Design Attributes



Note: Area of geometric shapes represents the approximate relative level of capacity to fulfill the desired force design attributes at the start of a challenging, large-scale scenario against the PRC. Other figures could depict the force design's capacity to address other scenarios, as well as capture how the contributions of assets could vary depending on the phasing of conflict.

Source: Authors.

Photo: A XQ-58 Valkyrie sits ready to launch for a test mission on August 22, 2023, at Eglin Air Force Base in Florida. (US Air Force)

4. FIGHTING FORWARD WITH THE EDGE FORCE

Edge Force units are asymmetric formations combining road-mobile missile and drone munition launchers, electronic warfare systems, and sensors.[60] Initially drawn from Air Force Special Warfare units, this formation would present a stark contrast to the runway-dependent, aircraft-centric units that dominate today's Air Force. Predominantly forward-deployed and tailored Edge Force units focused on solving specific operational problems would be ready to respond to short-notice contingencies, would lessen the capacity strain on general purpose forces, and would lower the risk to Pulsed and Core Forces.

Edge Force units reduce their dependence on airfields to generate effects. By exploiting low footprints, frequent relocations inside and outside bases, and camouflage, concealment, and deception (CCD) capabilities, these units could generate effects inside an adversary's lethal ring of precision weapons, forcing the opponent to devote considerable resources to tracking and neutralizing them.[61] To maximize survivability, some Edge Force units could minimize their signatures, passively receive targeting information from other parties, and unmask themselves only to fire on high-priority targets.

Israeli forces demonstrated during the 2025 Twelve-Day War against Iran that extensive intelligence penetration and sensing, special forces, and strike aircraft can conduct successful attack operations against defended ground-based launchers. The

PLA's ability to track targets in the Western Pacific and attack them could be comparable if not superior to that of Israel. Accordingly, to survive long enough to generate necessary effects, Edge Force units will not simply attempt to hide. They will also drive up the salvo size and complexity of enemy attacks through extensive CCD, organic short-range air defenses, and extended coverage of Core Force aircraft and inorganic ground-based air and missile defenses. Ukrainian troops have employed this approach to draw Russian weapons away from formations and force enemy units to waste weapons.[62] Although China has deeper magazines and a more robust defense industry than Russia, Edge Forces could reduce the efficiency of PLA strikes and slow the tempo of a PRC advance.

The Air Force would equip Edge Force units with organic sensors to cue their own strikes if they become cut off from higher-echelon intelligence. Yet they would also link to the broader Air Force enterprise, receiving, if available, real-time ISR from satellites or aircraft, a distributed sensing grid, and allied sensor networks. Keeping a localized target-and-shoot chain ensures that operations can continue if adversaries degrade theater-wide communications, while any additional data from major command centers can bolster precision and expand the target set.

Enemies could cause attrition or exhaustion of a large fraction of Edge Force units early in a campaign. In addition to employing expendable and attritable weapons, Edge Force units would operate in and around highly contested environments. Nonetheless, by pre-positioning these units forward and equipping them with enough magazine depth to persist through initial exchange volleys, Edge Forces would work with available Pulsed Force, Core Force, and other joint units to defeat initial adversary aims, while buying time for other forces to mobilize and deploy. Moreover, since Edge Force systems could be mass-produced, the Air Force could field them in large numbers in peacetime and rapidly reconstitute, adapt, and grow their capacity in a protracted war.

These formations would build on the expeditionary and adaptive logistics pedigree of Air Force Special Operations Command. Operators already versed in clandestine deployments, refuel-on-the-fly methods, and rapidly shifting flight plans could more swiftly bring the concept to maturity. Local partnerships with allied forces would ensure that roads, ports, or airstrips remain open for essential spares, reloads, and command elements. If extended supply lines break down, the organic sensor-to-shooter loops preserve basic functionality in a denied environment. Indeed, the entire scheme reflects the emphasis on minimal dependence on large, vulnerable nodes. It trades the conventional notion of an extensively networked force for a highly distributed set of heterarchical kill chains, each self-sufficient yet capable of linking back to the Air Force's enterprise-level reconnaissance if conditions allow.

Whether the Air Force deploys these formations in or near the First Island Chain (such as in the Philippines, Taiwan, Japan, or the Republic of Korea) or elsewhere, its primary aim would be to solve key operational problems involving high-end air and naval forces. Although their initial design is for contingencies in the Western Pacific, Edge Forces could address different operational problems in other theaters. By scaling or reshuffling the proportion of assets, the Air Force could reconfigure Edge Force units to address maritime chokepoint crises in the Middle East, respond to potential flashpoints in Europe, or augment allied exercises to discourage aggression. The following paragraphs describe a typical Edge Force.

Tailored Solutions to Operational Problems

The Edge Force would focus on solving specific operational problems, working with and supporting Pulsed Force, Core Force, and other joint units. In our analysis, we focused on:

- Maritime strike, specifically defeat of a PRC amphibious invasion of Taiwan
- Large-scale persistent air surveillance and targeting of enemy aircraft, specifically in highly contested airspace

- Offensive counter-air, specifically defeating high value airborne assets (HVAAs) in highly contested airspace

In general, the problems involve the need to immediately generate effects in highly contested areas without first rolling back defenses. The following section describes the representative operational problems and the potential Edge Force units that the Air Force could field to address them. It largely frames the units in the context of an attempted PRC invasion of Taiwan, but strategists could apply this set of solutions to other Indo-Pacific scenarios or to scenarios with similar demands in other regions. Of further note, the presented capabilities are representative of some options in this space and are not intended to be comprehensive or prescriptive.

Maritime Strike: Defeat of a PRC Amphibious Fleet Invading Taiwan

Operational problem: US, allied, and partner forces face multiple challenges in defeating a short-notice PRC amphibious fleet attempting to invade Taiwan. First, generating sufficient anti-ship capacity is difficult. Only a fraction of the Pulsed Force and Core Force aircraft can be forward deployed due to threats to airfields—even if the Air Force made recommended improvements to enhance the resilience of airfields. Also, the flow of aircraft forward could be slower than desired, including due to PRC attacks. Forces from the Republic of China (ROC), the US Navy, US Army, US Marine Corps, and other allied countries would make valuable anti-ship contributions and should increase anti-ship capacity. However, the capacity of their effects under the current plan could be considerably less than that of the Air Force, and many of their forces could face significant attrition or suppression early in a conflict. Moreover, their attacks may not be well coordinated with USAF attacks.[63]

A second major challenge is that periodic attacks by Pulsed Force aircraft could be straightforward for the PLA to identify and preemptively counter. And lastly, the PLA would provide a dense, overlapping, and healing web of defenses around the invasion fleet, including but not limited to decoys, combat aircraft, surface vessels with SAMs, and land-based SAMs. Attempting to roll back these defenses before attacking the invasion fleet could take weeks or longer and still fail to defeat the defenses, much less to destroy the invasion fleet that could land enough personnel within a few days. Developing new ways to directly attack key enemy forces despite defenses is imperative for the Air Force, and Edge Force units can contribute.

Solution: Edge Force units with road-mobile anti-ship munitions could target the invasion fleet. Squadrons could field 10 or so truck launchers, each armed with five or more off-the-shelf anti-ship drone munitions similar to the Shahed-136 (Geran-2) or Shahed-238 (Geran-3) that Russia has used against Ukraine, low-cost missiles, or ground-launched powered bomb alternatives. The anti-ship munitions could have a range of 300–1,500 nm (depending on their design and payload), enabling their units to operate from locations such as Okinawa and Luzon, or beyond. The Air Force could arm them with 100–200 lb warheads, roughly equivalent to one to two warheads on GBU-53/B Stormbreaker bombs or the warhead on one Mk-82 bomb that aircraft drop, which could damage or mission-kill large vessels or armored surface combatants and destroy small vessels. Or perhaps it could supply them with larger warheads, electronic attack payloads, or other payloads.

The anti-ship munitions would fly to designated kill boxes, scanning en route using simple, low-cost electro-optical/infrared and radiofrequency sensors and mesh communication to avoid threats and receive target updates before autonomously engaging vessels. Other systems the launchers could employ include smaller, more numerous decoys that would mimic the signatures of the lethal anti-ship munitions. Squadrons would operate the launch vehicles, mobile C2 and support vehicles, numerous decoys, and short-range air defenses. Principally relying on off-board targeting from satellites, low-observable aircraft, or other sensors, distributed squadrons would mass their fires and coordinate their attacks with other Air Force and joint attacks.

An attack by three squadrons making up a group (the organizational structure above a squadron) and firing together could consist of 150 anti-ship munitions or a mixed salvo, such as one with 100 anti-ship munitions, 50 or more decoys, and 25 electronic attack drones. The drones could conduct stand-in electronic attack jamming of target ships' air defense engagement radars or spoof the presence of hundreds more drones. Multiple groups of these units could coordinate to generate attacks with many hundreds of munitions.

Instead of attempting to solely operate more aircraft forward—which would need to overcome airfield attacks, screens of surface combatants, combat aircraft, and land-based SAMs—forward-deployed anti-ship munitions units could circumvent many of these threats. They would operate largely independently of airfields and could strike ships on their own. But more importantly, they would improve the probability of arrival of Pulsed Force, Core Force, or other joint force weapons. In coordination with Air Force and other joint force attacks, their inclusion would shift the PLA's defensive calculus from needing to address scores of weapons coming from bombers and fighters to defending against hundreds to thousands of weapons and other decoys and potent electronic attacks. Depending on their flight profiles and the electronic attacks they generate, the PLA could have difficulty discriminating between anti-ship munitions and other inbound threats. Additionally, even if the defenders could effectively discriminate the targets, the Edge Force attacks would force the invasion fleet's defenses to consume defensive resources engaging the threats. This may force surface combatants to come off station earlier to reload their magazines and force combat aircraft to use AAMs against the inbound drones. The adjustment could also force these aircraft off station and thus expose the fleet to attacks by Pulsed Force and Core Force aircraft.

The PLA will likely employ high-volume defensive capabilities, such as guns, directed energy weapons, and small interceptor missiles, that could down large portions of the attacking swarms. However, if Edge Force attacks are well-integrated with cross-domain effects from the rest of the force, its anti-ship munitions could generate scores of mission kills or greater on their own, and, more importantly, could greatly improve the probability of arrival of other weapons. To counter this potent threat, the PLA will also likely conduct attack operations targeting the launchers and reload magazines, which could be located at airfields. Along with the units' own extensive CCD measures and short-range air defenses, US and allied forces' Core Force combat air patrols (CAPs) operating from Resilient Airfields and extended-range ground-based air defenses could counter many of these attacks. Nonetheless, even if a fair portion of enemy attacks succeed, if the Air Force fields a robust maritime strike force forward, it could tolerate considerable attrition and still make a major difference early in a campaign. This contribution would complement the Pulsed Force and Core Force's activities and better position these forces to continue prosecuting attacks in a prolonged war.

Lastly, this class of weapons could be producible in mass. As Russia and Ukraine have demonstrated, manufacturers could make thousands of these types of weapons monthly, drawing not only from traditional defense-industrial contractors but also from commercial manufacturing.[64] Their cost could also be moderate. A group armed with 30 launchers, 450 anti-ship munitions (with an assumed cost of $125,000 per munition), and additional support vehicles and systems could cost less than $100 million, the cost of a single fighter aircraft. Another 1,000 munitions could cost $125 million, or a bit more than one fighter. Even if the munitions were thrice as expensive ($375,000 per round), $125 million could buy 333 of them, as opposed to only 38 or so Long-Range Anti-Ship Missiles (LRASMs).

Although these low-cost munitions will not equal the performance of high-end weapons such as LRASM, the cost spread and operational benefits of these weapons on their own and in terms of how they can make weapons such as LRASM far more lethal suggest including them in the portfolio would be prudent (see the Operational View in figure 7). The Air Force could forward-deploy these units in peacetime, providing a ready, responsive capability to strike ships in spite of enemy attacks on airfields and providing a class of forces that could dramatically scale in production in a protracted conflict. For a discussion of why the Air Force, rather than the Army, should field maritime strike Edge Force units, please see the section "Why Should the Air Force Field the Edge Force? Two Historical Vignettes" later in the chapter.

Large-Scale Persistent Air Surveillance and Targeting of Enemy Aircraft, Specifically in Highly Contested Airspace

Operational problem: How can US forces persistently surveil and target enemy aircraft in highly contested airspace where there are dense IADSs with land-based SAMs, vessels, and combat aircraft that can detect and engage US aircraft? Air surveillance and targeting capabilities are invaluable in generating situational awareness of the actions of enemy forces. The information provided by this capability informs commanders' tactical and operational decisions. Moreover, an ability to target over wide areas is instrumental to cue US air and other joint operations and to execute long-range kill chains.

If air surveillance and targeting coverage degrades, the theater is ripe for enemy air attack, and since the bulk of PLA fires would likely stem from combat aircraft, destroying them is essential. A lack of broad-area surveillance may force commanders to attempt to mount more defensive counter-air (DCA) CAPs to detect inbound threats and defend against them. Generating more DCA sorties detracts from offensive counter-air and strike sorties, which reduces US operational initiative. It also risks placing small force packages of US aircraft in situations in which limited situational awareness forces them to "grind it out" at the edge with more numerous enemy combat aircraft and take grievous losses. An increase in DCA CAP requirements would also likely exacerbate the already stretched demand on aerial refueling aircraft.

Furthermore, airborne early warning and control (AEWC) aircraft face a troubling duality. Large, crewed AEWC aircraft with powerful lower-frequency radars can reliably detect targets, including low-observable aircraft and missiles, at long ranges. This makes them powerful assets that can provide wide-area surveillance and targeting for, and orchestrate the efficient employment of assets in, defensive and offensive operations.

Yet, if the aircraft continuously emit at high power, enemy terrestrial and space-based sensors could easily geolocate them, and long-range weapons launched by land-based SAMs, surface vessels, and aircraft could engage them. To reduce this risk, AEWC aircraft can adopt tactics to principally operate passively and emit selectively when other assets cue them or to periodically scan areas. The Air Force can also equip them with countermeasures to decrease the probability of kill of enemy shots, but it is reasonable to expect that these high signature assets will be forced to stand back most of the time from highly contested areas. The increased standoff of AEWC aircraft could limit their ability to support offensive attacks and increase the defensive area that they or other aircraft must cover. Moreover, like other aircraft, they are also vulnerable on the ramp, and because of their size, large AEWC aircraft do not fit inside hardened fighter shelters. The Air Force has to instead house them in more expensive large-aircraft hardened shelters, or park them in hangars or in the open on the ramp, making them highly susceptible to submunition-armed weapons.

The US Air Force had planned to acquire a minimum of 26 E-7A AEWC aircraft (shown in figure 4) to replace its obsolete E-3G fleet, which was previously 31 aircraft and now after retirements consists of only 16.[65] The E-7A would provide a powerful capability to detect and target low-observable threats. In addition, it would benefit from commonality with, and the commensurate investment provided by, Australia, the Republic of Korea, Turkey, the United Kingdom, and possibly other allies and partners in the future. In the president's budget proposal for FY 2026,

Figure 4. Artist's Depiction of a USAF E-7A in Flight

Source: Staff Sgt. Nicolas Erwin, US Air Force, https://www.af.mil/News/Photos/igphoto/2003169600.

the Office of the Secretary of Defense proposed terminating the E-7A fleet and relying on expeditionary US Navy E-2D aircraft to fill the gaps until DoD could field airborne moving target indication (AMTI) capabilities provided by satellite constellations.[66]

Yet even if Congress overturns the cancellation, and the Air Force acquires the E-7A, it will likely face capacity gaps when trying to provide enough AEWC. A fleet of 26 E-7A total aircraft inventory (TAI) jets could result in as few as 13–18 aircraft available for operations. The Air Force could task a portion of these aircraft to provide coverage in and around US territory, leaving an even smaller number for expeditionary operations.

Other air surveillance and targeting options include fixed ground sensors, satellites, and alternate aircraft, such as penetrating ISR aircraft, fighters, or other uncrewed aircraft equipped with radars and other sensors to perform AEW.[67] In general, the DoW should generate air surveillance and targeting capabilities from multiple domains. It is reasonable to expect a need for robust terrestrial coverage from a heterogenous mix of assets, in particular ones that can scale to provide necessary coverage and persistence.

Solution 1: Numerous stratospheric balloons capable of steering and station-keeping could use long-wave infrared (LWIR), passive radiofrequency, or other sensors to persistently surveil and target air contacts in highly contested airspace.[68] Using satellite communication and mesh relays and some dedicated communications relay balloons, the stratospheric balloons could pass tracks that their sensors generate to surface and airborne C2 nodes. In addition to balloons equipped with real sensors, units could launch large numbers of decoy balloons with dummy payloads. It would be difficult for an opponent to discriminate between real and decoy systems.

Mobile ground teams could launch stratospheric balloons in the First Island Chain, Second Island Chain, and beyond, working together to maintain positions for months in areas of interest. The operation and performance of these systems would require operational concepts different from those of traditional AEWC. Packs of three or more balloons would be necessary to continually maintain one on station, and the sensors on each balloon may be capable of detecting desired targets only a fraction of the time. However, by fielding overlapping layers of stratospheric balloons, the Air Force could generate webs of balloons that have a high probability of detecting and tracking air targets in discrete areas.

Operationally, the balloons could provide surveillance sufficient for cueing and, depending on the payload, possibly for targeting long-range kill chains. They would be effective in highly contested airspace, where traditional AEWC aircraft would face difficulties surviving, as well as in less contested airspace. Their presence would deny sanctuary and impose dilemmas on adversaries. For example, to avoid detection by balloons' LWIR sensors, enemy aircraft could fly below the cloud cover, which would increase their fuel consumption and place them in a disadvantageous energy position, or they could fly high but risk being seen. Similarly, to avoid detection by balloons' passive radiofrequency sensors, enemy aircraft could limit their active emissions (thus constraining their degree of networking) or be detected.

Figure 5. Aerostar Launches High-Altitude Balloon During Arctic Edge 2025

Source: Staff Sgt. Jonathan McElderry, US Air Force, https://www.dvidshub.net/image/9239675/aerostar-launches-high-altitude-balloon-during-arctic-edge-2025.

Enemies could employ a wide range of methods with varying effect and cost profiles to degrade or defeat balloons. They include cyberattacks or electronic attacks on balloon C2 or satellite communication links, and destruction of balloons using lasers, high-powered microwaves, or missiles from ships, aircraft, or ground units. However, the employment of many of these countermeasures would entail costs for enemy forces. For example, fielding numerous decoys may require enemy forces to devote considerable resources to countering fake systems, such as using expensive AAMs or SAMs against inexpensive decoys. Moreover, if they fire their missiles against these targets, they may compromise their readiness to counter other targets, such as penetrating US aircraft. As another example, electronic jamming to blind balloon sensors or break their communication links could expose the emitters to counter-detection and attack.

Stratospheric balloons and their associated payloads could have low costs, as little as half a million dollars for a real balloon and significantly less for decoys. Compared to the approximately $450 million cost of a notional large crewed AEWC aircraft, the Air Force could field 75 stratospheric balloons with payloads and 150 decoy balloons (that could support the continuous coverage of 12 packs of balloons), and associated launchers and C2 systems.

The balloons could also be mass produced. Thousands of commercial balloons (such as Aerostar's, shown in figure 5) could be manufactured in peacetime and more in a conflict.[69] Mission system production could be more challenging. However, using mostly low-cost, commercially available systems and adopting modular interfaces could achieve appropriate production levels, and the Air Force could easily adapt or field new payloads as technology progresses.

Stratospheric balloon systems will not replace satellite AMTI or aircraft-based AEWC options. The E-7A or uncrewed aircraft options under development, such as MQ-9 equipped with AEW sensors, provide a much higher level of reliability and performance, including detection of low-observable targets through weather. Nonetheless, the balloons would provide a runway-independent class of capability that the Air Force could attritably operate in highly contested airspace, would impose distinct dilemmas on adversary operations, and would be mass-producible in peacetime and conflict. They would also accelerate and diversify the AEW transition from a few high-value aircraft to a rich system of systems of crewed and uncrewed capabilities.

Solution 2: Another class of solution entails the forward deployment of mobile, low-signature ground-based surveillance and targeting teams. These teams with vehicles would use capable passive and low-signature active sensors on the ground or on compact, low-cost aerostats to detect enemy air targets and could cost $10–$20 million each. Additionally, by incorporating or integrating with separate Tactical Operations Center–Light (TOC-L) units, these teams could provide local C2 nodes.[70] In this manner, the ground-based surveillance and targeting teams operating in contested areas would generate clusters of capable sensors to take in data from combat aircraft, stratospheric balloons, and other inputs that would inform local tactical and operational decision-making. This could support the execution of long-range kill chains by aircraft and other effectors (such as VLR SAMs and counter-air UAVs). It could also ensure that the Air Force fielded a heterarchical C3 structure in which local units could sense and make sense of the environment and exercise command, even if links to higher echelons were degraded. This approach would greatly enhance the resilience of the Air Force's battle management architecture.

The addition of these teams would shift the PRC's calculus. Attacking only a small number of air operations centers, communications links, or AEWC aircraft would no longer be enough. Instead, it would have to hunt down numerous mobile, low-signature units with extensive CCD capabilities and limited active air defenses operating under the umbrella of ground-based air defenses and Core Force counter-air operations. At the very least, these units could reduce the incidence of PLA aircraft flying over or near land since teams may be operating there and could call in long-range attacks against the PLA aircraft. They could also reduce the PLA's confidence that it can disrupt US C2.

Offensive Counter-Air: Defeating HVAAs in Highly Contested Airspace

Operational problem: In a conflict, establishing air superiority throughout the Western Pacific would benefit US, allied, and partner forces. However, given the time it could take to achieve that objective, at the onset of hostilities the United States will need to focus on the most consequential targets first. This step will allow US forces to gain appropriate levels of operational access to deny the initial aims of adversary aggression and position forces for a protracted conflict. A particular challenge is defeating enemy HVAA aircraft, such as AEWC and special mission aircraft, bombers, and transport aircraft, without first needing to eliminate or roll back fighter escorts or other defenses.

Figure 6. PLAAF WZ-9 AEW Uncrewed Aircraft

Source: Joseph Trevithick and Tyler Rogoway, "China's Massive WZ-9 Divine Eagle Drone Now Operating from South China Sea Base," TWZ, February 25, 2025, https://www.twz.com/air/chinas-massive-wz-9-divine-eagle-drone-emerges-now-operating-from-south-china-sea-air-base.

The PLAAF has fielded a large fleet of around 100 AEWC and AEW aircraft (collectively referred to as AEW/C aircraft), which could grow to over 200 by 2035. It has equipped them with highly capable active and passive low-radiofrequency and LWIR sensors.[71] Among other innovations, it has fielded long-endurance uncrewed WZ-9 AEW aircraft (shown in figure 6). Through their own detections and cues from other terrestrial and space-based sensors, the AEW/C aircraft can detect and target attacks against aircraft and missiles, including low-observable ones. They can also support long-range kill chains by providing in-flight target updates for long-range missiles. This potent capability contributes to the PLA's dense IADS in and around the PRC. By networking their passive and active sensors, PLA aircraft can create zones that are challenging to penetrate for even stealthy US aircraft.[72]

Other special mission aircraft, such as Y-9 variants that can conduct electronic attack and surveillance, could pose similar challenges. PLAAF AEW/C aircraft could support defensive coverage over an invasion fleet and other key targets. They could also enable large force packages with fighters and AEW/C aircraft to push out offensively to knock down US DCA CAPs, preemptively intercept US bomber raids, or attack targets.

PLAAF strike aircraft are another dangerous threat. The PLA has fielded the world's largest bomber fleet, and it is in the process of fielding new strike aircraft, such as the stealthy J-36, a forthcoming H-20 intercontinental-range bomber, and various large, stealthy strike UAVs. These strike aircraft in general and bombers in particular would likely deliver the bulk of PLA fires against US airfields and other targets in a large-scale campaign. Therefore, defeating them is essential to allow US forces to continue operating from not only First Island Chain locations but also intermediate and distant strongpoints that bombers could employ or other locations necessary to support the deployment and employment of forces in general.

Depending on the target's distance from the PRC, PLAAF strike aircraft can drop standoff missiles from over the PRC or near the PRC's coastline against targets in the First Island Chain. This makes it highly difficult for US fighters to penetrate into dense IADS to intercept bombers in time, even if they received cues early enough and maintained custody of the track, which could be increasingly challenging against the PLA's progressively lower-signature aircraft. Against targets in the Second Island Chain or beyond, strike aircraft must sortie a greater distance, but depending on the strike location, their force packages could include many escort aircraft. This could make it challenging to generate sufficient mass against the force package in time.

Transport aircraft are another type of HVAA target. In a Taiwan invasion scenario, they could drop parachuting airborne forces, gliders, or palletized munitions or drones directly onto and around Taiwan. Or, if an airfield was seized, they could land at the airfield. The PLA would strongly defend force packages with transport aircraft.

Solution 1: Mobile VLR SAM squadrons could directly attack AEW/C and other HVAAs in highly contested airspace. The US Navy and Army have fielded the surface-launched SM-6 with a range of around 200 nm.[73] A new class of VLR SAMs, including ones under development by the PLA, could engage maneuvering targets from well over 500 nm, and possibly out to 1,000 nm or beyond.[74] A manageable Edge Force configuration could comprise about six SAM launchers with two to four missiles per launcher, a pair of command and support vehicles, and short-range air defenses like the US Army Indirect Fire Protection Capability Increment 2. Two or three vehicles with mobile launcher decoys and multi-spectral camouflage could complement them.

The Edge Force could posture VLR SAM squadrons in the First Island Chain to threaten HVAA aircraft at the initiation of hostilities throughout the Western Pacific. Destroying key targets such as bombers and transport aircraft would directly reduce the offensive capacity of enemy forces, and destroying AEW/C and special mission aircraft would help disrupt enemy force packages. It would also generate operational access for Pulsed Force and Core Force aircraft, which could then more easily conduct strikes and eliminate other enemy aircraft. Furthermore, the extended reach of the VLR SAM squadrons could expand the danger zone for PLA aircraft to large portions of the theater. As Maximilian K. Bremer and Kelly A. Grieco explored, the threat of attacks could impose dilemmas on the PLA that would shape its operations in ways favorable to US forces.[75] For instance, it could force AEW/C and special mission aircraft to fly farther from potential VLR SAM squadron operating areas, which could increase access for US aircraft. It could also lead the PLA to attempt to neutralize VLR SAM squadrons before executing high-risk operations with HVAA, such as using transport aircraft for airborne landings or conducting aerial refueling operations closer to threats to enable longer-range strikes or sweeps. Such a delay could help US forces gain the initiative.

Facing this deadly threat, the PLA would likely respond with PLARF strikes, destruction of enemy air defense (DEAD) sorties, and special forces attacks to neutralize them. To reduce their vulnerability to attack, VLR SAM squadrons would largely operate passively to reduce their signature. And to fire deep into contested areas, they would rely on external targeting from satellites; aircraft such as penetrating ISR, fighters, or AEW/C aircraft; and Edge Force units, such as stratospheric balloons or ground-based surveillance and targeting teams. Forgoing large, powerful, but high-signature and less-mobile radars such as the US Army's Lower Tier Air and Missile Defense Sensor, the squadrons would have short-range radars and electro-optical/infrared sensors to serve as backup targeting capabilities in case threats directly approached them.[76] They would also move frequently, use multiple CCD capabilities, and have short-range air defense capabilities to enhance their resilience.

Figure 7. Castelion Development Test Flight

Source: Castelion.

VLR SAM squadrons could have disadvantages. Chief among them is that VLR SAMs could be very costly. Instead of pursuing the best weapon possible, the Air Force should balance cost, portability, lethality, capacity, and range to identify designs with the reach to generate responsive, overlapping fields of fire at a low enough cost to outfit necessary squadrons. Results from programs pursuing lower-cost long-range weapons designed for scaled manufacturing, such as the Castelion missile (shown in figure 7), suggest that such weapons are achievable.[77] Moreover, by not fielding a highly capable primary radar, Edge Forces could save 20–30 percent of the cost of a traditional SAM battery. Even with relatively expensive $4 million VLR SAMs, a squadron with six launchers capable of firing four missiles each, six other support and short-range air defense vehicles, and 72 VLR SAMs would cost approximately $375 million (or less than the cost of four crewed fighters), or even considerably less.

Other challenges include the duration of effect and logistical resupply of the forces. A moderately sized force of VLR SAMs could go through its inventory of weapons quite quickly—especially if enemy forces managed to frequently spoof or otherwise defeat the disaggregated kill chains necessary to successfully guide weapons to targets. To account for this, the Air Force could aim to increase the resilience of its long-range kill chains, such as by providing multiple targeting and in-flight targeting update paths to the VLR SAMs. Moreover, to husband rounds and minimize exposure, VLR SAM squadrons could snipe HVAAs and largely stay in hiding but engage a broader range of threats if commanders deemed it appropriate. The Air Force could also accept expenditure of a significant portion of the force early in a campaign but still gain enormous value. It would destroy key enemy forces and shape enemy operations in a manner that reduces enemy effectiveness and aids the effectiveness of the Pulsed Force, Core Force, and other joint forces. To ensure that VLR SAM squadrons could continue to generate effects in a protracted conflict, they could reload from magazines at airfields or other locations, and though challenging, use aircraft or other means to resupply missile rounds, similar to resupply of Patriot batteries.

Solution 2: Another, similar solution is the employment of squadrons of ground-launched, counter-air UASs. Using an overall concept of operation and organizational structure similar to that of VLR SAM squadrons, these mobile, airfield-independent units would launch salvoes of subsonic, rocket-assisted, ground-launched UASs with a range of 500–1,000 nm. The counter-air UAS would loiter in the area to be contested, acquire a target, and attack with AAMs or by using itself as a weapon.[78] Counter-air UASs could also perform electronic attacks, jamming enemy radars or spoofing the presence of numerous US or allied aircraft. This could be a highly valuable capability in highly contested airspace, where it would be difficult to operate EA-37B or EA-18G aircraft over sustained periods at acceptable levels of risk to force.[79]

Figure 8 depicts the Defense Advanced Research Projects Agency (DARPA) LongShot program, an air-launched UAS that designers could modify for deployment from ground-based launchers.

Figure 8. DARPA LongShot Program

Source: "LongShot," DARPA, https://www.darpa.mil/research/programs/longshot.

In addition to a VLR SAM Edge Force, the Air Force could also posture counter-air UASs in the First Island Chain to counter PRC aggression in the Western Pacific. However, in contrast to VLR SAMs providing rapid responsive fires, the service would send moderate-speed counter-air UASs into designated kill boxes in advance to autonomously hunt for targets and receive in-flight target updates (via line-of-sight data links or satellite communication) from aircraft or targeting units on the ground. Salvoes of counter-air UASs could engage enemy aircraft with AAMs and conduct electronic attacks. They could contest airspace, skirmish with enemy forces—especially in periods when Pulsed Force strikes were not taking place—and surge to support integrated attacks by Pulsed Force, Core Force, and other joint force assets.[80]

If they are low-observable, counter-air UASs may drive PLA AEW/C and other aircraft to emit more with their active radars, which could expose them to Edge Force surveillance and targeting (and other capabilities) and attacks by VLR SAMs and Core Force aircraft. PLA aircraft that detect the counter-air UASs may have to expend AAMs to defend themselves, which could decrease their ability to effectively counter Core Force fighters. At the planning level, the PLA may devote more escorts to HVAA aircraft to guard against counter-air UASs, which could impose a form of virtual attrition on PLA operations by reducing the number of operations the PLA could simultaneously execute.[81] Alternatively, PLA aircraft could choose to retrograde if they detected these inbound threats and temporarily cede the airspace to US aircraft, thus allowing them to achieve their desired effect (such as conducting a strike). If the PLA aircraft do not emit, they may fail to detect the counter-air UASs in time, and UASs could successfully engage them.

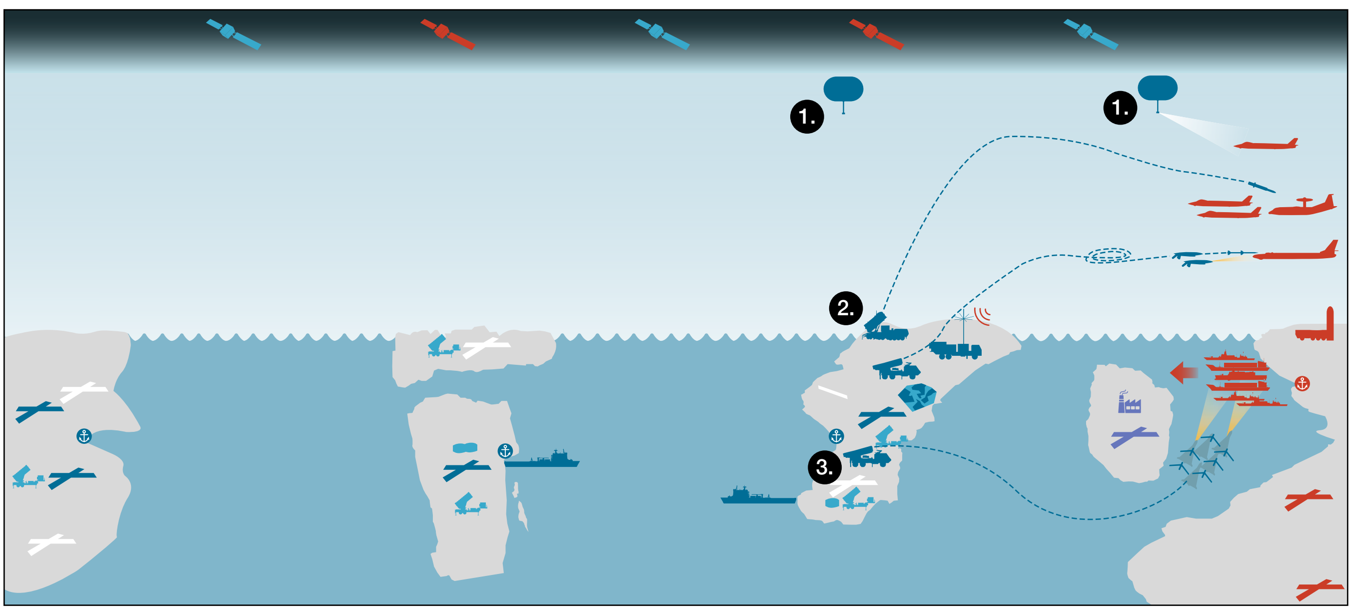
Counter-air UAS squadrons have potential drawbacks. As with VLR SAMs, the Air Force will need to balance the operational performance, cost, and manufacturability of the designs to field systems that meet operational demands yet are available in large numbers in peacetime and in even larger numbers during a war. Our analysis assessed a notional $4 million average procurement unit cost, inclusive of AAMs or an electronic attack payload, for a run of 1,000 or more.[82]

Another challenge is sustaining the effects that counter-air UAS batteries generate over a campaign. Given the moderate or slow speed of these systems, enemy forces could attempt to frequently feint a presence or surge of aircraft to draw down counter-air UAS inventories and force more frequent logistical resupply of squadrons—especially if the designs were expendable rather than recoverable. To guard against this, the Air Force will again need to acquire relatively low-cost designs that it could field in large numbers to offset both attrition on the ground and expenditures in the air. But it will also need to adopt sophisticated approaches to employ them that maximize their tactical and operational impact, in particular by pairing counter-air UASs with mutually supporting Edge Force, Pulsed Force, Core Force, and other joint assets.

Regaining an Edge

In sum, this mobile, forward-deployed force could operate with other elements of the Air Force and joint force to promptly deny

Figure 9. Operational View of Representative Edge Force Elements



1. **1.** Stratospheric balloons and mobile, low-signature ground-based surveillance and targeting teams provide persistent air surveillance and targeting, communications relay, and local C2.
2. **2.** VLR SAMs and counter-air UAS engage high value aircraft in highly contested airspace.
3. **3.** Road-mobile anti-ship munitions provide maritime strike lethal attacks, electronic attack, and decoys.

Source: Authors.

initial adversary aggression and be ready to sustain a protracted war. The Edge Force (shown in figure 9) offers a lethal, survivable, and responsive layer of combat power for the service. It seizes the offensive initiative by generating effects in highly contested environments, and it sidesteps PLA strengths to gain the advantage and improve combat outcomes.

Because the PLA can control the airspace near China, the Edge Force generates effects into the air from the ground. Because the PLA excels at attacking fixed airfields, the Edge Force employs mobile, low-signature units. Because the PLA aims to paralyze US military decision-making, the Edge Force establishes local C2 and taps into higher-level C2 systems through resilient, heterarchical C3 structures. And because the PLA assumes it can counter a small number of attacking US forces, the Edge Force brings immediate mass at the start of the conflict and a pipeline for production and adaptation at scale.

However, the Edge Force cannot succeed on its own. Only by integrating its operations with Resilient Airfields and Pulsed Force, and Core Force units can it impose difficult dilemmas on the PRC (or other adversaries), provide US commanders with more options, and achieve desired effects. But the integration of these cost-effective forces into the Air Force's overall design would clearly present multifaceted challenges and a changing repertoire of surprises to adversary commanders. The result is an asymmetric design that not only complements existing airpower but also stands ready to respond flexibly wherever and whenever rapid denial is necessary. Chapter 9 describes how the Air Force could fund the development and fielding of the Edge Force as well as the impact of the Edge Force on combat simulations.

Why Should the Air Force Field the Edge Force? Two Historical Vignettes

During the Cold War, the Air Force successfully embraced ground launched cruise missiles (GLCMs) yet failed to adopt loitering anti-radar munitions. The results of these decisions offer compelling historical precedents for why ground-launched asymmetric capabilities should be an integral part of the USAF and how to increase the likelihood of their acceptance.

Ground-Launched Cruise Missiles

Though GLCMs had a relatively short service life in the Air Force, their operational impact and political value were profound.[83] When the United States and NATO required new means to contest increasingly capable Soviet missile threats without relying solely on manned strike aircraft, GLCMs demonstrated a new capability to conduct strikes that did not require launch from a fighter. The Air Force fielded, trained, and sustained them under its operational concepts and command structures, helping to preserve centralized control and integrated targeting across the broader air component. Recent scholarship also shows that GLCMs helped shape Soviet threat perceptions in ways that advanced arms control accords, culminating in the 1987 Intermediate Nuclear Forces (INF) Treaty.[84]

The BGM-109G Gryphon GLCM story begins with a realization that to deter growing Soviet rocket forces—in particular, mobile intermediate-range ballistic missiles such as the SS-20—NATO needed a distributed, survivable capability that could be forward-based in Europe yet remain difficult for Soviet planners to target. Although the US Army already fielded Pershing ballistic missiles, political and command arrangements favored the Air Force taking ownership of cruise missile operations. The decision to place ground-launched Tomahawk missile units under the USAF was neither accidental nor purely bureaucratic. It resulted from the need for tight integration between these ground-based weapons and the Air Force's overall air campaign plans, targeting intelligence, and C2 networks. Contrary to the notion that *if it's a missile, it belongs to artillery*, the GLCM model confirmed that a missile's greatest strategic effect arises when it is deeply woven into the Air Force's architecture of airborne ISR, theater-wide battle management, and large-scale strike packages.[85]

The GLCM wings exemplified this synergy. Each wing included a relatively small number of transporter-erector-launchers

Figure 10. Camouflaged GLCM Unit

Source: Photo donated by Shawn Tabor, "Ground Launched Cruise Missile Program: 'GLCM Rangers,'" USAF Police Alumni Association, https://www.usafpolice.org/glcm-program.html.

capable of deploying swiftly and inconspicuously, hiding in dispersed locations until the moment to shoot and move (see figure 10). Although these were small formations, they depended on the full weight of the Air Force's targeting and C2 apparatus to function. Crews drew on USAF reconnaissance assets and centralized targeting cells to update flight profiles and coordinate salvoes alongside allied aircraft. As a result, GLCMs did not operate as a peripheral afterthought; they were part of an Air Force–managed combined arms approach to the European missile problem. This arrangement ensured that local launcher teams had direct lines of communication into broader theater planning, which helped avoid duplication of effort, prevented fratricide, and enabled cross-cueing with bombers and tactical aircraft. Hence, their success underscored the second key lesson for today's Edge Force concept: From a C2 and targeting perspective, close integration within the larger Air Force structure is crucial to maximizing combat effectiveness.[86]

Such alignment was not just an American quirk. Allied governments were initially wary of hosting nuclear-tipped cruise missiles. However, starting with the United Kingdom, they eventually recognized that the USAF's integrated approach—one that tied GLCMs to the daily operational rhythm of allied air forces—offered credible deterrence. Indeed, base agreements (for the GLCM units to operate from airfields) and readiness protocols hinged on the understanding that GLCMs, though launched from land, were a vital instrument of the Air Force's global power-projection mission.[87] Had the allies stripped GLCMs from that framework, forced them into a different service or siloed them from the operational air chain of command, their capacity to synchronize salvoes at critical junctures could have diminished markedly.

The synergy between GLCMs and the alliance's overarching air campaign magnified the psychological and operational pressure on the Kremlin, encouraging them to return to the negotiating table. The Soviets ultimately judged that GLCMs—which the Air Force so easily dispersed and so thoroughly embedded in its command loops—would be extraordinarily hard to preempt.[88] Thus, GLCMs became a pivotal bargaining chip in the INF negotiations. They convinced the Soviet General Staff that limiting intermediate-range weapons was preferable to contending with these nuclear-armed weapons, which could preventively or preemptively fire deep at the onset of a conflict to target C2 and other nodes in a manner difficult to detect or counter.

At bottom, the GLCM case underscores why an asymmetric force belongs under the Air Force umbrella, especially when that force is built on small-footprint, missile-centric capabilities. First, no matter how advanced future USAF platforms become, the mission of offensively contesting the air and denying adversaries free rein will continue to rely on missiles of various ranges. Those who believe only fighters should carry missiles overlook that land-based launchers—if the Air Force integrates them through its robust C2 enterprise—can in some cases extend the same offensive pressure at lower cost and with greater survivability. Second, the historical record shows that effective employment of GLCMs hinged on access to specialized ISRT and operational linkages that the Air Force was in the best position to supply. Pulling these missiles away from the service's targeting and command networks would have reduced their deterrent value. Finally, GLCMs' swift but decisive service life offers a proven model for how novel, asymmetric missile forces can transform strategic calculations, both in crisis bargaining and in arms control outcomes.

The concept of Edge Force detachments under Air Force jurisdiction therefore builds on the lessons of GLCMs. It leverages decades of institutional experience in planning, coordinating, and controlling air operations in ways that no other service has. Distributed missile units with roots in the USAF gain the very advantages that made GLCMs so vexing to the adversary: rapid retargeting, integrated overhead cueing, and real-time alignment with the broader air campaign. The "short, happy life of GLCMs" may have ended with the INF Treaty, but their legacy remains: an enduring affirmation that an air-minded approach to ground-launched missiles—underpinned by the Air Force's command-and-control infrastructure—is key to harnessing the full strength of offensive airpower.[89]

Loitering Anti-radar Munitions

The Air Force pioneered the development of drones for intelligence gathering and reconnaissance. But while it initially sponsored the development of a new class of loitering suppression/destruction of enemy air defense (S/DEAD) munitions, it failed to transition the program. Other countries did field similar capabilities, and the Air Force now has an opportunity to reclaim the unfulfilled promise of these weapons.

Starting in the late 1940s, US companies developed air- and ground-launched target drones, which by the early 1960s had further developed into air- and ground-launched UAVs that the Air Force operated in support of the National Reconnaissance Office (NRO) and Strategic Air Command.[90] During the Vietnam War, US forces launched various drones, most notably the Ryan Model 147 Lightning Bug, from aircraft and from the ground to conduct reconnaissance, collect electronic intelligence, use as decoys, conduct electronic attacks, drop propaganda pamphlets, and complete other missions. Throughout the war, the DoD rapidly adapted the drones to generate new effects and overcome enemy countermeasures, and Teledyne Ryan proposed follow-on variants focused on tactical strike and air defense suppression. However, the end of the Vietnam War stalled combat drone development. "Operational costs, budget cuts, and absence of Vietnam-era NRO 'black' funding for RPVs [remotely piloted vehicles]" led the Air Force to abandon the program. The drones then fell under the 1979 Strategic Arms Limitation Talks II Treaty limits on "self-propelled, guided, weapon delivery vehicles capable of flying distances of more than 372 miles (599 km) before fuel exhaustion," which throttled development.[91]

One of many parallel US drone programs in the 1970s sought to "engineer an affordable, radar-homing, one-way attack munition specifically designed to suppress or destroy enemy air defenses."[92] Drawing on a series of studies from the Advanced Research Projects Agency (an incarnation of DARPA), the USAF and the Federal Republic of Germany's German Armed Forces' Technical and Procurement Organization launched a collaborative program. Contenders consisted of E-Systems, Lockheed, and Northrop on the US side and a joint team of Messerschmitt-Boelkow-Blohm and Teledyne Brown on the West German side.[93] The primary mission of the anti-radiation drone program "was to detect and engage enemy radar systems," and it could also "simulate larger aircraft" and "serve effectively as a decoy."[94] These operations could help create penetration lanes for allied aircraft and enhance their survivability as they conducted attacks through the Soviet Union's IADS. In so doing, they could generate a S/DEAD effect even if allied airfields in Western and Central Europe had come under heavy attack and thus allow US and allied forces to immediately execute offensive strikes.

Figure 11. Die Drohne Antiradar Launch During Tests in the 1980s

Source: "First Shahed-136 Prototype Was Created in Germany in the 1980s, and It Was Called DAR," Defense Express, November 14, 2023, https://en.defence-ua.com/news/first_shahed_136_prototype_was_created_in_germany_in_the_1980s_and_it_was_called_dar-8560.html.

West Germany offered to pay 50 percent of the development costs for the US side of the program, and the team conducted demonstration launches in 1977. However, the US Congress "refused to approve the US Air Force's FY 1978 request for $2.5 million for engineering development. It based this decision on concern that the Tactical Air Command (largely composed of fighter and attack aircraft units) was not interested in ground-launched drones and that 'the Army and its Aviation Systems Command have shown keen interest in miniature remotely piloted vehicles.'"[95]

Even though the United States exited from the program, West Germany proceeded on its own, and West German aircraft manufacturer Dornier, using a seeker from Texas Instruments, developed the Die Drohne Antiradar (DAR, "The Anti-Radar Drone"). DAR supported NATO's Follow-on Forces Attack doctrine and succeeded in flight testing (as shown in figure 11). However, concerns regarding the effectiveness of its seeker and the collapse of the Soviet Union led to the program's cancellation.[96]

The program left, however, an enduring mark on other countries' loitering munitions programs. Israel Aerospace Industries' (IAI) Harpy (and later Harop) adopted a similar configuration to the DAR, with rocket-assisted take-off from truck launchers. Israel sold Harpy weapons to multiple countries, including the PRC, which has also fielded its own loitering munitions. Iran's Shahed-136 also adopted a similar design, which it then sold to Russia, which subsequently modified it into the even more capable Geran-2. As Yehor Shytikov stated, one can indirectly consider DAR the "German grandfather" of the Shahed-136.[97] Yet, it all started with a cooperative program with an American great-grandfather, or at least great-uncle.

To reclaim its legacy in this area and adopt ground-launched weapons as part of its Edge Force, the Air Force should heed the pitfalls and opportunities the historical case study illuminates. First, it should ensure that not only the push of technologists but also the pull of operators and buy-in of policymakers drive its programs. In the US case, DAR focused on a specific operational problem and leveraged available technologies; nonetheless, it did not gain the support of the fighter/attack community or adequately explain to Congress how it fit into the broader Air Force and joint force design. This lack of buy-in and integration led to its cancellation. Edge Force program managers should gain the buy-in of the Pulsed Force and Core Force communities early on and convey that their systems will not supplant the others and will only excel operationally when the Air Force employs all forces in an integrated fashion.

Second, on the US side, the DAR program suffered from questions regarding the appropriate Air Force–Army division of labor for ground-launched capabilities. The Air Force operated ICBMs and was getting ready to begin fielding GLCMs, while the Army operated Pershing medium-range ballistic missiles and short-range rockets and cannon artillery. Nonetheless, the question arose as to whether DAR should be an Army capability.

We contend that the Air Force should adopt these capabilities since they will excel when the USAF integrates them into its C2 architecture and broader approach to force design and employment. Policymakers will need to address this issue head-on. Internally, the Air Force will also need to overcome some cultural resistance to operating ground-launched weapons. It already does so with ICBMs, and airpower can encompass a rich variety of aircraft, ground-launched missiles and drones, and other systems.

In terms of opportunities, the DAR program demonstrated that this class of system has a low technological barrier to entry, which facilitates innovation to address discrete operational problems and encourages the participation of many competitors. The program also showed how funding and technology collaboration with allies in this area is possible. As the Air Force starts to field new Edge Force capabilities, it should pursue opportunities for co-development, licensed production, or other cooperative activities with allies.

5. WIELDING THE PULSED FORCE'S SCALPEL AND SLEDGEHAMMER

The Pulsed Force conducts long-range strikes at scale to destroy key nodes and other targets in enemy operational systems. These actions can deny an enemy's initial aims, compel the enemy to adjust defensive postures, disrupt their operational flows, and sustain large-scale strikes. Whereas the Edge Force stays small and agile inside or just outside an adversary's frontline interdiction zone, the Pulsed Force relies on specialized, long-range platforms that coalesce to complete high-impact missions at carefully chosen intervals. Even under concerted enemy attack, the Air Force can generate on relatively short notice timed, near-simultaneous strikes on high-value targets using penetrating, stand-in, and standoff aircraft and weapons. Pulsed Force attacks are enabled by Resilient Airfields and integrated into the strikes conducted by and operational access generated by Edge Force units, and the targeting, protection, strikes, and aerial refueling provided by Core Force units.

The key units of the Pulsed Force are bombers (currently the B-1, B-2, and B-52, and in the future, the B-21), other pulsing aircraft, and nuclear-armed ICBMs. In certain instances, the Pulsed Force may be augmented by Core Force airlift aircraft rigged for palletized munitions delivery, or vice versa.[98] Other assets could also join the Pulsed Force over time, including high-speed aircraft (such as designs like Hermeus' shown in figure 12), which could offer considerably higher sortie rates than the current and programmed fleet of subsonic-cruising bombers, and subsonic, low-cost uncrewed aircraft. The unifying theme is that each platform can strike from long ranges, using advanced weapons and networked kill chains, which will minimize the exposure window to adversary counter-airfield attacks and IADS.[99]

Photo: A B-21 Raider joins flight testing at Edwards Air Force Base in California on September 11, 2025. (US Air Force)

Figure 12: Hermeus Quarterhorse Mark 2 Under Construction

Source: Hermeus.

Targeting over Long Distances

A hallmark (and challenge) of the Pulsed Force is the need to identify and engage priority targets over thousands of miles. Strategists should not underestimate the difficulty of prosecuting dynamic targets at extreme range.

Targeting is one of the most significant challenges in conducting the Pulsed Force's mission of long-range attacks at scale. Most Pulsed Force aircraft are equipped with organic sensors to avoid threats and close kill chains on their own—especially when penetrating deep into enemy territory. Yet active organic sensors could expose Pulsed Force units to counter-detection and lack the precision and analytic capabilities of the broader joint C5ISR architecture. Therefore, external targeting information from satellites, forward sensors, and distributed intelligence grids is best for guiding long-range Pulsed Force attacks.[100] Close integration with the broader joint sensing apparatus, including newly proliferating low-earth-orbit satellites, is necessary to reduce the lag between detection and final targeting and ensure that forces maintain custody of tracks in spite of enemy countermeasures.[101] This integration may also require additional slack in the system to account for friction and enemy action. For example, if custody is broken on a target and bombers need to loiter until they reacquire it or recoalesce the pulse, they may need additional aerial refueling tanker offloads. This underscores the inherent complexities of long-distance dynamic targeting.

A key enabler of the Pulsed Force's high-impact strikes is real-time or near-real-time tracking of targets that may be constantly moving, dispersed, or concealed. By integrating space-based moving target indicator (MTI) sensing into the larger ISR apparatus, US forces can improve targeting custody of critical adversary elements—even when they relocate to avoid known overhead or terrestrial sensors.[102] Constellations of satellites, penetrating ISR aircraft, and other sensors can feed continuously updated positional data to the bomber streams or other long-range strike assets in the Pulsed Force, dramatically shortening decision cycles. This means that, when they execute a pulse, aircrews have highly accurate, time-sensitive location information on targets such as sensing and C2 nodes, missile launchers, air defense batteries, airfields, and naval task groups—all of which are crucial to degrading enemy anti-access/area-denial networks. As the Chief of Space Operations recently emphasized, the Space Force's evolving capacity to deliver resilient missile warning, tracking, and domain awareness will be central to shaping future kill-chain requirements and ensuring US forces can operate inside contested zones.[103]

Equally important is the seamless connection of these MTI feeds and other sensors into the Pulsed Force's C2 architecture. Because the PLA can quickly relocate high-value assets, universal data sharing and standard formats alone are insufficient. Instead, the Department of the Air Force's emerging approach—which the Joint Long-Range Kill Chain Organization (JLO) exemplifies—brings together operators, technologists, and acquisition personnel from multiple services to rapidly integrate new sensors and mesh them into operational frameworks.[104] This collaboration model directly addresses the system-of-systems nature of kill chains, aligning advanced space and other capabilities with bombers and emerging long-range munitions to maximize responsiveness and strike precision. The result is a Pulsed Force that not only hits hard but can dynamically adapt to changing target sets in high-threat environments.

A Dynamic and Agile Force

The Pulsed Force does not represent a return to rigid and predictable linear bomber offensives of past wars. Strike operations will need to become more dynamic for Pulsed Forces to exploit fleeting coverage gaps, saturation points, or overextension of enemy defenses.[105] Doing so requires greater reliance on remote sensing, real-time targeting data, and advanced communications networks to maximize targeting effectiveness. However, it also demands a shift in Pulsed Force units' force packaging and maneuvering.

Rather than a small number of large, predictable sorties, the Pulsed Force will need the ability to generate waves of varying sizes and periodicities: larger or smaller, higher or lower signature, frequently or episodically.

The Pulse Force's ability to vary the size and character of attacks will also help counter adversary interdiction efforts. A capable opponent like the PLA will likely be able to detect when strike sorties take off, predict when they will arrive at areas of interest, track groups of aircraft throughout large portions of their flight path, prepare defenses, and proactively attack the Pulsed Force units themselves or supporting assets to disrupt or collapse attacks.[106] Pulsed Force units and the broader DoW will adopt capabilities and measures to frustrate adversary surveillance and targeting, and in this world of prolific sensing and targeting, lower asset signatures may be even more valuable, since high signature assets may be easily engaged. But in general, observation of large aircraft such as bombers, and to an even greater degree supporting aircraft such as tankers, will likely become easier than currently is the case over time.[107]

A more recomposable and dynamic Pulsed Force can help undermine enemy air defenders' ability to understand the objectives and composition of a strike package. In addition to broad-area counter-C5ISRT capabilities, one approach to do this is to generate more optionality in the air. For example, instead of timed, massed launches, small flights of Pulsed Force aircraft could periodically take off from numerous airfields. After takeoff, these aircraft could take different flight paths and receive relatively more aerial refueling. This approach will enable them to loiter longer before opportunistically coalescing to conduct standoff, stand-in, or penetrating attacks when either local commanders onboard the bombers or remote commanders judge the moment ripe for attack.

Additional loitering exacts an opportunity cost since it reduces sustained sortie rates by increasing mission times. The Air Force would need to weigh this cost against the greater mass that the direct launch of many aircraft in modern composite air operations or "Alpha strikes" could bring to bear.[108] However, in some circumstances, the increased operational effectiveness that this approach can generate and the uncertainty enemies would face when dealing with unpredictable pulses would outweigh the alternative. From the adversary's perspective, these pulses could become an ever-present threat, forcing them to maintain a high tempo of defensive readiness with all the attendant costs. Moreover, staggering Pulsed Force unit takeoffs and recoveries could reduce the number of aircraft that personnel must turn at any single moment and commensurately reduce susceptibility to attack on the ground. It could also facilitate the recovery of aircraft if planned tanker support disruption or destination airfield suppression occurs. Redirecting packets of aircraft to alternate airfields would become easier, and redirected aircraft would have the endurance, thanks to staggered launches and earlier refuelings, to vector to other locations or remain airborne until additional aerial refueling support arrives.

Maximizing the Pulsed Force's Impact

The Pulsed Force will provide the bulk of USAF firepower in modern conflicts against potent adversaries. Although the Core

Force of strike fighters has been the mainstay of Air Force and Navy strike operations for decades, in an era of highly proliferated air defenses, ubiquitous sensing, and dense attacks against forward airfields, bombers will increasingly take on the role of projecting power. The Air Force should therefore maximize the impact of the Pulsed Force. Beyond the aforementioned ISRT and C3 resources, this will require smart investments in Resilient Airfields, weapons, aerial refueling, and Edge Force and Core Force counter-air and strike capabilities.

Unlike traditional expeditionary strike air wings that remain proximate for sustained operations, this force flies from a mix of intermediate and distant airfields with strong defenses, which we refer to as *strongpoints*. It leverages Resilient Airfields' fielding of necessary resources:

- Infrastructure and logistics, such as appropriate runways, ramp space, fuel stores and distribution systems, magazines, bunkers, and hardened aircraft shelters (HASs)
- Passive defenses, such as hardening and reconstitution capabilities and units
- Active defenses, such as ground-based air defenses and core force fighter and AEWC aircraft patrols

These resources ensure it can sustain operations not only from distant, traditional bomber airfields in the contiguous United States but also from intermediate airfields in US territory (such as Alaska, Hawaii, Wake Island, the Marianas) and allied bases (such as Diego Garcia and those in Australia). By increasing the proportion of aircraft that can rapidly stage to and sustain operations from these intermediate and distant locations, the Pulsed Force could increase the sustained sortie rate of the force by over 40 percent, which in turn increases the number of strikes it can conduct.

Reducing flight times provides enormous value for the force and would be difficult to replicate through additional aircraft production. For example, if the Air Force made 50 mission-ready B-21 bombers available to support a campaign, each costing an estimated $716.8 million in FY 2026 dollars, and they flew from only distant airfields, they might sustain a daily sortie rate of around 62 percent. If, however, the same 50 bombers flew from a mix of distant and intermediate airfields, the sortie rate could rise to around 89 percent, which would generate 14 more sorties per day. Generating the same effect with a larger force would require 71 rather than 50 bombers, an additional $15 billion, and two to three more years of production. Therefore, one of the fastest and most economical ways to enhance the effectiveness of the bomber fleet is to resource the Resilient Airfields investments necessary to sustain intermediate and distant strongpoints.

Pulsed Force aircraft can employ a range of weapons from penetrating, stand-in, and standoff ranges. Although a wide range of weapons are employable in uncontested or lightly contested environments, in contested environments, higher-signature bombers such as the B-1B and B-52 principally employ large numbers of standoff weapons. Among them are LRASMs, advanced cruise missiles, and next-generation hypersonic systems. The B-2 and emerging B-21 fleets combine reduced signatures, advanced networking, and flexible weapon loadouts with emerging operational concepts to either fire a moderate number of standoff weapons (such as the aforementioned ones or others like the Powered Joint Direct Attack Munition) or penetrate defenses to deliver large numbers of stand-in munitions (such as the Stand-in Attack Weapon) or direct attack munitions. Alternatively, it could deliver one or two very large penetrating weapons, such as the GBU-57A/B Massive Ordnance Penetrator bombs that the the United States employed against Iranian nuclear facilities in Operation Midnight Hammer. Pulsed Force B-52, B-2, and B-21 bombers can also employ nuclear weapons, supporting strategic deterrence and nuclear warfighting if necessary.

Employing a mix of launch platforms and weapons and synchronizing effects across domains, the Pulsed Force can strike high-value enemy assets and husband its finite stocks of long-range munitions. This ensures it can minimize risks to platforms and escort burdens while maintaining readiness to sustain a protracted campaign. Core Force mobility aircraft could also airdrop affordable palletized, long-range, networked munitions currently under development, potentially increasing the volume of weapons fired in pulses as well as preserving bombers for stressing missions. Of course, a large fraction of the mobility fleet will be tasked with mobility missions.

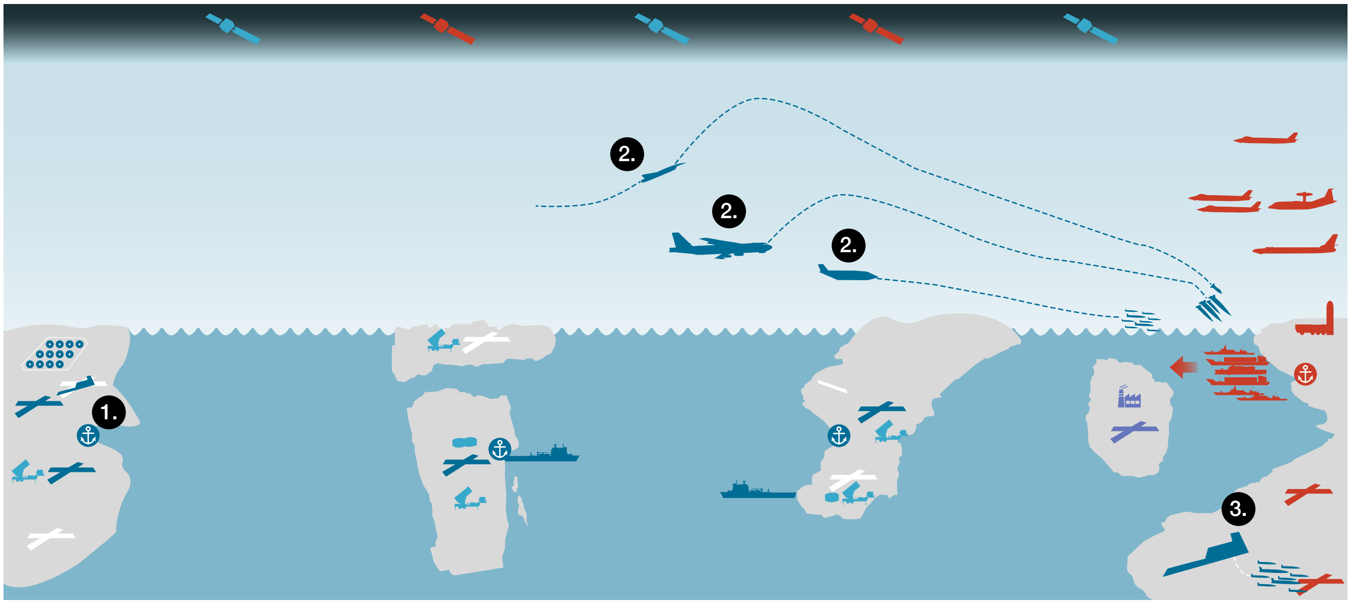
Aerial refueling is another critical enabler of the Pulsed Force. Although bombers have much longer ranges than most other aircraft (such as fighters), they require considerable aerial refueling support to fly from distant (and some intermediate) airfields to targets—especially if they are penetrating deep into contested airspace. For example, in Operation Midnight Hammer, "dozens" of aerial refueling tankers supported a raid involving a mere seven B-2 bombers.[109] The high number of tankers may in part reflect the desire to maximize mission assurance, and a considerable number of the tankers likely supported escorting aircraft. In a high-risk conflict against the PRC, it could be possible to reduce the number of per-bomber refuelings. However, the fact remains that large aircraft such as bombers flying long missions require considerable aerial refueling support, albeit far less than packages of fighter aircraft that can generate equivalent strike capacity over the same range. Novel concepts such as the proposed approach to generating more Pulsed Force optionality in the air would depend on even more aerial refueling.

Given their ability to rapidly destroy numerous targets early in a conflict, Pulsed Force units would likely receive priority for aerial refueling support, along with support for strategic deterrence and homeland defense requirements. But if the Pulsed Force requires a large fraction of the available tanker fleet due to the location of its operating airfields or other factors, then it would foreclose the provision of aerial refueling support to other important missions, such as mobility aircraft delivering forces and supplies and the operations of Core Force aircraft. Decreasing support for either of these missions could jeopardize success in a campaign.[110] Alternatively, the refueling fleet could attempt to increase its effective offload capacity by operating a large fraction of its fleet on a sustained basis from forward airfields, where they may incur an unsustainable rate of attrition on the ground.

The Pulsed Force's other synergies are with Edge Force and Core Force units. If an adversary devotes disproportionate resources to track flows of bomber or airlift aircraft (which could have palletized munitions), it may divert reconnaissance from the distributed, inside Edge Force units and Core Force units operating from forward and intermediate locations. Meanwhile, once the Pulsed Force unleashes waves of standoff weapons, it can degrade critical infrastructure and air defenses and provide pockets of advantage for follow-on actions by other elements of the force. Conversely, Edge Force and Core Force units support the Pulsed Force.

The counter-air surveillance and targeting capabilities of the Edge Force and Core Force provide valuable information to Pulsed Force units and higher command echelons regarding the presence of enemy forces, which they can then bypass if necessary. The counter-air engagement capabilities of the Edge Force and Core Force help create lanes for Pulsed Force strikes, and the VLR SAM sniping of the Edge Force can destroy key counter-air sensors and enablers or force them back. Meanwhile, the same force's counter-air UAVs can also destroy key assets and jam enemy sensors, helping to temporarily deny airspace to the enemy. Core Force crewed and uncrewed fighter and AEW/C aircraft selectively surge to attack key enemy formations at propitious times and locations to clear lanes for Pulsed Force aircraft and munitions. The Edge Force and Core Force's offensive counter-air activities (and defensive screening and escort) are essential to destroy capable enemy counter-air capabilities and create operational access for the Pulsed Force, which otherwise could meet potent enemy counter-air patrols and sweeps that would either destroy its aircraft or intercept its munitions. Core Force aircraft also di-

Figure 13. Operational View of Representative Pulsed Force Elements



1. ICBMs, bombers, and C3 maintain strategic deterrence.

2. Existing high signature bombers and future high-speed or low-cost strike aircraft fire from standoff.

3. Low observable bombers penetrate into highly contested airspace.

Source: Authors.

rectly and indirectly defend forward, intermediate, and distant airfields from the air, enabling the Pulsed Force to operate from the intermediate and distant strongpoints and have forward-divert locations in extremis.

Edge Force strikes (such as by anti-ship munitions launchers) generate enormous lethal mass, electronic attack effects, and decoys. In some cases, these effects integrate with the Pulsed Force attacks to overwhelm or thin enemy defenses and allow Pulsed Force munitions to strike the right targets. The Core Force also generates strike capabilities from intermediate strongpoints (and, in the case of mobility aircraft with palletized munitions, distant ones as well) and, to a lesser degree, forward airfields. Traditionally, forward-based fighter wings could provide greater strike mass than distant bomber wings due to their proximity to targets and high sortie rates. However, in a major conflict with the PRC, forward and intermediate airfields could face major attacks, and the moderate number of forward fighters would need to devote a large fraction of their sorties to counter-air efforts. In this case, the strike capacity of the Pulsed Force would likely outweigh that of the Core Force early in a campaign.[111] If US forces could sufficiently thin or suppress the enemy's offensive ability, and if they had sufficiently defended forward and intermediate airfields to preserve magazines or the ability to deliver munitions, then the core force could fly additional strike sorties.

A New Center of Gravity

By combining freedom of maneuver with massed firepower, the Pulsed Force (depicted in figure 13) challenges adversary planning in ways that the Core Force cannot. If the Air Force maintains the Pulsed Force at a high state of readiness and procures its components in appropriate numbers, these aircraft can reliably support strategic deterrence and swiftly project power despite enemy action. In concert with other forces, it can precisely strike enemy enabling nodes wherever they are located, collapsing their operational systems. This will maximize the effectiveness of the massed fires that the Edge Force, Pulsed Force, Core Force, and other joint forces bring to bear while minimizing exposure to enemy airfield attacks. By mixing loadouts of exquisite weapons with more numerous ones, the Pulsed Force can sustain penetrating, stand-in, and standoff attacks day after day. Wielding a scalpel and a sledgehammer, these attacks can precisely deny initial adversary aims and allow US and allied forces to gain positional advantage across domains. Since US and allied forces can thwart enemy offensive actions and kill enemy forces at much higher loss-exchange ratios, the attacks can convey to adversaries that the only successful outcome is the cessation of hostilities. An understanding of these dynamics can ultimately deter conflict.

6. STRONG CORE FORCE, STRONG AIR FORCE

At the heart of the Air Force is the Core Force. These units provide ISRT, counter-air, strike, mobility, and C2 capabilities that the Air Force and broader joint force require. By retaining appropriate levels of capacity, the Core Force ensures day-to-day US global presence forward and responsiveness. In a crisis, Core Force units surge to deploy necessary Air Force and joint force units and augment forward-deployed Core Force units. In a conflict, Core Force units operate with allies and partners from a mix of forward, intermediate, and distant airfields, and Core Force aerial refueling and airlift aircraft allow US forces to maneuver in the air and on the ground. Armed with conventional and tactical nuclear weapons, Core Force units support homeland defense, strategic deterrence, and power projection.

Core Force units enable the overall force to sense the environment, blind the enemy, command and control forces, maneuver, and fight. Without them, the USAF cannot fight effectively. Yet the current and planned structure of the Core Force lends itself to a force employment approach that is brittle, slow to deploy, susceptible to attack on the ground, predictable in the air, and incapable of denying initial adversary aims, much less sustaining a protracted conflict. To offset rising O&S costs and other demands, the Core Force has also been a bill payer. It has shrunk by 41 percent since 1990, 18 percent since 2000, and 6 percent since 2010. Over the next two years, it is slated to shrink an additional 12 percent. To succeed in future scenarios against the PRC, the composition of the Core Force should evolve while retaining the capacity and flexibility to address global demands, and it should significantly change how it deploys and wages war.

Photo: A US Air Force F-35A Lightning II performs during the 2025 Battle Creek Field of Flight Air Show over Battle Creek, Michigan, on July 5, 2025. (US Air Force)

Strengthening the Core Force

Air Superiority and Strike Aircraft

The Core Force provides a heterogenous assortment of capabilities that address specific operational problems and impose dilemmas on adversaries. Fighter aircraft are at the forefront of its ability to engage enemy threats, directly destroying enemy forces and defending friendly forces on the ground and in the air.

The F-16 Fighting Falcon is the most numerous USAF fighter. Although it lacks the stealth or payload of other fighters, the F-16 is an effective and low-cost-to-operate platform for air defense at home and abroad. It is useful for power projection in low-to-moderate threat environments, and the specialized F-16CJ fleet performs S/DEAD missions.

The multirole F-35A is replacing F-16Cs and A-10Cs, and it is currently the most numerous low-observable crewed fighter in the Air Force's inventory. It will conduct not only strikes but also air-to-air combat. Ongoing Block 4 upgrades will provide the F-35A with new radiofrequency and electro-optical/infrared sensors, internal carriage of six (rather than the current four) advanced medium-range AAM (AMRAAM)-sized weapons, and other improvements to maintain its superiority against the PLA's rapidly growing fifth- and sixth-generation

Figure 14. US Air Force Depiction of Current and Future Fighter Aircraft

Source: General David Allvin (@OfficialCSAF), "Our @usairforce will continue to be the world's best example of speed, agility, and lethality . . .," X, May 13, 2025, https://x.com/OfficialCSAF/status/1922357672487080412.

combat aircraft fleets. Further improvements, such as low-cost fuel drop tanks and costly but valuable engine upgrades or replacement, could increase the F-35A's range. These will enable it to fly from more distant airfields, reduce its dependence on aerial refueling, and expend more fuel to win tactical engagements.

The F-22 is the centerpiece of the Air Force's current air superiority fleet, and it too is undergoing upgrades to enhance its sensors, countermeasures, and range. The service is developing the longer-range and even lower signature F-47 to complement and eventually replace the F-22. Slated to be operational this decade and equipped with powerful sensors and more weapons than the F-22, the F-47 will lead the emerging Next Generation Air Dominance (NGAD) family of systems, shown in figure 14. The family includes collaborative combat aircraft (CCA) such as the YFQ-42A and YFQ-44A, which are candidate designs for the first CCA increment.

Figure 15. F-15E with Advanced Precision Kill Weapons System

Source: US Central Command (@CENTCOM), "U.S. Air Force F-15E Strike Eagle in the U.S. Central Command area of responsibility," X, May 30, 2025, https://x.com/CENTCOM/status/1928505455241728122.

The Air Force expects CCA Increment 1 vehicles to cost about one-third that of crewed fighters, or $25–$30 million apiece, and possibly significantly less.[112] It also expects the designs to be less expensive to operate.[113] Lower costs should allow the fielding of CCA designs in large numbers, providing commanders with numerous risk-worthy assets that allow force packages to execute more effective tactics, techniques, and procedures (TTP), and allow theater commanders to use CCAs to maintain tempo and pressure on enemies. With long range and endurance, CCAs should be capable of operating from First or Second Island Chain airfields without aerial refueling, and their ground support requirements could be less than those of crewed fighter aircraft. However, unlike the runway-independent counter-air UASs in the Edge Force, Increment 1 CCA may require fighter-length runways of around 5,000 ft to operate.[114]

CCA Increment 1 designs initially focus on serving as *weapon trucks* for crewed fighters, but future variants could incorporate new sensors or electronic attack payloads. Beyond the procurement of significant numbers of CCA Increment 1, future CCA designs could give US commanders more options and generate new challenges for adversaries. These designs could feature shorter or no runway requirements, lower signatures, or higher speeds.

The weapons that fighter aircraft employ are also likely to evolve. Longer-range weapons, such as the AIM-260, will enable distributed kill chains that allow shooters to engage targets beyond their line of sight. Conversely, high-capacity, short-range weapons such as the Advanced Precision Kill Weapon System (APKWS, see figure 15) could allow aircraft to intercept numerous inbound threats in defense of critical assets such as airfields, making it more challenging for enemy forces to overwhelm target defenses.[115] And, lower-cost affordable mass weapons such as the Extended Range Attack Munition and Powered Joint Direct Attack Munition will complement the Air Force's current portfolio of exquisite weapons.[116]

ISRT, Armed Reconnaissance, and Electronic Attack Aircraft

The Core Force fields a diverse array of ISRT, armed reconnaissance, and electronic attack aircraft. This includes the aforementioned AEWC aircraft, such as the current E-3G and planned E-7A, which provide a potent ability to detect low-signature threats. It also includes a large fleet of reconnaissance and special support aircraft, such as the RC-135, U-2, and RQ-4 fleets. Uncrewed MQ-9 can not only surveil but also conduct attacks with a range of munitions. The MQ-9 fleet has performed admirably throughout recent operations, incorporating new payloads and striking terrorists and other targets. Operation of the MQ-9 fleet reflects in part a recognition that the Air Force should not completely optimize its force design to defeat PRC aggression. Capabilities low in cost to procure and operate, such as the MQ-9, that can operate in low-threat environments are a valuable element of the Air Force's force design.

Yet the MQ-9 has also taken considerable losses over Yemen and other locations, signaling that the air environment will be increasingly contested and high-signature platforms will be especially at risk. Accordingly, the Air Force is fielding the RQ-170, an uncrewed, low-observable aircraft that performs penetrating ISR.[117] It is also considering new approaches to enhance the self-defense capabilities of high-signature aircraft. Lastly, the EC-130H and forthcoming EA-37B aircraft provide high-powered and advanced electronic attacks. They conduct information operations and help to suppress enemy sensing and communications to enable operational access for US force packages in contested environments.

Mobility Aircraft

The Air Force's fleet of mobility aircraft is one of the US military's most important competitive advantages. Transporting cargo and refueling aircraft, it allows the US military to operate globally and supports a wide range of operations in peacetime, such as transporting military personnel, forces, and cargo; transporting US political leadership on aircraft such as Air Force One; and delivering humanitarian assistance and disaster response supplies and capabilities. These peacetime activities signal US support and cultivate US influence, and because of them the DoW should retain appropriate mobility fleet capacity in the Core Force to enable global operations.

The mobility fleet is also vital for war. By enabling US military forces to rapidly deploy to other locations, it helps posture forces and is essential for sustaining the continuous operation of units. Given potentially limited indication and warning times (as well as the possibility that adversaries could preventively attack US forces during a buildup of forces), it is essential for the mobility to retain an appropriate level of capacity and readiness to allow US forces to rapidly deploy to augment forward-deployed units. Resilient Airfields allow it to operate from a range of locations and achieve necessary throughput in delivery, while forward-deployed Edge Force units require relatively little mobility support initially, but then require resupply of their munitions or other demands. A considerable number of key joint assets (such as Army Air Defense Artillery) would also need to be surged in a crisis, and forward-deployed Pulsed Force and Core Force aircraft will also require additional support and personnel sent forward. Yet, force designs should accommodate limits on these additional forces since there is an upper limit on the amount of cargo and personnel the Air Force can deliver within a short time—especially if attacks start.

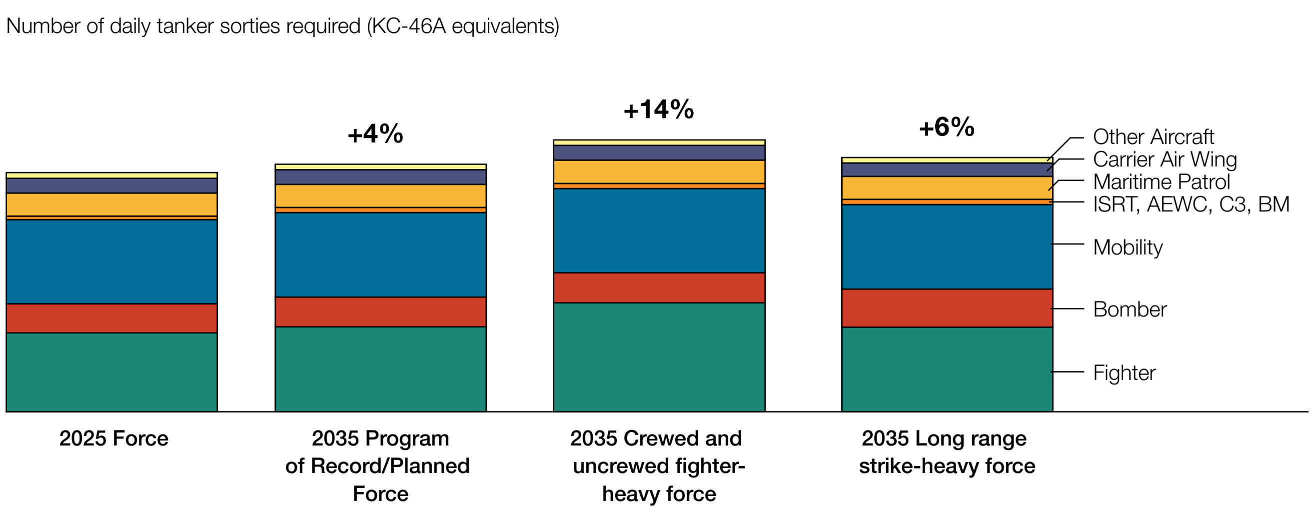
The C-5M and C-17 fleets transport forces and supplies, and the C-17 fleet is developing the ability to deliver palletized munitions such as the Family of Affordable Munitions (FAMM) from its cargo bay.[118] Neither aircraft has an active production line, and competing fiscal priorities may make introducing replacement aircraft in the near term difficult. Thus, husbanding the service life of these aircraft is essential, and the Air Force may need to extend the service life of its C-17 fleet, including replacing their engines.[119] Collaboration with allies and partners that require new or additional C-17s could help restart production as well as field new US C-17s.[120] Furthermore, during periods of increased demand, the commercial Civil Reserve Air Fleet (CRAF) augments the C-5 and C-17 fleet.[121] Drawing aircraft and crews from US airlines, CRAF is an essential element of the US ability to rapidly surge capacity in a crisis.

In contrast to large C-5 and C-17 aircraft that focus on inter-theater transport, smaller C-130 aircraft generally focus on intra-theater delivery. The Air Force is updating the venerable C-130 fleet with new C-130J variants, and existing C-130Js are receiving fuel efficiency upgrades to extend their reach.[122] C-130Js will also be able to employ palletized FAMM.[123] Lastly, C-130 aircraft support the Air Force Special Operations Command, which also uses a cornucopia of other fixed and rotary wing ISRT, transport, and attack aircraft. The USAF may also acquire or contract autonomous transport aircraft to efficiently support inter- and intra-theater delivery, including within clusters of airfields or operating locations.

Aerial refueling is essential to US military strategy. In support of homeland defense, aerial refueling sustains CAPs of fighter and AEWC aircraft to detect and intercept threats over and around US territory. In terms of strategic deterrence, tanker aircraft refuel nuclear-capable bombers, nuclear C3 aircraft issuing orders to all legs of the triad, and maritime patrol aircraft that guard maritime approaches. And in terms of power projection, aerial refueling is essential to rapidly deploy forces from the United States abroad. It allows aircraft to forgo intermediate stops and makes some distant deployments possible. It is also required for the large-scale, continuous, and pulsed employment of aircraft—Army, Navy, Marine Corps, and Air Force aircraft all rely to varying degrees on USAF refueling.

Demand for aerial refueling is high and growing. Over the past few decades, the Air Force has repeatedly employed every taskable tail when supporting concurrent combat operations, presidential visits, humanitarian assistance and disaster response, exercises, and regular deployments.[124] In operational planning, aerial refueling is frequently one of the chief factors limiting the employment of supported forces.[125] Moreover, the number of tankers the Air Force requires for strategic deterrence and

Figure 16. Estimated 2035 Aerial Refueling Demands for Operations in a US-PRC Conflict



Source: Authors.

homeland defense is rising, and the PRC could attrite tankers on the ground and in the air.

The DoW should increase the organic aircraft and weapons range of forces to reduce their dependence on aerial refueling. However, given distances in the Indo-Pacific and elsewhere, and given how current and emerging concepts emphasize greater distribution, dynamism, and tempo—all of which require the reach and endurance provided by aerial refueling support—aerial refueling demands will likely be high in the future. Figure 16 estimates how, whether the Air Force and Navy proceed as planned or adjust their force structures to emphasize fighters or longer-range strike capabilities, they will likely need more, and more-effective, aerial refueling capacity.[126]

The Air Force is recapitalizing its 1950s-era fleet of KC-135 tankers with new KC-46As. Although the KC-46A program has suffered numerous deficiencies and delays, it provides a bit more fuel offload capacity and much more and improved cargo, passenger, and aeromedical transport capacity, which helps offset demand on the airlift fleet. The Air Force is also adding enhanced C3 capabilities to aerial refueling and other mobility aircraft to improve their ability to dynamically plan missions and be aware of threats.[127]

However, the aerial refueling force faces two major threats. First are threats in the air: sweeping fighters, SAMs, and other threats can force tankers to stand back a considerable distance from where receiver aircraft would like to receive fuel. This greatly increases the number of receiver aircraft it takes to accomplish the task. Although increasing the organic range of aircraft and weapons can help with the tanker stand-back problem, the survivability of tankers in the air will require new approaches to employ tankers dynamically, new self-defense capabilities, and possibly reduced-signature designs.

Even more significant, however, is the PLA's threat to tankers and their supporting airfields and bulk fuel architecture on the surface. These threats could force a major proportion of the tanker fleet to operate from distant airfields. However, the KC-135 and KC-46 are designed to offload relevant quantities of fuel at short-to-medium radii. If they have to operate from distant airfields, they must force-extend (one tanker refueling another), and their effective capacity drops precipitously, which limits the number of operations Pulsed Force and Core Force aircraft can conduct.

Future longer-range tankers such as medium-sized blended wing body (BWB) designs like JetZero's shown in figure 17 could make it difficult for the PRC to suppress aerial refueling operations since they could access forward, intermediate, and distant airfields and deliver relevant quantities of fuel to receivers.[128] With appropriate self-defense capabilities, they could stand-into contested airspace to support receivers. Medium-sized BWB tankers would ensure the resilience of air operations, give US commanders far more options to execute distributed and dynamic air operations, increase US force deployment speed, and make it much harder for the PLA to suppress US air operations.

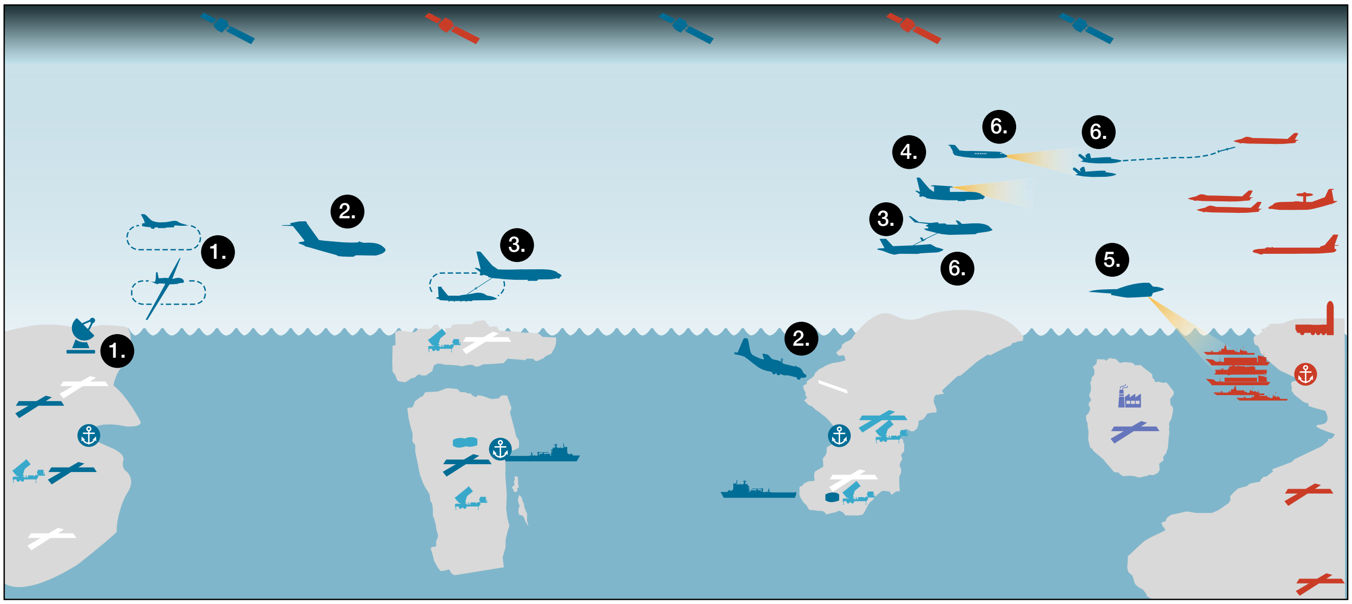
ISRT and C2

The Core Force also provides a range of non-aircraft ISRT and C2 capabilities that the Air Force and joint force rely on. Surface-based line-of-sight and non-line-of-sight radars and other sensors detect and track threats, allowing US forces to efficient-

Figure 17. JetZero KC-Z4 Aerial Refueling Tanker Design

Source: JetZero.

Figure 18. Operational View of Representative Core Force Elements



1. Surface sensors, C2 nodes, and fighter, ISR, and AEW/C aircraft defend the homeland, maintain strategic deterrence, and provide battle management.
2. Transport aircraft conduct inter and intra-theater delivery of cargo.
3. Standoff and stand-in refueling aircraft support Pulsed and Core Force aircraft.
4. AEW/C aircraft provide surveillance, targeting, and battle management.
5. P-ISR aircraft identify enemy forces and support targeting.
6. Fighter and electronic attack aircraft engage enemy aircraft and surface targets, escort Pulsed and Core Force aircraft, and defend critical assets.

Source: Authors.

ly address them. Furthermore, the Air Force exercises C2 over its forces from a range of fixed, relocatable, and mobile surface C2 nodes. In general, the USAF will seek to integrate effects and coordinate operations at higher echelons when possible, but contested communications and the need for rapid decision-making on the edge are key challenges. The proliferation of local C2 nodes will enable heterarchical decision-making that ensures US forces maintain the initiative despite enemy attacks. Figure 18 depicts representative Core Force elements.

Changing How the Core Force Deploys and Fights

This accounting of the composition and changing roles of the Core Force is not comprehensive, but what is clear is that the Core

Force is more than simply "everything else." It directly attacks enemy forces, defends friendly assets in the air and on the ground, deploys forces, senses the environment, degrades and deceives enemy sensing, and generates decision advantage. Throughout all these functions and more, it enables and relies on the contributions of Resilient Airfields, Edge Forces, and Pulsed Forces, and it remains at the heart of the Air Force's ability to defend the homeland, maintain strategic deterrence, and project power. However, to ensure some of its elements continue being salient to the Air Force's force design, the core force needs to evolve not only its composition but also the way it deploys and fights.

Portions of the Core Force should deploy forward and be ready to provide immediate effects. Yet given the PLA's major threat to airfields, it is tempting to attempt a shift to a bimodal posture in which only the Edge Force remains forward and the Pulsed Force conducts attacks from range. Core Force units would deploy to an area of operations only when the enemy had sufficiently degraded counter-airfield capabilities. However, such an approach would likely fail for three principal reasons:

1. **Simplifies operational challenges for the PLA.** If the Air Force lacks forward-operating Core Force elements, such as fighter aircraft, then it risks simplifying the problem of attacking for the PLA. The PLA could spoof and exhaust the limited counter-air capabilities of the Edge Force, shoot down Edge Force and Pulsed Force strike munitions before they reach their targets, and circumvent US and allied ground-based air defense zones. It could then approach critical assets at relatively short ranges to deliver overwhelming numbers of stand-in or direct attack munitions (rather than having to use fewer, more expensive standoff munitions). The PLA's potent attacks would destroy targets such as airfields, thus denying US and allied forces the ability to operate from those locations to reinforce the Edge Force or deploy Core Force units. Lastly, even if US and allied forces defeated the initial aims of adversary aggression, ceding air superiority to the PLA would improve the PLA's position in a protracted conflict. The PLA could suppress US and allied activities throughout the theater and ensure it could win future rounds of the conflict.
2. **Allows the PLA to collapse Pulsed Force operations.** A major reduction in aerial counter-air activities forward would allow the PLA to bypass ground-based forward defenses to attack intermediate and distant tanker and bomber airfields at greater scale, which would likely greatly reduce the strike capacity that Pulsed Force operations could bring to bear.
3. **Limits options for US forces.** An ability to destroy enemy targets from the air, in addition to the offensive counter-air capabilities of the Edge Force and counter-airfield strikes of the Pulsed Force, provides US commanders with more options to execute the campaign. Moreover, use of the Core Force forward imposes dilemmas on the PLA, such as whether it should use a higher fraction of sorties for defensive CAPs to guard against Core Force attacks or strikes against forward airfields. It also decreases the fraction of forces the PLA can devote to attacks against intermediate and distant airfields since Core Force aircraft could intercept outbound aircraft. Further, it swells the target set from a small number of airfields suitable for tankers and bombers to the numerous locations from which Core Forces can operate, and it allows the Core Force to sustain a higher overall frequency of offensive actions, which helps US forces regain the operational initiative. Use of the Core Force forward creates operational ambiguity, forcing adversaries to plan for multiple credible behaviors and preserving options to surge airpower at the time and place US commanders choose. Lastly, it provides more options to US political leaders for escalation management since, if desired, the Air Force could conduct a campaign without heavily attacking airfields on PRC territory and still destroy enemy aircraft in the air.

Despite the benefits of operating the Core Force forward, these forces should not be highly vulnerable on the ramp. If they are, their deployment could be crisis destabilizing since it could incentivize PRC aggression rather than deter it. Moreover, given current infrastructure and logistical support limits, it may be difficult to support the sustained distribution of Core Force aircraft to numerous locations across the First Island Chain. Even if they were distributed, unless they had adequate defenses on the ground, they could be easy to detect, target, and defeat in detail.

Our proposed solution is to forward-deploy an appropriate, moderate portion of Core Force aircraft to forward and intermediate airfields. Then, in a crisis, additional Core Force aircraft would rapidly surge forward, possibly under attack, to those and other forward and intermediate airfields. They would also poise themselves to guard distant critical assets and serve as a deep reserve of aircraft that the Air Force could forward-deploy as other forward- and intermediate-stationed Core Force units suffer attrition, thus allowing the force to sustain a protracted campaign.

This approach relies on key enablers, such as the contributions of the Resilient Airfields, to establish a suitable number of locations with requisite infrastructure and logistics as well as varying levels of passive and active defenses to sustain operations. The number of Core Force aircraft that the Air Force deploys would align with the level of preparation of Resilient Airfields and the ability of those airfields to reconstitute after attacks, which enables the deployment of additional Edge Force reloads or reinforcements and Core Force aircraft. It also requires the Core Force's mobility fleet to be ready to rapidly surge the deployment of additional Core Force aircraft and joint force assets.

Improving approaches to posture and deployment, though, is not enough. The Core Force needs to change how it fights as well. Over the past few decades, the Air Force leveraged qualitative and quantitative superiority to establish fixed and predictable CAPs that could defeat any enemy combat aircraft that attempted to interfere with US operations. Now that PLA capabilities are comparable to and outnumber US forces, such an approach would likely subject US forces to considerable attrition in the air, and the PLA would likely have the agency to set its operational tempo and decide how and where to attack. Growth in the PLA's inventory of advanced combat aircraft will aggravate deficiencies in this approach, making the traditional US approach to establishing air superiority increasingly insolvent.

Instead, US forces will need to adjust their offensive and defensive approaches to gain air superiority. Offensively, US Edge, Pulsed, and Core Forces should surge to attack in locations where they can establish localized superiority or gain an outsized advantage, including attacking enemy aircraft and other airpower nodes on the ground. Edge Force units could snipe at high-value enemy aircraft and contest zones; Pulsed Force aircraft could attack aircraft at airfields and other airpower nodes; and Core Force aircraft could penetrate to ambush enemy force packages and employ deep munitions arsenals to execute long-range attacks. These operations will need to leverage improved C2 tools that allow for the dynamic, peripheral coordination of units. They will also need ample aerial refueling support to allow US forces to both increase endurance to selectively mass and surge and adapt resiliently to enemy counterattacks. But throughout these operations, offensive counter-air activities (particularly destroying enemy fighter aircraft) should be subordinate to higher campaign-level goals, such as defeating invasion forces.

Defensively, US forces should prudently choose where and how to fight, avoiding situations in which US CAPs "grind it out" with enemy forces in the air. Moreover, in a select number of forward, intermediate, and distant locations, US forces could establish well-defended strongpoints that benefit from DCA CAPs, AEWC coverage, and other assets. However, in many locations, US forces will need to establish a light-to-moderate defensive capacity to focus sorties on offensive actions.

And throughout these operations, US forces should maneuver better. In part, this maneuver should be physical, leveraging prepared and pre-positioned fighting positions and new locations throughout the theater. But it also requires developing new approaches to probe, decoy, and penetrate enemy operational systems across domains in ways that disrupt their operational plans and allow US forces to gain the initiative. Broad-area and local counter-C5ISRT capabilities are an essential enabler to degrading and deceiving enemy sensing and sensemaking at scale to support US access and maneuver, helping create operational access for all force elements and setting the conditions for larger fractions of the Core Force to flow into contested areas.

7. A FOUNDATION OF RESILIENT AIRFIELDS

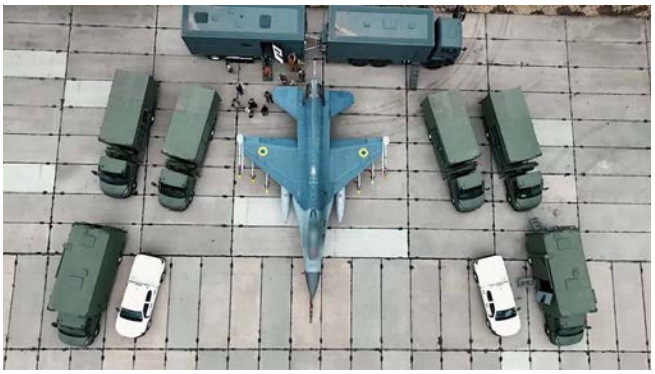
The Air Force should prioritize enhancing the resilience of its airfields. The grand majority of its current and programmed aircraft rely on airfields to operate, yet the service has devoted relatively few resources to enhancing the resilience of its airfields.[129] As the character of war has changed and airfields (and the aircraft they host) can come under precision attack at scale, the Air Force should relearn and fund the infrastructure, logistics, capabilities, and forces necessary to sustain operations amidst attack.

Although a range of actors can conduct attacks, the PRC can mount large-scale, sustained strikes against US and allied airfields in the Indo-Pacific and beyond. As Timothy A. Walton and Thomas H. Shugart observe, "To generate airpower amid this onslaught, US and allied forces need to devote a radical level of effort to learn how to 'fight in the shade.'" Otherwise, regardless of how capable US aircraft are in the air, the PRC will paralyze and annihilate them on the ramp. "The current DoD approach of largely ignoring this fact invites PRC aggression and risks losing a war."[130]

Sustained air combat operations require an interdependent system of systems of personnel, aircraft, runways, parking space, fuel, munitions, maintenance, and other support assets and infrastructure to work effectively.[131] At scale, this can be demanding even when there is no contest. Generating sorties under attack is even more difficult. Thankfully, drawing from the historical record and contemporary analyses, the DoW has a well-understood portfolio of options to enable operations.

Photo: A US Air Force F-16 Fighting Falcon sits inside a hardened aircraft shelter during exercise Turbo Weasel at Spangdahlem Air Base in Germany on April 14, 2025. (US Air Force)

Figure 19. Ukrainian Mobile Support Unit to Enable Distributed F-16 Operations



Source: Come Back Alive Foundation video capture, Joseph Trevithick, "Ukrainian F-16s Get Specialized Vehicles for Operating Constantly On the Move," The War Zone, July 23, 2025, https://www.twz.com/air/ukrainian-f-16s-get-specialized-vehicles-for-operating-constantly-on-the-move.

Resilient Airfields are necessary to deploy aircraft and other forces to and from areas of operation, support the employment of aircraft from range, and directly employ aircraft.[132] If the Air Force pre-positions and deploys equipment and supplies, resilient networks of various types of airfields, ranging from improvised operating strips to heavily defended strongpoints, can increase the scale and tempo of operations. As the Air Force considers airfield infrastructure investments, it should pursue clusters of mutually supporting Resilient Airfields that ensure the ability to respond locally continues and does not collapse if an enemy suppresses some locations. It should also mature redundant paths of airfields to deploy, employ, divert, and recover forces. This can provide commanders with more options to rapidly deploy and retrograde units, operationally and tactically employ forces, and reduce losses due to fuel exhaustion.

The Air Force will also need to radically improve its ability to resupply distributed forces under attack. This includes not just fixed logistical support infrastructure but also mobile ground support equipment and units to enable dispersal throughout airfields and distribution to other operating sites, such as highways and roadways. For example, figure 19 depicts a Ukrainian mobile support unit fulfilling this purpose.

One acute weakness is the DoW's bulk fuels architecture, in particular its insufficient capacity to deliver fuel over-the-shore and securely store it at distributed airfields. However, the DoW and the US Maritime Administration can field viable solutions, such as by increasing the number of US-flag maritime tankers and barges to deliver fuel, field over-the-shore fuel distribution systems, and construct numerous small-capacity underground or capped cut-and-cover fuel tanks and expeditionary fuel storage systems. For large-scale air operations to work effectively, the Air Force will need to resource some of these areas and vigorously motivate other parts of the DoW to address those outside its purview.

"Resilient architectures should include both passive defenses (such as redundancy, geographic distribution, tactical dispersal, and hardening as well as reconstitution, camouflage, concealment, and deception capabilities) and active defenses."[133] Analyses show that combinations of passive and active defenses can effectively sustain air operations.[134] Yet, to date, the Air Force has underinvested in passive defenses in general and hardening in particular.[135] It should pursue a robust portfolio of passive defenses, including dispersion, camouflage, concealment, deception, reconstitution, and hardening. However, "the US military's current dispersion-heavy/hardening-light approach is inappropriate in light of two vital considerations:

1. Plentiful PRC targeting and engagement capabilities can repeatedly attack US forces, with mass, wherever they disperse.
2. US and allied airfield and logistics factors limit the number of airfields and other locations that aircraft can disperse to and operate from on a sustained basis."[136]

Hardening and other passive defenses can increase the scale and complexity of enemy attacks, which decreases the number that can be conducted concurrently. This in turn allows friendly offensive operations to gain the initiative. Such defenses can also limit the impact of attacks, which could not only aid in US force preservation but also disincentivize adversary preventive attacks and deter aggression. Lastly, they can work symbiotically with active defenses. Active defenses should aim to raise an attacker's required salvo size and frequency, not to promise airfield invulnerability. Active defenses should aim to raise an attacker's required salvo size and frequency, not to promise airfield invulnerability. If an airfield has robust passive defenses, ground-based air and missile defense units may not need to attempt to maintain such a high level of protection and could instead accept more leakers. Such an approach can contribute to an elastic defense design that prolongs the survivability of active defenses and in turn imposes real and virtual attrition on enemy forces and weapons.

As already suggested, and as Walton and Shugart argue, active defenses play a pivotal role in airfield resilience:

> Passive defenses are highly cost-effective, [and] the United States should invest far more in a range of them. Nonetheless, "given the diversity and large capacity of PLA strike forces, a solely passive defense approach would not pose sufficient complexity to PLA planning" in terms of risks imposed, operational opportunity costs, and numbers of targets.
>
> To sustain operations, airfields will need protection via active defense designs that are lethal, adaptable, and resilient in the face of continued enemy action. Rather than attempting and failing to mount a perfect but brittle defense, such a force could "survive protracted enemy attacks and continue protecting defended assets and frustrating enemy operations." Key elements will include distributed passive and active sensors, adaptable C2 systems, and novel low-cost and high-capacity kinetic and non-kinetic effectors. By adopting weapons such as less expensive missiles, medium-caliber cannons . . . and high-powered microwaves that can engage lower performance threats (such as drones and cruise missiles), more expensive missile systems such as the Patriot and the Standard Missile series could focus on engaging stressing missiles and aircraft.[137]

To date, the US Army Air Defense Artillery Branch has been responsible for providing air and missile defense of airfields; however, there is a major gap in the capacity required to defend primary operating airfields and dispersal ones. Active defenses are clearly an essential part of the Air Force's force design, and the service will need to consider whether to field its own air and missile defense capabilities or depend on more Army support.

Furthermore, as the Air Force develops the infrastructure, capabilities, and forces necessary to sustain operations amid attack, it will need to holistically enhance its airfields so that attacks on weak links do not paralyze operations. Clearly, the Air Force should look beyond any single fix and instead integrate multiple resilience measures. Dispersal, base hardening, more active defenses, pre-positioning adequate materials for rapid airfield repairs, training far larger numbers of engineers and ordnance-disposal personnel, constructing hardened and low-signature fuel storage and distribution methods, fielding low-signature C2 vehicle nodes, and a myriad of other changes appear indispensable for functioning under sustained attacks. This "may require the DoD to prioritize funding a comprehensive set of improvements to a limited number of locations (that can grow over time) rather than attempting to field disjointed improvements to many sites."[138]

As the Air Force considers requisite investments, it can draw on lessons from the Cold War, the RAND Corporation's rigorous analysis of the investments the DoW should prioritize, and its own recent operations. In 2024, strategists witnessed the benefits of an approach to airfield resilience that integrates passive

Figure 20. US Air Force F-16 Fighter in an Israeli Hardened Aircraft Shelter

Source: Maeson Elleman, "US Air Force F-16s, Coalition Partners Kick Off Blue Flag Israel 21 [Image 3 of 9]," DVIDS, October 17, 2021, https://www.dvidshub.net/image/6891598/us-air-force-f-16s-coalition-partners-kick-off-blue-flag-israel-21.

and active defenses during Israeli, partner, and US operations to defeat Iranian salvoes against Israel. US and other friendly forces operated predominantly from airfields with hardened personnel bunkers, aircraft shelters (such as the one shown in figure 20), magazines, and active defenses. The robust defenses ensured the success of the airfield and gave flight and ground crews the confidence to complete their missions, sallying from their protected positions to turn and launch aircraft when necessary—even amidst attacks.[139] Ironically, even though Iran's strike capabilities pale in comparison to the PLA's, US airfields in the Indo-Pacific are largely unhardened and lack many other defensive measures. Their lack of resilience jeopardizes the survivability of personnel and aircraft and the ability to accomplish necessary missions.

Resilient Forward, Intermediate, and Distant Airfields

Airfield resilience is essential for a variety of airfields. Although they could be highly contested, operative forward airfields "can provide three to five times as much capacity on station as distant airfields. Consequently, unless the size of US air forces dramatically increases, forward airfields will be necessary to provide appropriate levels of capacity in many campaigns. Moreover, the continued operation of forward airfields presents a threat that adversary air forces must honor during competition by building forces to counter them, and during conflict by allocating forces to suppress them. Forward airfields require robust passive and active defenses to fight effectively."[140]

Retrograding to fight only from long range "surrenders a significant portion of the capacity that US forces can generate in order to operate from airfields that will still face contestation." Counterintuitively, the threat density in the Second Island Chain, for instance, could be comparable to attacks in parts of the First Island Chain (due to the reduced number of airfields to attack in the Second Island Chain and the PLA's significant capacity to strike them) and could still be significant in the Third Island Chain. Moreover, even if the Air Force prudently adjusted its force design to field relatively more long-range aircraft or runway-independent capabilities, "the ability to operate a major proportion of US aircraft from forward airfields would still be highly valuable."[141]

Intermediate and distant airfields should also be resilient. Though it may be tempting to consider airfield resilience necessary only near adversaries, recent history has demonstrated there is no sanctuary. "The PRC will likely be capable of attacking US forces at great distances—even within the continental United States." It can do so by using intermediate and intercontinental-range PLARF missiles; missiles and lethal drones delivered by H-20 bombers, vessels, covert containerized launchers (like what Ukraine did in Operation Spiderweb); and special forces raids.[142] "Although it is likely that the density of attacks far from the PRC would be much smaller than attacks near the PRC, airfields will still be contested areas that require passive and active defenses."[143]

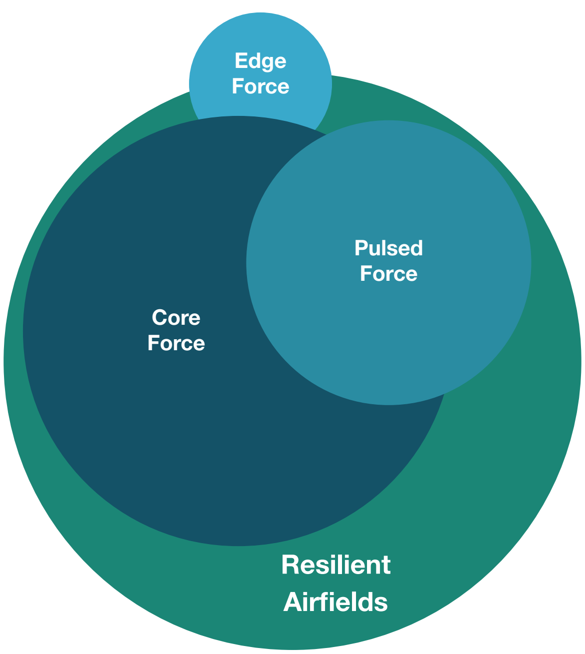
Elevating Resilient Airfields

Sustaining air operations, including amid attack, requires specific resources:

- Infrastructure: runways, ramp space, shelters, fuel stores, magazines, and other facilities
- Capabilities: ground support equipment, fuel distribution equipment, surveillance and C3 systems, reconstitution equipment, and active air and missile defenses
- Forces: force protection, base support, reconstitution, and air and missile defense units

Other services may provide some of these resources at least in part; for example, the US Army's Air Defense Artillery Branch provides some ground-based air and missile defense. Aircraft units may provide other capabilities, such as some types of ground support equipment and personnel. In general, however, non-aviation-affiliated parts of the Air Force should provide the necessary resources.

Figure 21. All US Air Force Mission Areas Depend on Resilient Airfields



Source: Authors.

Currently, Resilient Airfields suffer from a free-rider problem: Other parts of the Air Force (principally the aircraft community) depend on them, yet the Air Force has not properly resourced them. Figure 21 depicts how the mission areas depend on Resilient Airfields to varying degrees. Even runway-independent Edge Force units would likely use airfields to deliver much of their equipment and forces and to rearm their units in a protracted conflict. Resilient Airfields also depend on the choices of a diverse and usually unaligned set of communities and stakeholders.

Recognizing Resilient Airfields as a key enabler to the force design would not only highlight its importance but also programmatically associate and prioritize the integrated portfolio of valuable capabilities necessary to enable the Edge Force, Pulsed Force, and Core Force at the mission and campaign levels. This includes both acquiring existing capabilities and resourcing the development of new ones. For example, if the Air Force assessed that the ability to repair airfields faster would be impactful, it could consider new technologies to accelerate this process, such as faster-drying cement mixes, autonomous runway repair machines, and autonomous debris-clearance machines. As another example, if the service takes on the ground-based air and missile defense mission, in full or in part, it will need to consider capability development and fielding. Neither of these examples would fall under the current Edge Force, Pulsed Force, and Core Force (MA1, MA2, and MA3) construct or would fit neatly into one of the mission areas if desired.

Designating Resilient Airfields as a key enabler to the force design would also drive cohesion in overall force design, allowing the Air Force to interactively consider how choices among the Resilient Airfields, Edge Force, Pulsed Force, and Core Force portfolios impact outcomes. For example, what demands for different levels of airfield resilience at different locations would these force capabilities impose? Could other changes in force design reduce the demands on Resilient Airfields, such as fielding Edge Force units that depend less on airfields, longer-range and/or faster Pulsed Force units, and longer-range and greater endurance fighters and tankers? Or could improvements in airfield resilience allow the Edge Force, Pulsed Force, or Core Force to fight differently?

Additional infrastructure, logistics, and defenses at airfields could detract funding from other combat capabilities. The Air Force should weigh options throughout its portfolio in an integrated manner. It is likely to find, though, that without a currently missing baseline level of airfield resilience, an enemy may rapidly neutralize its combat power in a conflict. A targeted set of Resilient Airfields are needed to allow the Air Force to fight effectively.[144]

8. FIGHTING TOGETHER

Our proposed approach to force design and employment enables the National Defense Strategy. It focuses on the threat that the PRC poses while husbanding sufficient capacity and unique capabilities to flexibly address other demands. It is also ready, with an immediate response capability by forward-deploying Edge Force and theater-assigned Core Force elements and maintaining the ability for Pulsed Force and Core Force units to rapidly employ and deploy to meet global challenges.

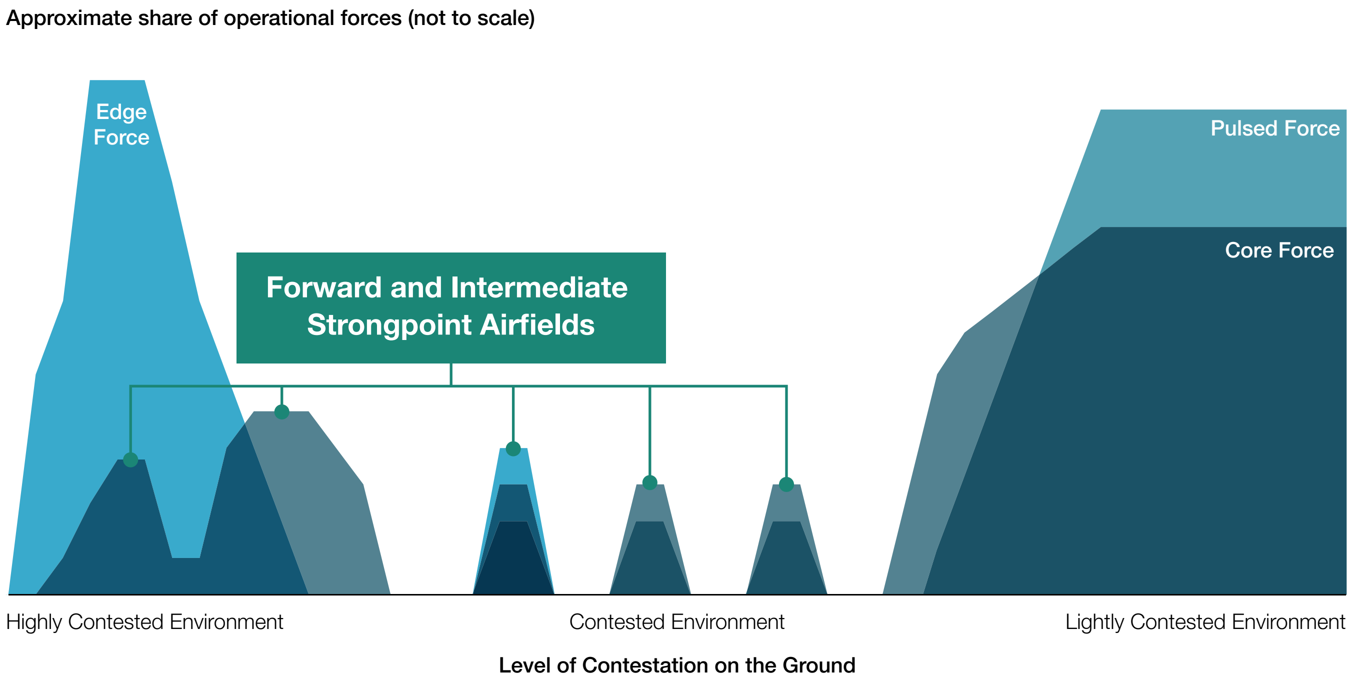
Leveraging a mix of current and emerging assets, effectors, and C3 capabilities, the proposed force design greatly enhances the operational performance of the force. With force elements that mutually support each other and a mix of penetrating, stand-in, and standoff capabilities, it is more lethal, able to quickly generate more kills against enemy forces from the ground and the air using a variety of means that impose dilemmas on adversaries.

The force design is more adaptable through its addition of functionally disaggregated force elements whose hardware and software are easily modifiable and a C3 architecture that allows the entire force to adapt under attack and gain a decision advantage. Significantly improved force integration provides far more (and recomposable) effects chains. Collectively, this allows the force to retain a competitive advantage as it evolves in peacetime and conflict and disrupts the PLA's efforts to paralyze US air operations.

It is also more survivable. Enabled by Resilient Airfields and a robust mobility enterprise, its laydown (shown in figure 22) aligns the deployment of forces with the infrastructure, logistics, passive defenses, and active defenses provided at locations to sustain effects amid attack. This allows US forces to deploy enough protected

Photo: Marines and airmen load a rocket system onto a plane during exercise Orient Shield 25 at Japan Air Self-Defense Force Kenebetsu Air Base in Hokkaido, Japan, on September 19, 2025. (US Marine Corps)

Figure 22. Representative Laydown of USAF Force Design Elements



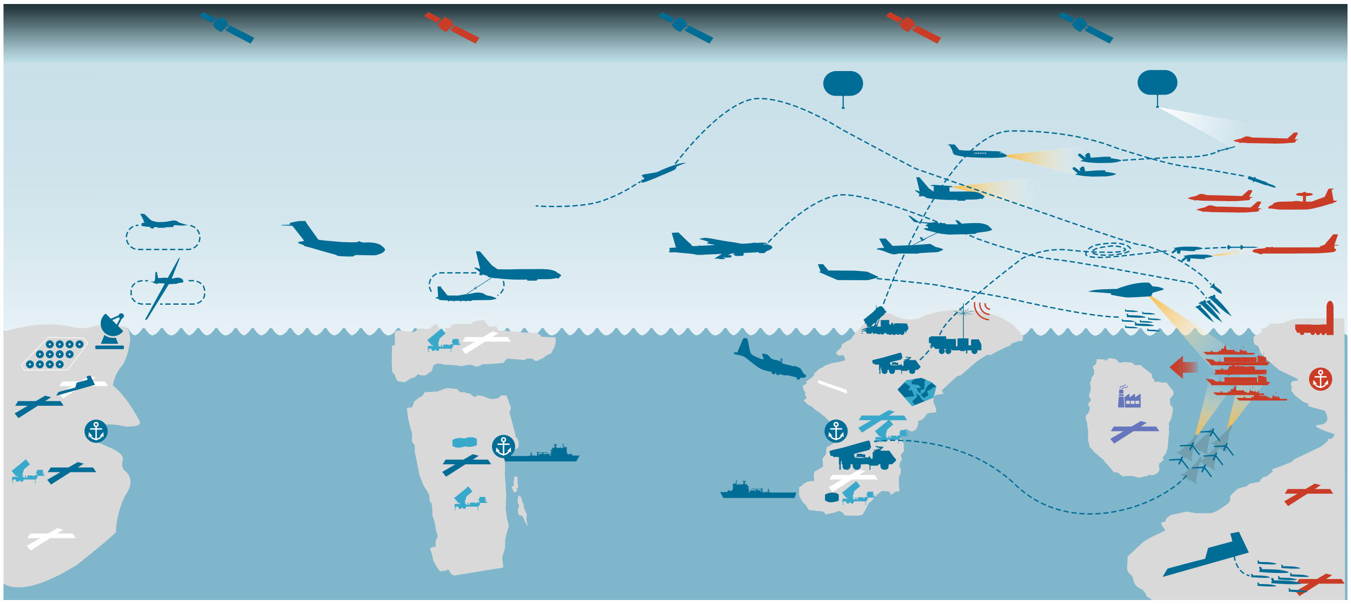
Source: Authors.

and at-risk forces forward to deny adversary aggression while maintaining a deep well of reserves for commitment as necessary. Moreover, the Edge Force masses effects from distributed forces while retaining a relatively low signature that is difficult to target.

The inclusion of the Edge Force's expendable, attritable, and risk-worthy assets provides US commanders with more options to tactically employ forces. It generates operational access for and boosts the lethality of other forces, and allows more judicious tactical employment of Pulsed Force and Core Force elements. Strategically, it also allows US political leadership and military commanders to better calibrate the fraction of forces deployed to the details of the evolving political crisis and military campaign.

The overall force's attributes make it highly strategically credible to other countries. They would recognize that it could generate effects early, fight in different ways (some of which would be well-understood and others would remain uncertain to them), and win. This recognition could deter aggression and reassure allies and partners. By embracing easily manufacturable assets and weapons, the force could also rapidly scale in production, allowing the Air Force to field Edge Force and other elements in mass within a few years and be poised to surge mass production in a protracted conflict. The service could also extend elements of the proposed force design to many of the United States' allies and partners, bolstering their defenses. And lastly, the proposed design is affordable to design, procure, and sustain, balancing its areas of emphasis among Edge Force, Pulsed Force, and Core Force units, and key enablers (such as counter-C5ISRT and Resilient Airfields) and allowing the Air Force to commit to fielding and operating it. Figure 23 depicts how all force elements could fight effectively together.

Figure 23. Operational View of Combined Force Design Elements



Source: Authors.

9. FORCE ARCHITECTURES AND INSIGHTS FROM SCENARIO ANALYSIS

To explore the relative performance of different force designs and employment concepts, we assessed them using theater-level simulations of a circa 2035 Taiwan invasion scenario. We developed a simplified analytical framework that captures key operational dynamics while remaining accessible for rapid iteration and analysis. We then initially tested three 2035 force architectures.

1. Blue 1 baseline force that kept the USAF on its current plan
2. Blue 2 force that added many more of the same aircraft and weapons and boosted readiness
3. Blue 3 force that adopted a balanced approach to force design with Edge Force, Pulsed Force, Core Force, and Resilient Airfields shifts (and additional RDT&E, munitions, readiness, and budgetary reserve investments)

We also conducted analytic excursions, including ones testing different approaches to employ forces, and sensitivity analyses. The results of a fourth, budget-neutral "balanced" force architecture are described in chapter 11.

This simulation effort, while not intended as a detailed combat simulation, illuminated critical relationships between force designs, force posture, operational phasing, and campaign outcomes. It built on a series of Hudson Institute wargames that focused on US and allied force design. The results strongly support our proposed balanced force design concept and suggest that if the Air Force were to embrace a balanced force design and operate in concert with other joint forces, it could succeed in a potential large-scale conflict with the PRC.

Representative Force Architectures

To assess relative performance in a potential conflict against the PRC, we generated three circa 2035 force architectures, which

Photp: A US Air Force KC-135 Stratotanker aircraft takes off at Andersen Air Force Base in Guam on July 23, 2025. (US Air Force)

Table 1. Summary of Representative 2035 Blue Force Architectures Used in Simulation

FORCE ALTERNATIVE	BLUE 1: "BASELINE" AIR FORCE	BLUE 2: "MORE" AIR FORCE	BLUE 3: "BALANCED" AIR FORCE
Changes in composition compared to planned force	• Maintains planned inventory by 2035, including the following total aircraft inventory aircraft • 99 F-15E, 129 F-15EX, 608 F-16C, 185 F-22, 825 F-35A, 55 F-47, 150 CCA Increment 1, 130 MQ-9A, 239 KC-46A, 227 KC-135R/T, 10 EA-37B • 76 B-52H, 63 B-21, 19 B-2	Builds upon Blue 1 by adding the following: • Procures and fields 482 additional aircraft (150 F-35A, 150, F-15EX, 150 CCA, 32 B-21) • Boosts weapons procurement by $2 billion per year • Increases flight hours by 15% and creates parts reserve	Builds upon Blue 1 by adding the following: • Enhances resilience of 20 Regular and 20 Dispersal Airfields with additional infrastructure, logistics, passive defenses, and 15 PAC-3 MSE batteries (6 of which are deployed in the scenario) • Fields Edge Force with ground-launched anti-ship munitions, stratospheric balloon and ground air surveillance and targeting capabilities, VLR SAMs, and ground-launched counter-air UAVs • Pulsed Force of bombers leverage Resilient Airfields to operate from both intermediate and distant contiguous US strongpoint airbases • Develops improved large aircraft mission systems, such as C3, self-defense countermeasure systems, and new fuel transfer systems; incorporates improved large aircraft self-defense and other mission systems on 140 large aircraft; develops and starts procurement of a NGAS tanker, modeled as a medium-sized BWB tanker • Increases flight hours by 15% and creates parts reserve • Boosts weapons procurement by $2 billion per year • Retains $1 billion per year optionality reserve

Source: Authors.

are summarized in table 1 and detailed in appendix A, table A. Although these force architectures were not comprehensive, they accounted for most major elements of the Air Force and served to explore, at a high level, various force design and operational employment concepts.[145]

Blue 1: "Baseline" Air Force

Blue 1 consists of the baseline, publicly understood current plan for the Air Force. In it the USAF would maintain its planned inventory of aircraft. It retires the A-10, F-15C/D, B-1B, E-3G, and AC-130 fleets and slims down the upgraded Block 40 and Block 50 F-16 fleet to 608 aircraft. It expands the F-35A fleet to 825 aircraft (procured at a rate of 36 per year after fiscal year 2026) and the KC-46A fleet to 239 aircraft. It also fields new crewed and uncrewed aircraft (129 F-15EXs, 150 CCA Increment 1s, 55 F-47s, 63 B-21s, 26 E-7As, and 10 EA-37Bs), upgrades various aircraft (most notably the F-22 and F-35A fleets), and expands the capacity of a modest number of Indo-Pacific airfields. It maintains munitions procurement levels and readiness rates at current levels.[146]

Blue 2 ("More" Air Force) and Blue 3 ("Balanced" Air Force) took Blue 1's Baseline Air Force as the starting point, and each made changes in additional RDT&E, procurement, military construction, and O&S costs over a decade (FY 2026–2035). Compared to the planned force, Blue 2's force architecture would cost approximately $100 billion more in constant FY 2026 dollars than the planned force. Blue 3's force architecture would cost $75–$100 billion more.[147] Blue 3's cost difference depends on whether the Air Force or the Army would bear the $16 billion or so in procurement and O&S costs to field and operate 15 additional short-to-medium-range air and missile defense batteries and about $9 billion in procurement and O&S costs to field and operate 15 new VLR SAM batteries. The Air Force may also plan investments in proposed Blue 2 or Blue 3 force structure elements within the FY 2027–2030 budgets, but it has not yet defined these.

The additional $75–$100 billion in requisite funding for Blue 2 and Blue 3 could originate from higher DoW topline funding, relative decreases in Department of the Army or Navy funding, or (for a small portion) reprioritization and efficiencies within the Air Force, or from combinations of these. For example, if the DoW topline grew by a modest 1 percent in real terms each year over a decade, the resulting additional $97 billion for the Air Force would near $100 billion.[148] Alternatively, if the DoW budget grew by a meager 0.5 percent each year over a decade and the Air Force received 1 percent of the Department of the Army and Department of the Navy budgets each year (a total of around $45 billion) and itself grew by 0.5 percent each year (an additional $48 billion), then the resulting $93 billion would near the $100 billion mark. Other scenarios could include significant spurts of funding in some years, such as with reconciliation funding, followed by flat budgets.

The nation's fiscal problems merit immediate attention, and the DoW needs to be an effective steward of funds. Whatever the topline funding level, though, there are options to direct appropriate funding to the Air Force. Additionally, more important than the precise amounts of funding necessary to achieve the force architectures is what they represent. Blue 1 ("Baseline") continues the current path. Blue 2 ("More" Air Force) and Blue 3 ("Balanced" Air Force) answer the question, If the DoW directed additional funding to the Air Force, should it fund more of the same or something different? Lastly, even if the Air Force received no additional topline funding, there could be budget-neutral ways to initiate the transition to an alternate force design, chiefly by prioritizing its most impactful elements (as described in chapter 11).

Blue 2: "More" Air Force

Specifically, Blue 2 buys more aircraft and weapons and enhances aircraft readiness. Building on the planned force, Blue 2 procures nearly 500 additional aircraft (150 F-35As, 150 F-15EXs, 150 CCAs, and 32 B-21s), costing an additional $59 billion in procurement and O&S costs from fiscal years 2026–2035. It also boosts weapons procurement by $2 billion per year (a total of $20 billion), which could allow the Air Force to continue its current rate of production with existing weapons while pursuing many new weapons, particularly ones whose production it could surge in a large conflict.[149]

Furthermore, Blue 2 spends another $21 billion above FY 2025 levels to boost the current readiness of aircraft units' flight hours by 15 percent and funds at a 100 percent level the weapon system sustainment (WSS) required to fly those flight hours.[150] It also procures one week's worth of extra WSS parts per year over a decade (for a total of 10 weeks of WSS parts). This healthy reserve of parts significantly increases aircraft mission-capable rates by ensuring parts are available in the field at operating units and provides a reserve of parts that the Air Force can pre-position forward and surge forward in case of high-tempo operations in a crisis or conflict.

Blue 3: "Balanced" Air Force

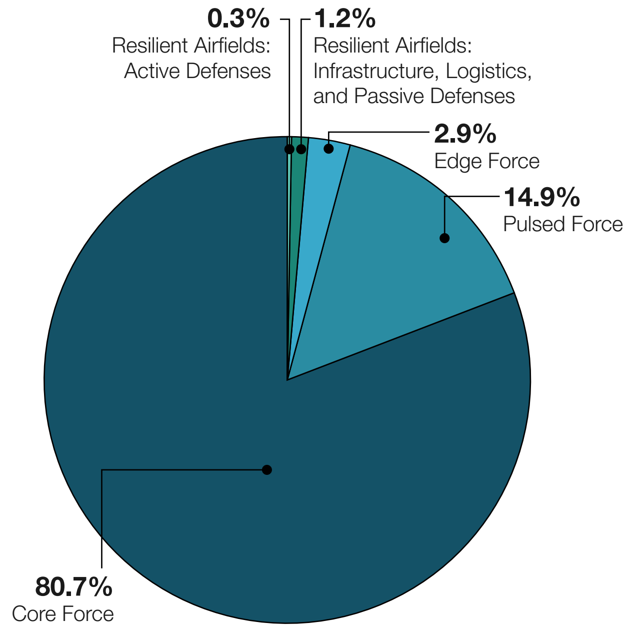
Blue 3 tests a force structure with Edge Force, Pulsed Force, Core Force, and Resilient Airfields shifts (and addi-

Table 2. Blue 3 Edge Force Assets

TYPE OF SYSTEM	NUMBER FIELDED	NUMBER EMPLOYED IN SIMULATION
Anti-Ship Munition Launcher Group	7	5
Forward Ground-Based Targeting System Squadron	30	20
Stratospheric Balloon Squadron	7	4
Very Long-Range Surface-to-Air Missile (VLR SAM) Squadron	15	6
Ground-Launched Counter-Air UAS Squadron	7	4

Source: Authors.

Figure 24. Blue 3 O&S Costs, 2026–2035



Source: Authors.

tional RDT&E, munitions, readiness, and budgetary reserve investments).

In terms of the Edge Force, Blue 3 acquires units that support maritime strike, surveillance and targeting, and offensive counter-air missions. It forward-stations or -deploys a portion of these units and can deploy some additional units within an approximately one-week indication and warning window. Table 2 displays the Edge Force units fielded (for a total of $27.2 billion over a decade in RDT&E, procurement, and O&S costs) and employed in the simulations.[151]

In terms of the Pulsed Force, Blue 3 maintains the same TAI of bombers as the baseline Blue 1 force (76 B-52H, 63 B-21, and 19 B-2). However, by leveraging Blue 3's major investment in Resilient Airfields, it can refuel and rearm a portion of the bomber force from a select number of intermediate strongpoints on US and allied territory during the conflict, in addition to distant airfields in conterminous states. This shift in laydown increases its daily sortie rate (over those of Blue 1 and Blue 2) from approximately 62 percent to 88 percent.

In terms of the Core Force, Blue 3 keeps the same TAI as Blue 1. As a reflection of the relative size of the Core Force, figure 24 shows how, despite introducing Resilient Airfields investments, an Edge Force, and a B-21 fleet, Blue 3 devotes over 80 percent of its 2026–2035 O&S costs to the Core Force. This percentage is similar in Blue 1 (84 percent) and Blue 2 (85 percent).

Blue 3 does, however, invest in enhancing the resilience and effectiveness of the mobility fleet to ensure it can operate in contested environments. It devotes $3 billion in RDT&E to de-

Table 3. New Blue 3 Airfield Infrastructure, Fuel Storage and Distribution, Reconstitution, and Other Passive Defenses

TYPE OF SYSTEM	NUMBER
Small Aircraft Hardened Aircraft Shelters (12 per Regular Airfield)	240
Large Aircraft Hardened Aircraft Shelters (3 per Regular Airfield)	60
Hardened Fuel Storage and Distribution (set of 3 25,000 bbl Underground Storage Tanks or capped cut and cover tanks and pumps, 10 100,000 gallon expeditionary fuel bladders and pumps, 10 R-11 trucks, 2 IPDS, and 2 OPDS) (1 per Regular Airfield)	20
Expeditionary Fuel Storage and Distribution (set of 10 100,000 gallon expeditionary fuel bladders and pumps,10 R-11 trucks, 1 IPDS, and 1 OPDS) (1 per Dispersal Airfield)	20
Munitions Magazines (10 per Regular Airfield)	200
Expeditionary Munitions Storage Units (10 per Dispersal Airfield)	200
Small Bunker (10 per Regular Airfield)	200
Large Bunker (2 per Regular Airfield)	40
RADR Kits (2 per Regular Airfield; 1 per Dispersal Airfield) (1 additional RADR / RED HORSE construction engineer unit per airfield)	60
Additional RADR Supply Sets (2 per Regular Airfield; 1 per Dispersal Airfield)	60
Passive Defense CCD Kit for Airfield (2 per Regular Airfield; 1 per Dispersal Airfield)	60

Source: Authors.

Note: IPDS = Inland Petroleum Distribution System; OPDS = Offshore Petroleum Distribution System; UST = underground storage tank.

veloping improved large-aircraft mission systems, such as C3 and decision support, self-defense countermeasure systems, and new fuel transfer systems. This funding augments programmed RDT&E investments in this area. It also incorporates improved self-defense and other mission systems on 140 large aircraft (such as but not limited to KC-46A and C-17A), at a conservative cost of $10 million per aircraft. Finally, the Core Force spends $7 billion developing a Next Generation Air-Refueling System (NGAS) tanker. Its design is modeled as a medium-sized BWB tanker with the range and endurance to efficiently operate from distant and intermediate airfields, reducing the risk of destruction on the ramp while still being capable of accessing forward ones and standing into contested air environments. The Core Force starts procurement of 15 NGAS tankers per year over five years, which Blue 3 assumes to cost $25 million more than a KC-46A, for a total of $250 million per aircraft. Although none of the NGAS tankers are fully operational in time for our circa 2035 scenario, analytic excursions assess the potential impact of substituting KC-135s with medium-sized BWB tankers.

Table 4. Blue 3 Ground-Based Air and Missile Defenses

TYPE OF SYSTEM	FORWARD STATIONED	DEPLOYED IN CRISIS	TOTAL EMPLOYED IN SIMULATION
THAAD batteries	3	1	4
PAC-3 MSE batteries	18	8	26
IFPC platoons	4	4	8
Guam Defense System	1	0	1

Note: IFPC = Indirect Fire Protection Capability; THAAD = Terminal High Altitude Area Defense.

Source: Authors.

Across the Pulsed Force and Core Force aircraft fleets, like Blue 2, Blue 3 boosts the readiness of aircraft units by increasing the number of flight hours by 15 percent over 2025 levels, funds at a 100 percent level the WSS required to fly those flight hours, and procures one week's worth of extra WSS parts per year over a decade (for a total of 10 weeks of WSS parts).

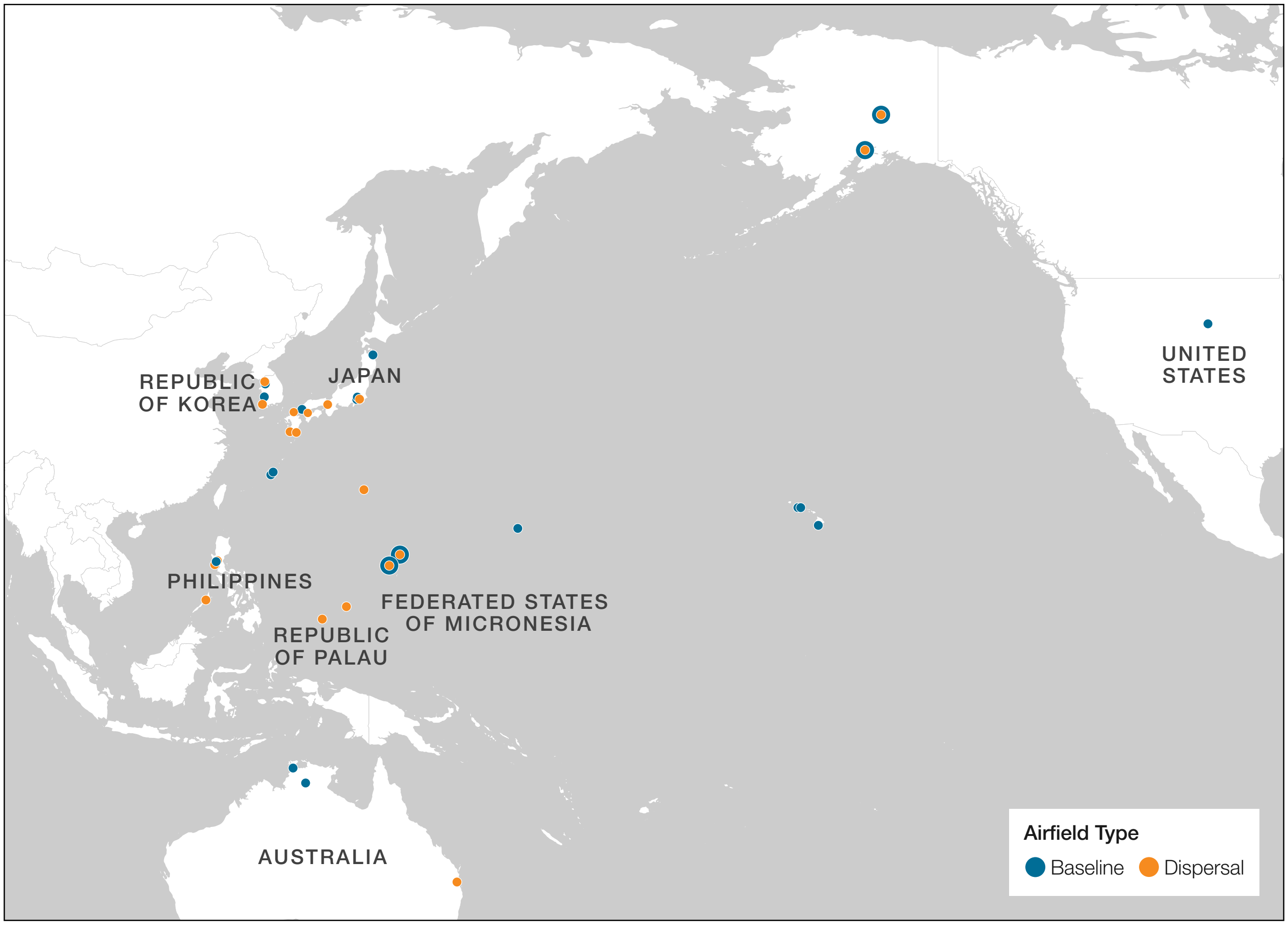
Building on Blue 1's baseline force, Blue 3 lays a foundation of infrastructure and logistics and passive and active defenses to the 40 key airfields that all Blue teams use in the simulation: 20 Regular Airfields that US forces are currently based at or routinely operate from and 20 Dispersal Airfields. Table 3 lists Blue 3's new airfield infrastructure, fuel storage and distribution, reconstitution, and other passive defenses, which cost $15.8 billion in procurement and military construction and another $3.8 billion in O&S costs over a decade. These estimates include conservative assumptions of additional necessary personnel.

In terms of active defenses, Blue 3 fields 15 additional PAC-3 Missile Segment Enhancement (MSE) batteries (or alternatives) and their commensurate units to provide short-to-medium-range airfield defense, which supplement the existing air and missile defense systems that Army Air Defense Artillery provides. This costs $15.4 billion in procurement and $1.1 billion in O&S over a decade. In practice, either the incumbent service, the Army, or the Air Force could acquire and operate these systems (or other short-range air defenses, such as ones to counter drones).[152]

Table 4 shows Blue 3's ground-based air and missile defenses used in the simulation. These estimates account for operating cycles and readiness levels, reasonable levels of forward-deployment, and airlift capacity during about a week of early warning of an impending conflict. Of note, they are the same as in Blue 1 and Blue 2, except for six additional PAC-3 MSE batteries; of the acquired 15, the simulation assumes that this number will be available for Indo-Pacific operations and that the Air Force can deploy and emplace them in time to defend airfields.

The infrastructure, logistics, and passive defenses at airfields work together with surface and airborne active defenses to sustain air operations. Figure 25 depicts the airfields used in

Figure 25. Blue 3 Airfields Used in Simulation

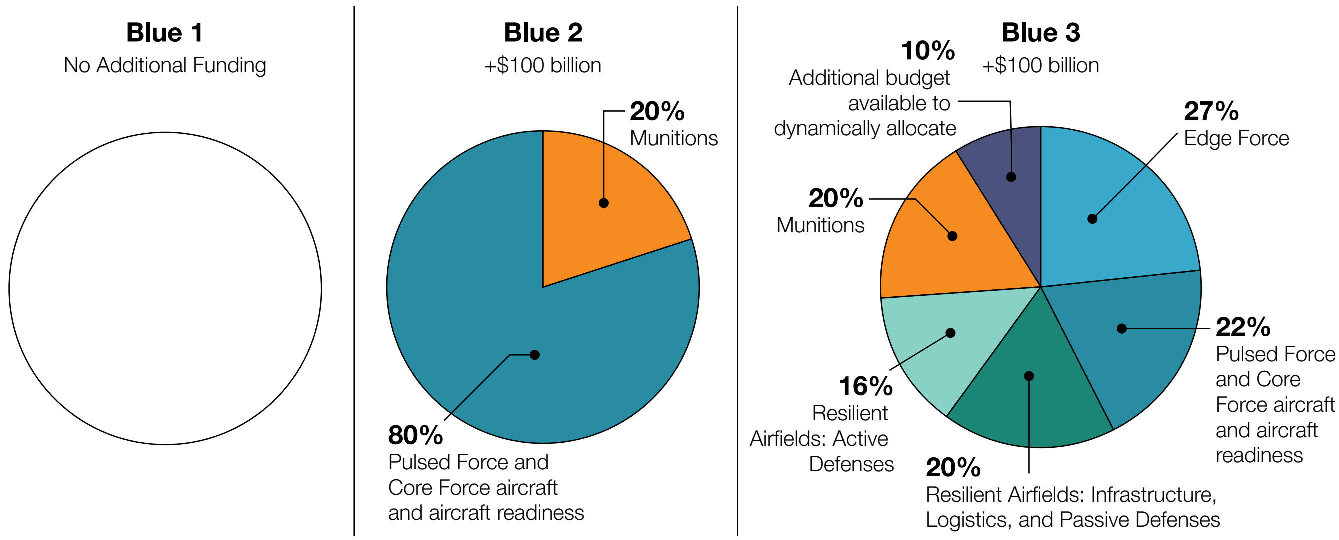


Source: Authors.

the simulation, which although not comprehensive serves to explore operating dynamics in the theater.[153] Accounting for the characteristics of airfields and their defenses, the risk of enemy attack, and other factors (such as distance from desired operating areas and aerial refueling demands) results in weighted resilience scores for different types of aircraft that in turn inform their laydowns. Blue 1 and Blue 2 use the same airfields, but their force architectures have not fielded Blue 3's aforementioned additional Resilient Airfields capabilities.

Lastly, Blue 3 recognizes that there is no perfect, static force design. Instead, the Air Force requires a portfolio that adapts, reallocating programmed and planned funding and adding new funds to promising capabilities in response to emergent opportunities and threats. Accordingly, it creates a $10 billion funding wedge for other capabilities that it is developing and could introduce within the decade to generate advantage for US forces and challenge adversaries. This wedge could steer funding for additional counter-C5ISRT investments, mission integration and

Figure 26. Allocation of Spending Beyond Air Force's Planned Blue 1 "Baseline" Force



Source: Authors.

C3 capabilities, more munitions, additional uncrewed aircraft (to include potential fast, stealthy, or low-cost designs), inter-theater mobility aircraft readiness improvements, new intra-theater mobility assets, or other capabilities.

To summarize, figure 26 depicts the allocation of additional spending by force architecture compared to the Air Force's planned force (Blue 1).

Scenario and Simulation

To explore the relative performance of different force designs and employment concepts, we assessed them using theater-level simulations of a circa 2035 Taiwan invasion scenario. We selected 2035 as near enough to have a moderate degree of confidence in projecting US and PRC capabilities, yet far enough to realistically field relevant numbers of proposed force design elements. We selected a Taiwan invasion scenario as a highly stressing, consequential scenario that is reportedly DoW's lead defense planning scenario.[154]

Red Attack and Forces

Within the scenario, the PRC (termed "Red" in the scenario) attempts an amphibious invasion of Taiwan. The US intelligence community assesses that an attack is imminent one week before the initiation of open hostilities, which, in light of US political leadership decision timelines and military force deployment rates, provides little time to deploy additional US forces into the theater. To initiate the conflict, the PRC executes a joint firepower strike campaign that starts with surprise, preventive attacks against not only targets in Taiwan but also US and allied targets (to include airfields) in the Indo-Pacific and beyond.[155] These attacks aim to paralyze Taiwanese, US, and allied operational systems, destroy key nodes and forces, and seize superiority across domains, including in the air. The PLARF draws from a projected, estimated inventory of 965 launchers and 6,092 conventionally armed missiles and employs an aggressive firing rate against airfields where USAF aircraft operate.[156] In terms of aircraft, the PLAAF and PLAN field TAIs of 4,070 and 946 advanced fixed-wing aircraft, respectively (exclusive of transports and support aircraft). They employ force packages of aircraft to defend PRC territory, escort amphibious task groups and other naval formations, sweep against enemy aircraft, and forcefully strike airfields in the Western Pacific and beyond, among other missions. Given the PRC's proximity to Taiwan and the high readiness of its forces, the PLA can generate over 1,000 aircraft per six-hour operating window to face US and allied forces.

The PLA executes a rapid joint island landing campaign contemporaneously with the joint firepower strike campaign to attempt to achieve a fait accompli before US and allied forces can mobilize and deploy a larger fraction of their forces in response.[157] Drawing from PRC naval and merchant fleets, the PLA amasses an armada of 532 surface vessels to directly conduct and defend the invasion. This force includes four carrier battle groups, several amphibious task groups, and multiple surface action groups.[158] Coupled with active defenses, the array of large and small vessels and decoys makes discrimination of targets difficult. The fleet's 297 amphibious vessels of varying sizes and roles can land an estimated 68,550 troops per lift (exclusive of airborne troops or other forces) and conduct on average 0.62 lifts per day, absent interdiction.[159]

To gauge relative differences in force architectures' ability to defeat the invasion force, we assessed how many PLA forces would be necessary to establish a successful lodgment and eventually succeed in conquering Formosa. We used an estimated 74,129 or greater soldiers as the threshold, which would provide PLA forces with a greater than one-to-one superiority over defending ROC forces in two defensive sectors.[160] This figure is not meant to precisely estimate the number of PLA forces needed to seize Taiwan, but rather it serves as a useful benchmark in comparing the relative performance of force designs. Delivering 74,129 soldiers requires a weighted average of 322 amphibious vessel lifts, which is only 8 percent more than the amphibious fleet's initial delivery capacity. Therefore, it is imperative for ROC, US, and other allied forces to have the authority to engage attacking enemy forces early and the ability to destroy the amphibious fleet quickly; otherwise, the PLA can rapidly land enough forces to establish a successful lodgment and seize the island.

Blue US Air Force, Joint, and Allied Forces

Within the simulation, US forces (referred to as Blue units) employ one of the three architectures in table 1, referred to as Blue 1 "Baseline" Air Force, Blue 2 "More" Air Force, and Blue 3 "Balanced" Air Force. The simulation also accounts for deployment of US Army ADA units to defend airfields and for the anti-ship contributions of ROC and other service forces, specifically those shown in table 5.[161]

To scope the simulation, US forces operate only from the aforementioned 40 airfields on US territory and the territory of a set of Pacific allies—namely the Federated States of Micronesia, the Re-

Table 5. Blue Other Service and ROC Anti-Ship Forces Employed in Simulation

UNIT	NUMBER EMPLOYED IN SIMULATION
Republic of China Ground-Based Anti-Ship Launchers	200
US Army Multi-Domain Task Force (4 Typhon launchers and 6 Precision Strike Missile launchers)	2
US Marine Corps Marine Littoral Regiment (18 Navy/Marine Expeditionary Ship Interdiction System [NMESIS] launchers)	2
US Navy CSG (1 Carrier Air Wing)	1
US Navy DDG	2
US Navy SSN	6

Source: Authors.

public of Palau, Australia, Japan, the Republic of Korea, and the Philippines—and in the case of vessels, from the sea. Future analyses could consider how the United States and these countries could fight in an integrated manner more effectively. They could also consider US access to the territory of a broader range of allies and partners, including but not limited to the Republic of Marshall Islands, New Zealand, Thailand, NATO states, Israel, India, Indonesia, Singapore, and a range of Indo-Pacific island countries. The contributions they could provide and operations they could conduct to defeat PRC aggression are worthy of analysis.

Comparing Force Architectures Through Simulation

The simulations assess how well Blue 1, Blue 2, and Blue 3 architectures fare at denying the Red invasion force over the course of a week.[162] Although this is a short period, it was sufficient to gauge the general trends associated with each force alternative. Future analyses could examine longer-duration conflicts and a broader range of capabilities across domains. Figure 27 summarizes the results for each force architecture.

The goal for the Red invading force is to gain a lodgment on Taiwan. A lodgment is a ground force of sufficient size to defend and sustain itself on shore. A lodgment gives the invasion force a jumping-off point for moving inland and acts as the receiving point for reinforcements and resupply. As noted above, the PRC would need about 322 amphibious ships to establish a lodgment that could succeed in conquering Taiwan. Additional vessel lifts, which Blue forces could attempt to interdict, would be needed to resupply PLA forces ashore if the conflict became prolonged.

Figure 27. Simulation Results: Three Force Architectures

	Blue 1 “Baseline” Air Force	**Blue 2** "More" Air Force	**Blue 3** “Balanced” Air Force
Percentage of Blue airfields operational for fighters at end of scenario	**45%**	**35%**	**95%**
Percentage of Blue total aircraft inventory destroyed	**14%**	**16%**	**6%**
Percentage of Red total aircraft inventory destroyed	**1%**	**1%**	**22%**
Time to eliminate Red invasion fleet escorts	**168 hours**	**144 hours**	**60 hours**
Time to eliminate Red invasion fleet amphibioius escorts	**156 hours**	**120 hours**	**42 hours**
Percentage (number) of Red amphibious vessel lifts to 322 threshold	**118% (380)**	**106% (341)**	**43% (139)**
Blue denies successful Red lodgment?	**NO**	**NO**	**YES**

Source: Authors.

Note: Simulation results are the mean of 1,000 runs for each architecture. Percentages and numbers are rounded to whole numbers.

Figure 28. Simulation Results: State of Airfields of Three Force Architectures

	Blue 1 “Baseline” Air Force	**Blue 2** "More” Air Force	**Blue 3** “Balanced” Air Force
Mean percentage of Blue airfields operative for duration of scenario	52%	44%	96%
Percentage of Blue airfields suppressed at least once	75%	83%	40%
Percentage of Blue airfields destroyed	73%	80%	5%
Blue airfields where active air and missile defenses were eliminated or exhausted	36%	32%	23%
Average percentage of interceptors remaining	36%	48%	50%
Percentage of Blue airfields with RADR supplies remaining	44%	44%	100%

Source: Authors.

Figure 28 shows the state of airfields associated with the three force architectures. The health of airfields provides insights into the ability of Blue Core Force and Pulsed Force aircraft to conduct operations from those locations.

General Observations Regarding Scenario Outcomes

The simulations show that, overall, Blue 3’s “Balanced” force architecture provides better outcomes than the planned force or one in which the Air Force doubles down on familiar investments in aircraft, munitions, and readiness. The following are high-level impressions of the scenario outcomes. Subsequent sections describe what usually transpired for each force architecture in the scenario.

1. **Blue 1 and Blue 2 failed, and Blue 3 succeeded.** Both the baseline Blue 1 force architecture and Blue 2, which acquired nearly 500 more aircraft, failed to deny Red a successful lodgment. Red forces delivered 18 percent and 6 percent more amphibious vessel loads than required, respectively.[163] Although Blue 1 and Blue 2 exceedance percentages are unacceptable, arguably more concerning is that they also lost over 14 percent of their TAIs in the process, yet destroyed only around 1 percent of Red’s TAI. This lopsided exchange was the result of missiles and aircraft heavily attriting Blue aircraft on the ground, and surviving Blue aircraft were then heavily outnumbered in aerial engagements. In contrast, our proposed “Balanced” force architecture of Blue 3 denied a successful Red lodgment (allowing only 43 percent of the required amount to land), suffered a 60 percent smaller reduction in its aircraft inventory due to combat losses, and destroyed 22 percent of Red’s TAI. This outcome not only stops the initial invasion but advantageously positions Blue 3 to continue a protracted conflict or seek a favorable cessation of hostilities.

2. **Modern warfare can be highly attritionary.** All the force architectures imposed and suffered horrendous losses. Blue architectures lost hundreds of units and could have suffered over 500 casualties in flight crews alone. For Red, the results were even more scarring. Depending on the Blue architecture, Red lost from around 100 to over 1,000 aircraft and over 500 vessels, which could result in tens of thousands of casualties.[164] Our simulation assessed only a portion of the engagements that could take place over a single week in a war. These sobering results should encourage national leaders to seek peace and prepare their militaries to deter conflict. They should also encourage defense leaders to adopt force designs that not only succeed at initial limited scope denial but also account for the need to support a protracted conflict.

3. **Different force architectures can make major differences in outcomes, and capabilities other than aircraft are necessary.** Although Blue 2 procured nearly 500 more fighter and bomber aircraft than the baseline Blue 1, its outcomes were highly similar, and both resulted in campaign failure. This suggests that without other force architecture elements, additional aircraft—especially fighters—still encounter the same operational problems and provide only a marginal benefit. Conversely, by adopting a different force architecture that introduces an Edge Force, changes how Pulsed Force and Core Force aircraft are employed, and enhances Resilient Airfields, Blue 3 fared far more favorably.

4. **All Blue architectures can destroy Red's invasion fleet; the questions are, How quickly, and at what cost?** Notably, all Blue teams eliminated Red's invasion fleet amphibious vessels and escorts. Blue 3 accomplished it within two and three days, respectively, while Blue 1 and Blue 2 took between five and seven days. Although this may seem to be a silver lining for Blue 1 and Blue 2, the establishment of a successful lodgment would likely allow Red forces to leverage the PRC's enormous advantage in commercial shipping (and additional naval forces that it did not employ in the initial invasion) to rapidly unload more troops at seized ports and beachheads in Taiwan. Accordingly, denying a successful lodgment is imperative for Blue campaign success.

   It is also critical that US and allied forces not only win the initial clash but also preserve their forces to succeed in a protracted war.[165] Red forces attrited 57 and 59 percent of the simulated aircraft that Blue 1 and Blue 2 respectively dedicated to the campaign (a smaller fraction of the overall TAI). Moreover, Red fractured the primary blade that Blue used to eliminate the invasion fleet, the bomber force. Since Red attacks against forward and intermediate airfields halved the number of Blue 1 and Blue 2 fighter sorties within 48 hours, Blue was unable to generate enough offensive counter-air sorties and mass to desired areas. Blue 1 and 2 bombers in turn faced heavy Red air presence and respectively lost 69 and 59 percent of their committed force to Red attacks. Blue 3 still lost 25 percent of its simulated committed aircraft, including 17 percent of those bombers, but did deny the lodgment and ended the week in a largely favorable position.

   Lastly, the simulations suggest that in even the most optimistic set of scenarios for Red (fighting against Blue 1), it could lose its entire invasion fleet and many tens of thousands of personnel. Even in this case, Red succeeded narrowly and could have failed due to a variety of unexpected conditions, from weather to other unexpected allied or joint force contributions. Conflict against the proposed Blue 3 would be far worse. These sobering results should instill reservation in PRC leaders.

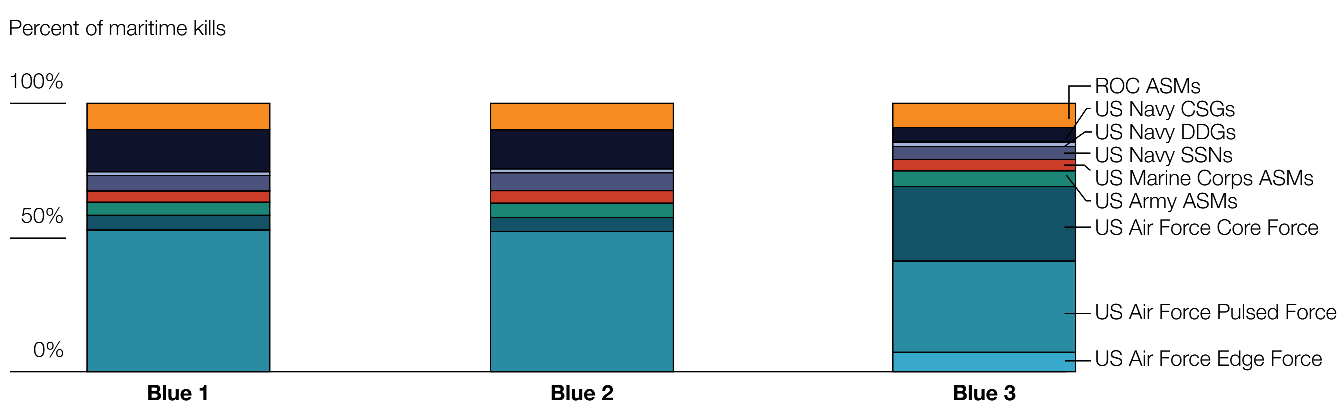
5. **Airfield attacks can collapse Blue air operations, but with the right investments, airfields can continue to generate sorties.** Heavy Red PLARF and PLAAF attacks on airfields suppressed and then destroyed 73 percent and 80 percent of Blue 1 and Blue 2 airfields, dramatically reducing their ability to generate sorties and respective-

ly eliminating 321 and 446 aircraft on the ground.[166] Blue 3's architecture invested $15.8 billion in infrastructure, fuel storage and distribution, reconstitution, and other passive-defense procurement and military construction and another $15.4 billion in procurement of additional ground-based air defenses. As a result, Blue 3 largely sustained air operations: 40 percent of airfields were suppressed at least once, but on average, 95 percent of airfields were operative throughout the scenario, while only two out of 40 airfields were destroyed. Blue 3 lost only 105 aircraft on the ground to Red PLARF and strike aircraft attacks.

6. **The combination of passive and active defenses could affect Red airfield-targeting logic and allow Blue forces to gain the initiative.** Within the simulation, Red's targeting algorithm prioritized attacking the most valuable airfields, which it measured in terms of number of aircraft, proximity to the PRC, and other factors. It also accounted for the passive and active defensive capacity of airfields. In many cases, this led the algorithm to mount large attacks on a smaller number of airfields to overcome their defenses and cause major damage. Conducting fewer large attacks in turn reduced the concurrent number of attacks Red could execute and gave Blue forces time to reconstitute damaged runways and an opportunity to gain the operational initiative. The phenomenon was especially pronounced in Blue 3, which invested in Resilient Airfields. It underscores the importance of fielding infrastructure, logistics, passive defenses, and active defenses at airfields that increase adversary salvo sizes rather than only distributing aircraft among different airfields.

7. **Although ROC and other Blue military services made valuable contributions, the majority of Blue maritime kills came from the US Air Force.** Other forces contributed greatly to attacks on the Red invasion fleet. ROC ground-launched missiles posed a formidable force of 200 launchers to start, but Red attrited half of them at the start of the conflict, and the remainder suffered heavy losses over the first two days. Nonetheless, they generated mission kill or greater damage against 9–10 percent of enemy vessels. US Army and US Marine Corps launchers together generated another 9–10 percent of kills. US Navy destroyer contributions were modest, while nuclear submarines and carrier strike groups were quite powerful. Combined, the US Navy generated 12–23 percent of kills over a week.

Figure 29. Share of Red Invasion Fleet Kills by Force Architecture and Type



Source: Authors.

However, as figure 29 shows, these contributions pale in comparison to the 57–69 percent of ship kills that the Air Force generated, with on average over three-quarters of the kills coming from Pulsed Force bombers. There are opportunities for the other forces to improve their performance. For example, US Indo-Pacific Command's proposed Hellscape concept could have ground and naval forces deploy new classes of weapons and uncrewed assets to attack an invasion fleet.[167] These capabilities would not only provide more kills in a scenario but also present new facets to the challenging problem set the PLA faces. The DoW should resource Hellscape and other such concepts. The projected disparity in strike capacity with other joint force contributions, though, suggests the DoW should ensure its most promising approach to deliver mass to defeat an invasion receives necessary and additional funding.

Blue 1: Simulation Results for "Baseline" Air Force

We derived Blue 1's force architecture from our understanding of the projected US Air Force in 2035, based on publicly available information. In the presented circa 2035 scenario, Red PLARF and PLAAF attacks rapidly suppressed and then methodically destroyed Blue 1 airfields. Red aircraft greatly outnumbered the few Blue 1 aircraft that did get airborne, which took heavy losses and faced the deadly air defenses of Red naval forces. This largely forced Blue 1 combat aircraft to fly defensively near their airfields since they could not generate enough mass to mount significant offensive counter-air or anti-surface attacks, and a dearth of aerial refueling support constrained their operating radii.

To limit attrition on the ground, most of the KC-46A and KC-135 tankers committed to the campaign had to fly from intermediate and distant airfields in Australia, the Central Pacific, Alaska, and beyond (in direct flights and using force extension), in addition to a portion of the tanker fleet that operated from in and around the First and Second Island Chains. On average these long-distance operations reduced the tanker fleet's effective offload capacity, and Blue 1 faced a 20 percent gap in desired aerial refueling support.[168] Moreover, because of the lack of Resilient Airfield investments to intermediate strongpoints, bombers flew from only distant airfields in the contiguous United States, which significantly increased their tanker demands and in turn reduced available refueling support for fighters and other aircraft. The limited amount of aerial refueling available for forward and intermediate forces constrained their operations, making them predictable and brittle in the face of enemy attacks. All the while, PLARF and PLAAF strikes annihilated Blue 1 aircraft on the ground. By the end of the second day, despite Blue 1's dispersal of aircraft across 40 airfields, Red forces had destroyed more than half of the simulated Core Force aircraft that Blue 1 had committed to the campaign.

A small number of airfields with limited capacity or far from the PRC remained operational, but the few highly distributed forces operating from them had a modest impact. At the end of the week, Blue 1 had destroyed only 6 percent of the aircraft Red committed to the campaign, compared to the 57 percent it lost. Blue bombers continued to attack the invasion fleet and were able to eliminate it by the end of the seventh day. However, Blue lacked localized air superiority, which led to losses in the air, and Red long-range attacks against Blue's distant tanker and bomber airfields limited the frequency of Pulsed Force bomber attacks. By the end of the week, 69 percent of the committed bomber force was destroyed in the air and on the ground. Overall, Blue 1 failed to deny the amphibious lodgment, incurred extremely high losses, and ended the week in a poor position to execute a protracted conflict, including one in which Red expanded the campaign and conducted even more attacks on US, allied, or partner territory, or one in which Blue might attempt to set the conditions to retake Taiwan.

Blue 2: Simulation Results for "More" Air Force

Blue 2's addition of 482 aircraft to the baseline inventory provided a modest 10 percent reduction in the number of Red amphibious vessels that reached Taiwan, but Red destroyed 59 percent of the simulated aircraft Blue committed to the campaign and 16 percent of its total inventory—a worse outcome than Blue 1. This surprisingly poorer outcome was principally caused by the fact that higher concentrations of Blue aircraft at airfields drove even more sustained Red attacks against them. Moreover, adding more combat aircraft to the force aggravated the tanker gap. Blue 2 failed to fill an even higher 49 percent of desired aerial refuelings. This larger gap slightly increased the ratio of non-mobility Core Force aircraft that needed to operate from the First Island Chain and the Republic of Korea compared to the more distant Second Island Chain, reduced the fraction of potential sorties that could be flown, and increased losses in the air and on the ground.

In general, Blue 2 suffered the same fate as Blue 1, and this suggests that more of the same force composition does not address projected risks to either mission or force.

Blue 3: Simulation Results for "Balanced" Air Force

The employment of a balanced force architecture radically improves Blue's performance in the scenario. Blue 3 swiftly defeats the invasion, destroying all Red amphibious vessels within two days and escorts within three. It accomplishes this at a much lower aircraft loss rate and in the process destroys over 20 times as many Red aircraft.

Taiwan continues to be in an existential fight. Despite its critical casualties, Red still has nearly 3,000 remaining aircraft, over 3,000 PLARF missiles, hundreds of additional warships, and thousands of merchant vessels. A weighted average of 139 amphibious vessel loads (with over 4,000 vehicles and 32,000 soldiers, plus likely many thousands of additional airborne and special forces) landed on Formosa. The island confronts relentless bombardment and blockade, and PLA forces would likely adapt and attempt to reinforce the troops that landed before Blue kills or captures them and generate new amphibious waves. Nonetheless, Blue 3 has denied the initial invasion attempt.

Furthermore, having established localized air superiority, Blue 3 is in a favorable position to prosecute an extended conflict as necessary or seek a favorable cessation of hostilities. Given the operational status of its airfields, it can reinforce and reposition its forces to press its dismantling of Red operational systems, accelerate the attrition of Red forces, or reduce risk. This may be only the first battle of a long war in which wills, economic and industrial capacity, alliances, technological innovation, and operational adaptation could be determinative. However, Blue 3 could build on its success, gain further superiority, and convince Red decision-makers that they have no favorable outcome in prolonged bloodshed.

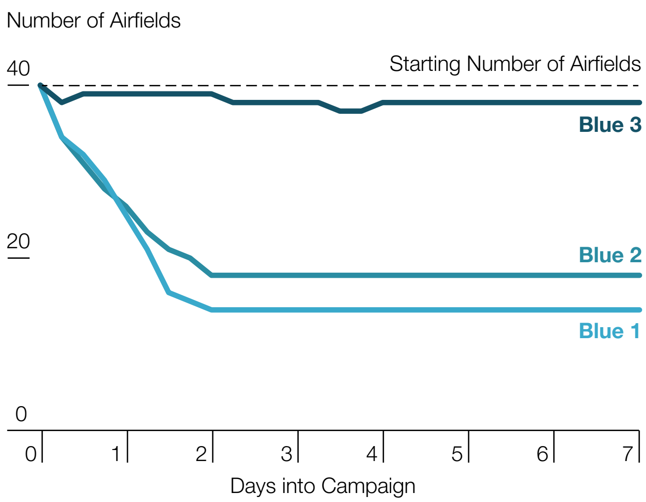
Blue 3's mutually reinforcing force design created virtuous cycles that contributed to its resounding initial victory. The following are some of the key factors that in turn should inform future force design and architectures for the Air Force:

1. **Resilient Airfields sustained air operations.** Like Blue 1 and Blue 2, Blue 3 faced withering attacks on its airfields. Unlike them, however, its additional Resilient Airfields investments, such as HASs and more active defenses, protected aircraft on the ground. Blue 3 lost only 105 aircraft on the ground, compared to 323 and 446 for Blue 1 and Blue 2, respectively.

   Red suppressed 40 percent of airfields at least once, but with at least one RADR unit at each airfield (and up to several at major ones) and extensive RADR supplies that were not exhausted throughout the campaign, airfields could be briefly down but not out of the fight. Blue 3's hardening and reconstitution forced Red to devote continued PLARF missiles and PLAAF sorties to attack major Blue 3 airfields that still generated sorties, which in turn reduced the number of attacks against smaller airfields. The number of operational airfields over time for each Blue force architecture is shown in figure 30.

   After the exhaustion of RADR supplies, the destruction of constructed and expeditionary fuel stores and distribution

Figure 30. Operational Airfields over Time for the Three Force Architectures



Source: Authors.

systems was the leading reason that Red was able to permanently neutralize 73 percent and 80 percent of Blue 1 and Blue 2 airfields, respectively (or to destroy them, in terms of this week-long scenario). However, Blue 3's robust set of underground fuel tanks, capped cut-and-cover tanks, expeditionary fuel storage, and redundant land and over-the-shore fuel distribution systems kept fuel flowing. Other investments—such as constructed and expeditionary munitions magazines and personnel and equipment bunkers—kept aircraft armed and reduced casualties. On average, Red fully destroyed only two of Blue 3's airfields, and 95 percent were operative during the scenario.

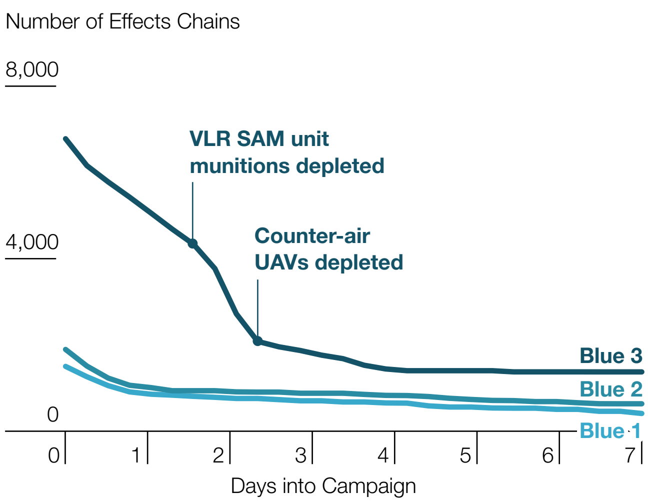
2. **The Edge Force made huge contributions early.** Given its outsized impact, analysts should critically examine the contributions of the Edge Force and consider whether Red countermeasures could attenuate its efficacy. However, within the simulation, in spite of aggressive Red attacks that heavily attrited it, the Edge Force was able to make a major impact. Moreover, in practice, Blue forces would likely adopt sophisticated employment concepts that generate effects early while preserving portions of the force to present a continued real and virtual threat, shaping enemy operations. The Edge Force made several key contributions:

   – **Anti-ship munitions launchers** attacked the invasion fleet in coordination with Pulsed Force and Core Force aircraft. These attacks struck targets directly and accelerated the proportion of invading escort vessels needing to come off station to reload, which reduced the number of escorts guarding the amphibious vessels.[169]

   – **Air surveillance and targeting capabilities** would provide targeting for the Edge Force's VLR SAMs and counter-air UAVs, enable Core Force counter-air attacks and defense, and help the Pulsed Force to avoid air threats. The simulation represented a highly aggressive and effective campaign by Red to destroy these capabilities over the first few days. Despite this, their contributions were valuable, and real units would likely be able to sustain effects for a much longer period.

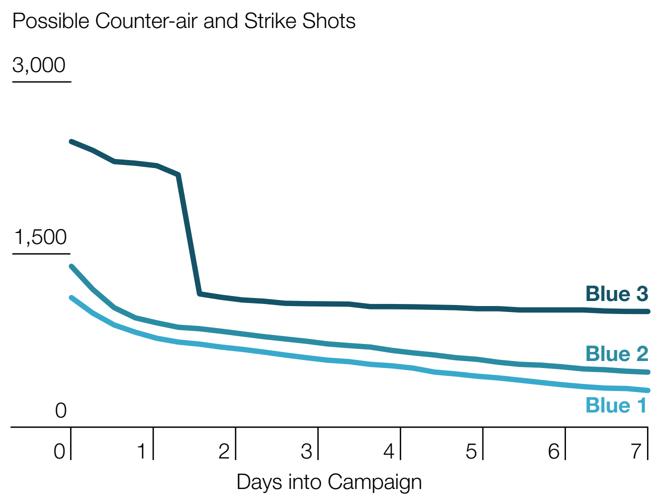
   – **VLR SAMs and counter-air UAVs** generated numerous kills early in the campaign—especially against enemy HVAAs. Coupled with Edge Force and Core Force air surveillance and targeting capabilities, these units were able to offensively strike at enemy force packages, independently sniping, skirmishing, and decoying, and support Pulsed Force and Core Force surges by eliminating key enemy aircraft. The long range and responsiveness of VLR SAMs could also enable them to virtually guard certain operating areas, which in turn could reduce the demand for DCA CAPs in some of those locations. Like other Edge Force elements, VLR SAMs and counter-air UAVs suffered heavy Red attrition (which an alternative employment concept could likely reduce), and on average exhausted their munition stocks by 36 and 54 hours, respectively. In practice, they would likely aggressively fire and then husband stocks of these weapons to generate contin-

Figure 31. Available Effects Chains over Time for the Three Force Architectures



Source: Authors.

Figure 32. Possible Counter-Air and Strike Shots over Time for the Three Force Architectures



Source: Authors.

ued effects, and the Air Force could factor resupply of these and other Edge Force units into future analyses. Similarly, the mass producibility of most Edge Force units favorably positions Blue to sustain a longer conflict—provided the Edge Force units can be deployed with aircraft, vessels, or other means into the theater of operations.

Overall, massed numbers of mobile Edge Force units fighting and launching systems from the ground, working with Pulsed Force and Core Force units, played a major role in offsetting Red's numerical superiority. As shown in figure 31, Edge Force units operating on their own and with Pulsed Force and Core Force units heavily contributed to Blue 3 generating 3.7 and 2.9 times as many effects chains (measured as combinations of C2 nodes, sensors, and effectors) over the campaign as Blue 1 and Blue 2, respectively. They were also more lethal, able to fire 2.2 and 3.2 times as many counter-air and anti-ship shots as Blue 1 and Blue 2 (see figure 32). Collectively, this meant Blue 3 commanders had far more options to attack Red forces, killed more of them, and were more difficult to suppress than the other force architectures. The Edge Force did not roll back Red defenses or exhaust its munitions stocks, but it did offset Red's numerical advantage, solve key operational problems, and contribute to decisively changing the terms of the engagement early in the campaign.

3. **The Pulsed Force delivered mass.** Resilient Airfields provided infrastructure, logistics, and passive and active defenses, and the Edge Force and Core Force counter-air units provided direct and indirect defenses. Thanks to this combination, Pulsed Force bombers were able to operate from some intermediate and distant strongpoints and in turn reached daily sortie rates of 88 percent (compared to 62 percent for Blue 1 and 2). Operating, as a weighted average, closer to strike locations increased the rate at which bombers destroyed enemy vessels and reduced tanker

demands, which in turn made aerial refueling support adequate for Core Force aircraft. The direct escort and indirect protection that Core Force units provided limited bomber losses to only eight aircraft. It also allowed bombers not only to employ standoff munitions to reduce their level of risk but also to employ more numerous stand-in and penetrating weapons, which helped them destroy even more vessels.

4. **The Core Force was vital to operate at scale.** Core Force aircraft operated from a mix of forward, intermediate, and distant (to support homeland defense) airfields. They provided extended air defense coverage for Edge Force units, protected bombers and airfields, and attacked many enemy aircraft and some vessels on their own. These operations denied Red air superiority and allowed other force elements to turn the tide in Blue's favor.

   Furthermore, Blue 3 generated a surfeit of aerial refueling capacity, able to meet 149 percent of aerial refueling demands. This was a product of its approach to employing bombers from both intermediate and distant airfields while not increasing the number of Core Force aircraft that required aerial refueling. Consequently, Blue 3 was able to:

   - Operate a larger fraction of its Core Force fighter, AEWC, and electronic attack aircraft at a time than Blue 1 and Blue 2 did,
   - Operate a slightly larger fraction of receiver aircraft from airfields in the slightly less contested Second Island Chain,
   - Have tankers available to recover and drag to other airfields and aircraft that launched on warning of an airfield attack (which in turn reduced attrition of those aircraft due to fuel exhaustion), and
   - Have spare tanker capacity to serve as attrition reserves.

5. Overall, the Core Force was invaluable in allowing the force to fight together effectively and in posing multifaceted challenges to Red.[170]

Analytic Excursions and Alternative Options

Blue 3's force architecture far outperformed the others. It denied the initial amphibious invasion and better positioned Blue forces for a protracted conflict. However, to test how Blue 3's force architecture fares with modification of key independent variables, we ran analytic excursions that increased and decreased the number or effectiveness of Blue and Red capabilities (shown in appendix B).

Improvements in Red capability or capacity could moderately decrease Blue's campaign success (as measured by the number of Red amphibious vessels that reached Taiwan) or decrease Red:Blue aircraft loss ratios. However, we generally found that Blue 3's force architecture could still defeat the invasion, albeit with an increased loss of aircraft. For example, if Red increased the number of PLARF launchers and missiles in the campaign by 50 percent, then the number of Red amphibious vessels that landed would increase by only 10 to 149, which is well short of the requisite 322. The Red:Blue loss ratio, though, would decrease by 43 percent. Other tests we conducted in which Red adopted alternative airfield attack algorithms (such as ones that more widely distributed attacks among airfields or shifted the priority of targets at airfields) generally resulted in similar outcomes.

In terms of Blue force changes, adjustments to the number of Edge Force units and combat aircraft each generated only small shifts, 5 percent or less, in the level of campaign success. In terms of Red:Blue loss ratios, 50 percent changes in F-47, CCA, and B-21 numbers resulted in 2–10 percent shifts. Changes in the number of Edge Force units, though, did result in negative 68 percent to positive 29 percent swings in Red:Blue loss ratios, indicating this class of capability has enormous potential, yet merits considerable critical analysis. Overall, Blue 3's balanced, mutually reinforcing architecture made it relatively resilient to variations that Red imposed or Blue caused.

Blue 3's force architecture made major investments in munitions, readiness, and aerial refueling that were not factored into the standard scenario runs.

More, Better, and More Manufacturable Munitions

Weapons capacity gaps are a perennial problem facing the DoW, and they are particularly egregious now that the United States has transferred large quantities of weapons to Ukraine and Israel and expended major portions of its stocks in operations against Houthis and Iran. In response, Blue 3's force architecture spent an additional $2 billion per year over a decade on munitions procurement. Without it, it is questionable whether the Air Force would have the requisite munitions to sustain an intensive campaign much longer than one week.

The additional funding could deepen stocks of existing weapons, and the Air Force could scale production of new classes of weapons designed for mass production.[171] Furthermore, it could adopt operational concepts that employ a mix of standoff, stand-in, and penetrating weapons from bombers and Core Force aircraft, and massed numbers of munitions and electronic attack from the Edge Force. This change would increase the probability that salvoes could defeat threats and decrease the likelihood that US inventories would run out.

Executing disaggregated counter-air and strike kill chains at scale is increasingly technically viable, but it is practical only if the Air Force has the weapons, targeting infrastructure, and C2 support systems to do so. Keeping costs in mind, leaning into long-range weapons would minimize risks to launch platforms, escort requirements, flight times (and in turn increase sortie rates), and aerial refueling demands. For example, all things being equal, if bombers were able to fire equivalently sized weapons at targets from 1,000 nm instead of 500 nm away, it could on average improve baseline Blue 1 campaign success by 4 percent and increase the Red:Blue aircraft loss ratio by 30 percent.

Readiness

Our simulations did not account for the impact of readiness funding on differences in the mission-capable rates of systems or the proficiency of crews. History has shown that these factors play a major role in determining outcomes—especially for units that are trying to "win the first battle of the next war while fighting outnumbered."[172] However, the readiness of USAF units is in question.

Current Air Force fighter pilots are flying around 110 hours, which is less than half the level Air Force pilots averaged in the 1990s, far lower than the 200 hours per year analysts believe PLAAF pilots are accumulating, and even fewer than the 120 hours or so derided Soviet pilots flew in the 1980s.[173] Additionally, major shortages of parts and components hamper aircraft availability rates. In response, Blue 3's architecture allocates an additional $22 billion over a decade to boost aircraft readiness, including about $12 billion in additional funding over a decade to fully fund an average of 130 flight hours per year and introduce one week of extra WSS parts per year over a decade.

A further increase in flight hours is a laudable but expensive goal. For Blue 3, increasing flight hours by an additional 10 percent (to an average of 143 hours) may cost an estimated $2.9 billion per year. As the F-35A and other advanced aircraft replace lower-flight-hour-cost aircraft in the inventory, such as A-10Cs and F-16Cs, this will be increasingly expensive. As a countervailing trend, new uncrewed aircraft such as CCA Increment 1 could cost far less to operate, given that they may be less technically complex, be more reliable, and be flown less often than their crewed counterparts. Therefore, the addition of CCA could increase mass without such a large commensurate increase in O&S costs. Overall, however, the Air Force will need to arrest the general trend of rising O&S costs through new lower-cost-to-operate designs and shifts in training.

In addition to an immediate, moderate increase in flight hours and WSS budget to restore degraded readiness and provide a contingency reserve of parts, the Air Force should pursue other mechanisms to boost readiness. Procuring and operating a robust network of simulators that allow every pilot to conduct rigorous, near-daily home station advanced virtual training would be highly valuable and would likely cost less than seeking to achieve a comparable level of readiness through live flying. Virtual training will not replace live flying, but it does provide a necessary means to exercise advanced TTP at scale and could be a complementary high-value lever the Air Force can pull to increase readiness.[174] It could then direct additional funding beyond the stipulated $100 billion over a decade toward more live flying hours and WSS.

Aerial Refueling

In the simulations, the amount of aerial refueling available to different types of receiver aircraft played a major role in the tempo and survivability of combat operations. Although all three force architectures had the same number of KC-46A and KC-135 tankers, Blue 3 operated bombers from both intermediate and distant airfields (as opposed to only distant ones). This adjustment reduced the number of tanker sorties devoted to bombers and conversely increased tanker sorties available to support other aircraft, which boosted their effectiveness and lowered their attrition.

Blue 3's force architecture also funded two other major improvements to the tanker fleet that standard scenario runs did not factor in. First, Blue 3 spent $3 billion on developing and $1.4 billion on acquiring and incorporating onto 140 large aircraft (such as KC-46A and C-17A) improved large aircraft mission systems, including C3 and self-defense systems. These systems should improve tanker survivability in the air, allow tankers to stand-into contested air environments, and orchestrate dynamic aerial refueling that could adapt to changing conditions on the periphery.

Second, Blue 3 allocated $7 billion to developing and by 2030 began procuring a new type of next-generation tanker.[175] These medium-sized BWB tankers could fly from forward, intermediate, and distant airfields, and employing the aforementioned mission systems, and perhaps modest signature reduction, they could stand-into contested air environments to deliver appropriate offloads of fuel to receivers. In contrast, when operating from distant airfields, KC-46A and KC-135 tankers would need to force extend (or have one tanker give fuel to another

Figure 33. Performance of Select Alternative Tanker Fleets in Taiwan Invasion Scenario Compared to Blue 1 "Baseline" KC-46A and KC-135 Force

TANKER FLEET OPTIONS	RECEIVER SORTIES THAT DESIRE AERIAL REFUELING THAT CAN BE ADDRESSED BY TANKERS	RED:BLUE AIRCRAFT LOSS RATIO	RED AMPHIBIOUS VESSEL LOADS LANDED ON TAIWAN
Alternative 1: KC-46A and Medium-sized BWB	+46%	+38%	-5%
Alternative 2: KC-46A and Shuttle Tanking Medium-sized Reduced Signature	-7%	+19%	+12%
Alternative 3: KC-46A and Shuttle Tanking Collaborative Tanker Aircraft	+1%	+13%	-1%

Source: Authors.[178]

midair) to support receiver aircraft forward. In the simulation, this reduced the effective capacity of the tanker fleets.

With medium-sized BWB tankers and access to a greater number of airfields that keep tanker attrition on the ground at manageable levels and host bulk fuel storage and distribution (instead of a small number of forward and intermediate sites), US commanders could generate a more dynamic and resilient aerial refueling architecture. This could flexibly address changing US demands in the air and be far more difficult for adversaries to suppress on the ground.[176] Medium-sized BWB tanker concepts greatly outperformed other refueling design concepts we separately evaluated, including ones in which small or medium-sized stealthy tankers shuttled back and forth from KC-46A. Compared to alternative design classes, medium-sized BWB could access 1.4-2 times as many airfields, deploy farther and faster with less mobility aircraft support, refuel at least 2.5 times as many force packages, sustain operations the longest amidst airfield attacks, and as shown in figure 33, improve campaign success and Red:Blue aircraft loss ratios the most in this study's Taiwan invasion scenario.[177] Medium-sized BWB tankers can enable new approaches to force employment that provide greater lethality, optionality, and resilience. Accordingly, provided they can stand-in a moderate distance into contested air environments and can be developed and procured at reasonable costs, Medium-sized BWB should be the next aircraft type in the evolution of the aerial refueling fleet.

Next-generation tankers might not be fully operational in large numbers by the circa 2035 timing of our standard scenario. However, since Blue 3's architecture starts procuring them, we conducted analytic excursions to examine the potential future impact of the designs (in particular medium-sized BWB replacing the KC-135 fleet). In the case of Blue 3's force architecture (as opposed to the impact on Blue 1 shown in figure 33), the resulting combined fleet of medium-sized BWB and KC-46A was able to refuel 46 percent more sorties than the baseline fleet of KC-135 and KC-46A, which would provide commanders with far more optionality. It also increased the Red:Blue aircraft loss ratio by 33 percent and decreased the number of Red amphibious vessel loads that landed by 4 percent, further elevating Blue 3's superiority.[179]

10. DIFFERENT APPROACHES TO FORCE EMPLOYMENT

A new force design should not only change the composition of the force but also allow it to deploy and fight differently. Our proposed force design (represented by the Blue 3 "Balanced" architecture) leverages a combined arms paradigm to set up the Air Force for decisive advantage in scenarios involving the PRC and around the globe. Strategically, it uses a mix of US-based, forward-deployed, and expeditionary forces to defend the homeland, maintain strategic deterrence, and project power. By retaining appropriate levels of capacity in the Core Fore, it can deter PRC aggression and has the flexibility to address other global demands with allies and partners, thus advancing US influence and defending US interests.

An attempted PRC invasion of Taiwan is idiosyncratic: US and allied forces would need to destroy large numbers of PRC forces, on short notice, in a small window of time, and near the PRC. The Taiwan invasion scenario has some similarities with other potential scenarios involving the PRC, such as PRC attacks on allied territory or forces. Yet, in many ways, it is particularly stressing. Despite this, our simulations suggest Blue 3's "Balanced" architecture could successfully defeat the invasion.

Equally important, though, it could defeat the invasion in different ways. Conflicts seldom evolve exactly as planners envisioned. Political circumstances change, and adversaries present surprises. Accordingly, it is critical for the Air Force to field a

Photo: Airmen step toward a B-1B Lancer to prepare for a mission during Bomber Task Force 25-2 at Misawa Air Base in Japan on April 29, 2025. (US Air Force)

Table 6. Results of Various Employment Strategies

STRATEGY	NUMBER OF BLUE AIRCRAFT DEVOTED TO DIRECT CAMPAIGN THAT WERE ATTRITED	RED AMPHIBIOUS VESSEL LOADS LANDED	INVASION DEFEATED? (322 NEEDED FOR SUCCESSFUL RED LODGEMENT)
25% Reserve and Early Core Force commitment	178	139	**YES**
25% Reserve and Delayed Core Force commitment	120	276	**YES**
50% Reserve and Early Core Force commitment	218	200	**YES**
50% Reserve and Delayed Core Force commitment	96	387	**NO**
75% Reserve and Early Core Force commitment	165	532	**NO**
75% Reserve and Delayed Core Force commitment	87	695	**NO**

Source: Authors.

force design that can easily incorporate new elements to adapt to adversary changes in confrontation or conflict, and that, at the operational level, presents US leadership with a range of options to execute a campaign.

Our proposed balanced force design does both. Its combined arms approach fields an Edge Force forward that immediately destroys key enemy nodes and forces and complements a fraction of the Core Force that, thanks to Resilient Airfields, operates from contested forward and intermediate airfields. Pulsed Force units operate from intermediate and distant strongpoints to deliver massed fires. Collectively, these forces present as few vulnerable forces forward as possible while denying enemy aims.

We examined two contrasting operational approaches to understand how the timing and composition of forces shape campaign outcomes. These scenarios, while simplified, capture the essential tension between early force presence and force preservation in a major conflict. As one option, military commanders could increase or decrease the proportion of Core Force aircraft they commit to forward and intermediate airfields at the start of the campaign. Blue 3's balanced force architecture invests in robust airfield resilience to enable an appropriate portion of forces to operate from forward, intermediate, and distant airfields. But commanders could choose to delay the arrival of a portion of surging fighter, ISRT, and electronic attack aircraft that supplement theater-assigned forces. Another option is to change the proportion of the total inventory to commit at the start of the campaign, perhaps to hold a fraction in reserve as reinforcements or to prepare for a protracted conflict.

Table 6 depicts how Blue 3's force architecture could adjust these two levers. Holding a smaller fraction of the force in reserve and committing a larger fraction of the Core Force early in the campaign results in a lower risk to mission while incurring a higher risk to force.[180] In all cases in which the Air Force holds 75 percent of the primary mission aircraft inventory (PMAI) fleet in reserve, Red defeats Blue 3, unsurprisingly demonstrating that a major conflict with the PRC would require many forces.

Overall, political leaders and military commanders will need to judge risk to mission and force considerations based on a range of factors. Blue 3, however, provides those options and does not commit to a single, brittle method of executing a campaign. In addition to its operational value, this flexibility enhances strategic deterrence of adversaries and reassures allies and partners since US forces could defeat the enemy in different ways.

Lastly, as discussed in the preceding section, Blue 3's baseline architecture provides US commanders with far more tactical options, and further additions to the Edge Force and other elements of the force would further deepen this advantage. This optionality advantage would allow US commanders to offensively seize the initiative early in a campaign and make US operations difficult to comprehensively counter. For instance, Blue 3's architecture does not require attempting to "grind it out" using persistent numerous CAPs of fighters near the PRC (where the PLA enjoys superior mass and interior lines). Instead, it can employ Edge Force units to snipe key enemy aircraft, skirmish and screen, and create operational access for surging attacks of Core Force aircraft.[181] This approach can restore the lethality and flexibility of these aircraft. In practice, DCA CAPs with fighter and AEWC aircraft will be necessary in some areas, but by taking a combined arms approach, US commanders can have multiple methods to address these counter-air demands and devote a higher relative share of fighter aircraft to offensive actions. More broadly, the balanced approach to force design, and in turn employment, shores up US vulnerabilities, imposes dilemmas on adversaries, and provides US political leadership and military commanders with a range of more effective options to employ the force.

11. IMPLEMENTING THE FORCE DESIGN

Given the acute threat of the PRC, the need to address other national demands, and mounting problems with sustaining the planned force, the Air Force needs to adopt a different force design. More of the same capabilities are neither effective nor affordable. Instead, a different, balanced force that appropriately resources Edge Force, Pulsed Force, Core Fore, and key enablers such as counter-C5ISRT and Resilient Airfields could deter the PRC, deny initial aggression, prevail in a protracted conflict if necessary, and retain the flexibility to address other national demands.

Moving beyond the conceptual force design stage and fielding credible combat capabilities will require urgency and agency. Previous USAF Chiefs of Staff have conveyed the need for the Air Force to advance; then-Chief of Staff, General Charles Q. Brown, exhorted it to “accelerate change or lose.”[182] Yet, change how? The Air Force’s initial One Force design started to answer that question, and we think it could be even more effective with our proposed evolution.

To head along that vector will also require collaboration with senior DoW leadership and Congress. Air Force leaders can articulate the outsized value that the Air Force in general and new force elements in particular can bring to bear in relevant scenarios, and the speed at which it can field force architecture elements. By doing so, they can convince policymakers that allocating additional resources to these efforts is among the highest-value defense investments the DoW and Congress can make in the near-to-midterm to head off conflict and poise the

Photo: US Air Force airmen from the 18th Civil Engineer Squadron clear a simulated damaged area in preparation for rapid airfield damage repair training during a base-wide operational readiness exercise at Kadena Air Base in Japan on November 6, 2025. (US Air Force)

United States for long-term competition. The balanced force architecture's estimated minimum of $70–$100 billion of funding beyond a flat budget over a decade (ideally front-loaded) is a large amount, but the DoW could draw it from the other services, from higher toplines, and from some internal rebalancing.[183] Congressional buy-in will also be essential to evolve the roles of some Air Force units, such as assigning a portion of Edge Force missions to some Air Force Special Warfare units or raising the number of Rapid Engineer Deployable Heavy Operational Repair Squadron Engineers (RED HORSE) and other units to support Resilient Airfields.[184]

Even if additional funding were unavailable, though, the Air Force could begin the transition to this new force design by prioritizing the most significant contributors to the "Balanced" force architecture's success, in particular the Edge Force and Resilient Airfields.

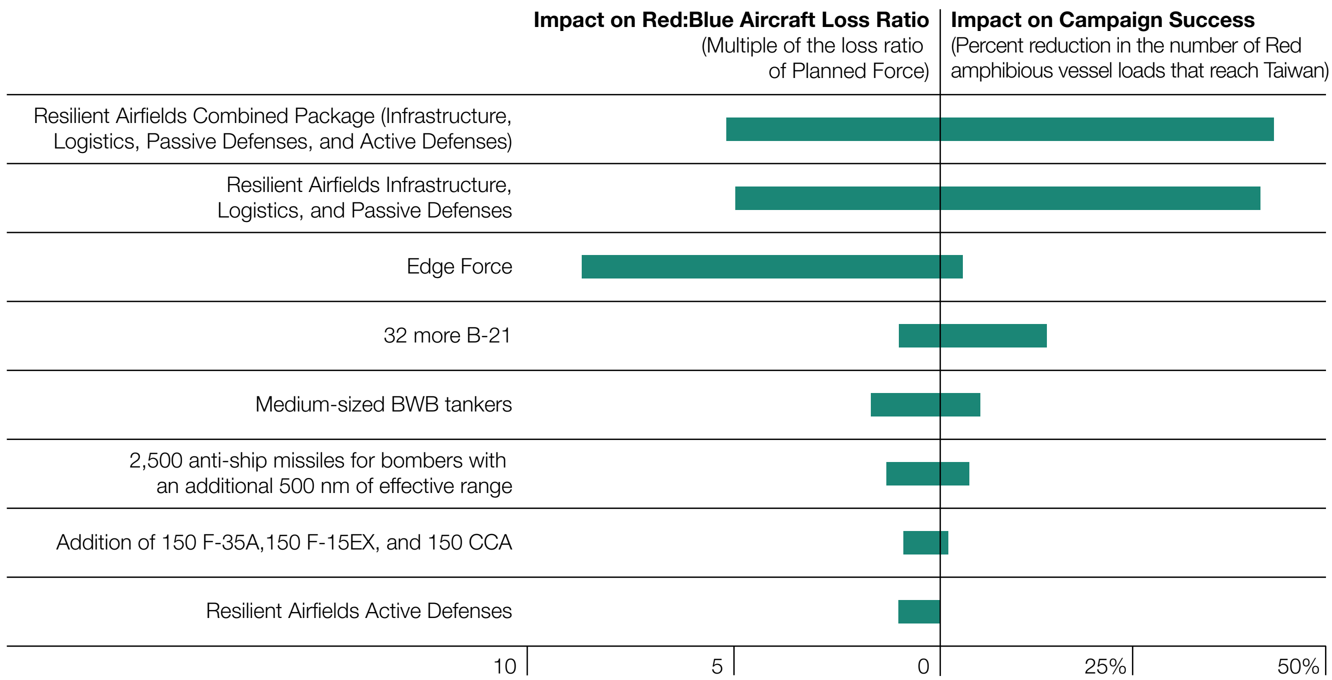
Prioritizing and Sequencing Investments

The Secretary of War and the Air Force can articulate to the president and Congress that it is possible to quickly allocate additional funding, which would allow the USAF to rapidly help deter aggression and provide the nation with more options. However, given fiscal constraints, the necessary funding may not become available all at once. At the very least, the Air Force would likely need to sequence it.

To inform a plan for funding priorities, the Air Force could consider what additional capabilities would have the greatest impact in consequential campaigns. To elaborate one approach to such an analysis, figure 34 starts with Blue 1's "Baseline" force architecture and then incorporates additional sets of capabilities to see which ones make the greatest difference in Blue's level of campaign success (as measured by the number of Red amphibious vessel loads that reach Taiwan) and Red:Blue aircraft loss ratios (the number of Red aircraft destroyed divided by the number of Blue aircraft destroyed) in our circa 2035 Taiwan invasion scenario simulations. The results in figure 34 (and subsequent figure 35) identify ways to improve performance in this specific scenario instantiation. They should not be read as a general claim that an option alone will buy down risk. For example, Resilient Airfields can make a major, cost-effective impact on risk to mission and risk to force. However, durable advantage would stem from their impact on shaping Blue and Red operations through the interactive employment of Edge Force, Pulsed Force, and Core Force units, rather than solely keeping airfields open. The following are some highlights of figure 34:

- By far the most consequential capability to improve campaign success is additional Resilient Airfields investments, in particular infrastructure, logistics, and passive defenses. Accordingly, to buy down risk to mission, the Air Force should start by building the Air Force from the ground up, first funding these three features. They are overwhelmingly straightforward projects that contractors could start at scale within 24 months after accelerated review and contracting processes.
- The proposed Edge Force makes the greatest difference in Red:Blue aircraft loss ratios since its counter-air elements excel at efficiently destroying aircraft. But it has a more modest impact on campaign success on its own because its anti-ship munitions launchers rely on integration with other strike capabilities to destroy amphibious vessels. Using off-the-shelf technologies and focusing on a limited set of functions could allow the Air Force to field some Edge Force elements (such as anti-ship munitions, forward ground-based surveillance and targeting units, and stratospheric balloons) within 24 months. It could take less than five years to field others, such as ground-launched counter-air UAVs and VLR SAMs, in significant numbers.
- Additional B-21 bombers also greatly improve campaign success and significantly improve Red:Blue aircraft loss ratios, and the Air Force could build on FY 2026 and Congress's 2026 reconciliation bill to fund an increase in the B-21 production rate.[185]

Figure 34. Impact of Options on Blue 1 Campaign Success and Loss Ratios

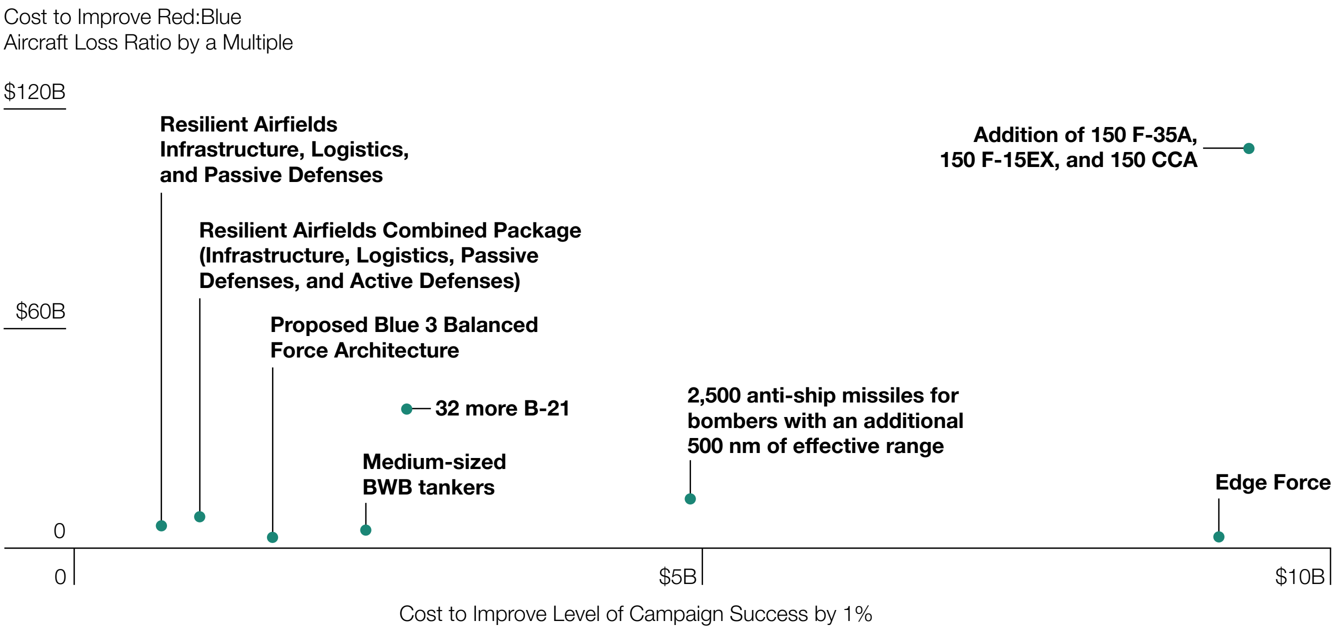


Source: Authors.

- The development of a next-generation tanker (modeled as a medium-sized BWB design) makes the next greatest difference, significantly improving campaign success and loss ratios. Over the next few years, in addition to acquiring more KC-46A as a transition to a future design, the Air Force should fund the development and fielding of new large aircraft C3 and self-defense capabilities to enable mobility aircraft to stand-into contested air environments, and mature future tanker designs and mission systems. Then, it should fly its BWB demonstrator in 2027 and procure a medium-sized BWB tanker before 2030.[186] Although problematic, the Air Force could slightly reduce the KC-46A bridge tanker annual procurement rate to 12 or so aircraft if necessary to prioritize funding for mobility aircraft upgrades and the development of its new tanker.

Another way to analyze what investments to prioritize is to consider the marginal cost to increase Blue 1's campaign success and the cost to increase the Red:Blue aircraft loss ratio by a multiple (e.g., from 3:1 to 4:1).[187] This form of analysis is particularly helpful since it illuminates the relative value of capabilities and the incremental and partial impacts of options, which could help the Air Force determine the next best investment. Figure 35 shows the results on a scatterplot, accounting for RDT&E, procurement, and O&S costs over 15 years. Ideal capabilities are in the lower-left-hand quadrant, costing little in additional funding to improve both the level of campaign success and the Red:Blue aircraft loss ratio. Resilient Airfields infrastructure, logistics, and passive defenses are the lowest-cost way to improve campaign success. Our proposed Blue 3 "Balanced" force architecture provides the best performance on both axes,

Figure 35. Additional Costs to Improve Blue 1's Level of Campaign Success and Aircraft Loss Ratios ($ Billions)



Source: Authors.

suggesting its comprehensive, mutually reinforcing approach yields great success.

As figure 35 shows, the option to add 150 F-35As, 150 F-15EXs, and 150 CCAs (the approach taken in the Blue 2 "More" Air Force architecture) is the outlier that costs a great deal on both axes, suggesting additional fighters provide lower marginal benefit than alternatives. This is not to suggest the Core Force should not have a robust fighter fleet (the baseline 2035 force has 99 F-15Es, 129 F-15EXs, 608 F-16Cs, 185 F-22As, 825 F-35As, 55 F-47s, and 150 CCAs, which is 1 percent more than the fleet size in 2025), or that more fighter aircraft would not help—they would. Rather, it suggests the other options provide more value in our specific scenario, and in turn deserve priority. More rigorous assessments across a range of scenarios could critically evaluate this conclusion, compare the effectiveness of crewed and uncrewed fighter types, and weigh upgrades to programmed fighters with additional aircraft beyond those planned.

A third way to prioritize investments is to sum the marginal cost to increase Blue 1's level of campaign success and the cost to increase the Red:Blue aircraft loss ratio by a multiple. This would provide insights into what capabilities would help more in both categories. Table 7 shows the results, accounting for RDT&E, procurement, and O&S costs over 15 years. Our proposed Blue 3 "Balanced" force architecture additions provides the lowest cost, followed by the Edge Force; Resilient Airfields infrastructure, logistics, and passive defenses; and medium-sized BWB tankers.

Alternate architectures were also developed to test the impact of emphasizing to a greater degree Edge Force, Pulsed Force, Core Force, and Resilient Airfields investments. In general, Resilient Airfields investments had the highest payoffs in terms

Table 7. Additional Costs to Improve Blue 1's Campaign Success and Aircraft Loss Ratio (Lowest to Highest)

CATEGORY	COST IN BILLIONS OF DOLLARS
Proposed Blue 3 Balanced Force Architecture	$4.3
Edge Force	$5.6
Resilient Airfields Infrastructure, Logistics, and Passive Defenses	$9.3
Medium-sized BWB tankers	$9.6
Resilient Airfields Combined Package (Infrastructure, Logistics, Passive Defenses, and Active Defenses)	$10.7
2,500 anti-ship missiles for bombers with an additional 500 nm of effective range	$13.6
32 more B-21	$34.8
Addition of 150 F-35A, 150 F-15EX, and 150 CCA	$92.7

Source: Authors.

of improving campaign success; more investment in Edge Force capabilities improved Red:Blue aircraft loss ratios; more investment in Pulsed Force capabilities improved campaign success; and more Core Force fighters had a modest impact on campaign success and Red:Blue aircraft loss ratios.

Considering Other Factors: C3, New and Upgraded Assets, Readiness, Munitions, R&D, and Personnel

Our examination of options to enhance and evolve the Air Force is not comprehensive. Central to the performance of the future force is C3. Recognizing the PLA's focus on paralyzing US C3, our proposed force design and representative Blue 3 "Balanced" force architecture pursues distributed C2 and network resilience. Heterarchical C3 structures support continued, high-tempo human command and machine-enabled decision-making across echelons throughout the theater, despite PLA attacks on C2 nodes and communications links.

We assume the Air Force continues and evolves initiatives to field the Department of the Air Force's Battle Network in the Core Force, including distributed TOC-L, 26 E-7A AEWC, and new C2 and mission planning applications and communications paths.[188] The proposed Edge Force's fielding of ground-based surveillance and targeting teams should also aid decision-making, and stratospheric balloons could help with mesh communications. And as aforementioned, the ability to receive joint C5ISR information and rapidly generate targets with new C3 capabilities across echelons is needed to enable Pulsed Force and other units to dynamically execute integrated operations at scale. Although our assessment did not rigorously examine the sufficiency of the Air Force's planned and our proposed initiatives in this area, maturation and continuous evolution of these necessary capabilities could easily require billions of dollars.

Our study also inadequately considers the role of some new platforms (such as P-ISR aircraft and intra-theater mobility aircraft) as well as upgrades to existing platforms and weapons.[189]

Other assessment gaps include the impacts of readiness, munitions, and research and development funding on combat performance. Our proposed Blue 3 "Balanced" force architecture boosts readiness in terms of both increasing flying hours by 15 percent and creating a reserve of parts and components. We suspect such moves would benefit the quality of aircraft crews and the availability of aircraft in peacetime and conflict, but we have not quantified either impact.

In terms of munitions, our proposed Blue 3 "Balanced" force architecture increases munitions funding by $2 billion per year over a decade. This should help restock the Air Force's sparse cupboard and position it to field a portfolio of weapons whose production it could scale in wartime. But, again, we did not quantify these impacts or how new weapons could change the way the force operates.[190]

Lastly, our analysis assumes the Air Force will maintain high levels of RDT&E funding. The United States faces a relentless competition for qualitative advantage with the only other technological superpower. Robust RDT&E spending is necessary to upgrade systems to stay current with threats and to develop new capabilities. There are certainly opportunities to improve the allocation and yield of research and development spending and to reduce the barriers involved in and accelerate testing and evaluation processes. These changes may generate efficiencies that allow the Air Force to redirect some RDT&E funding to procurement. However, absent the aforementioned reforms, greatly reducing RDT&E to spend more on readiness or capacity risks eating the Air Force's "seed corn" and renders it vulnerable to being technologically surpassed by the PRC.[191] Accordingly, we took a conservative approach of not cutting RDT&E to pay for procurement or O&S. More detailed assessments and broader reforms could potentially identify opportunities in this area, but robust RDT&E spending will be necessary to generate continuous advantage in the information age.

Personnel is another key limiting factor that will shape the future Air Force. In particular, a chronic 2,000-pilot shortfall and the pressure to fill billets will likely increase in the coming decades given US demographic trends.[192] Accordingly, the Air Force should embrace a force structure that generates more capability with fewer personnel. The incorporation of ground-launched munitions and uncrewed aircraft and balloons—especially autonomous and long endurance ones—can help reduce personnel requirements. As a countervailing factor, however, fielding the Resilient Airfields force that the Air Force needs will likely require far more infrastructure and logistics support, reconstitution, and air and missile defense personnel than it has currently devoted to this mission area. Operating forces under attack through high attrition will also require more personnel in general throughout the Air Force. There are likely opportunities to reduce the labor that some aspects of these functions require, such as by introducing high throughput, automated explosive ordnance disposal, and runway repair capabilities. However, overall this area is likely to require more personnel—especially in the near term.

Taking a conservative approach to personnel requirements, our proposed Blue 3 architecture may require nearly 11,000 additional personnel, which is 2 percent more than what the Air Force has in 2025.[193] Although much less than the 21,000 additional personnel required by Blue 2's "More" Air Force architecture, this is a significant increase. Solutions could consist of combinations of increasing the total end strength of the Air Force relative to the other services, internally rebalancing billets, and adopting measures to reduce personnel requirements.

Other Services and Bulk Fuel

This report finds that the Air Force would likely take the lead role in defending the homeland, maintaining strategic deterrence, projecting power to deny and defeat PRC aggression, and addressing many other global demands. That said, the Air Force cannot win alone. Our 2035 simulations find that without the Army, Navy, and Marine Corps' potent anti-ship contributions to the campaign, the ability of US forces to defeat an invasion would markedly decline.[194] All three of those services, the Space Force, defense agencies, and the intelligence community can improve their ability to succeed across a range of scenarios, and the DoW should steer funding toward the organizations with the most effective operational concepts and capabilities.

Furthermore, the Air Force relies on extensive joint enablers. Army ADA and infantry are vital to protect airfields and other critical supporting assets. The Air Force will need more Army defensive capacity as well as clarity regarding whether it too will field some active defenses (such as counter-C5ISRT or counter-drone systems). The Space Force provides ISRT, counter-C5ISRT, and communications capabilities that are essential for the Air Force to operate in a distributed manner at scale and pace. Deeper aerospace integration will enable the Air Force to target enemy forces anywhere and synchronize the necessary effects to defeat their defenses. And the Navy, the Department of Transportation's Maritime Administration, US-flag commercial merchant marine, and the Defense Logistics Agency defend airfields as well as deliver bulk fuel and other necessary supplies and assets to them.

Current major gaps in fuel storage and maritime fuel distribution make large-scale, sustained, distributed aviation operations in the Pacific impractical. Many airfields lack enough fuel for sustained operations; their fuel storage tanks are predominantly above ground and vulnerable to attack; and they have limited over-the-shore fuel transfer systems, such as fuel piers, single-point moorings, or the Offshore and Inland Petroleum Distribution Systems. Coupled with munitions gaps, this is likely the most egregious weakness limiting the potential of US aircraft. Exercises to lighter fuel to airfields on transport aircraft provide more options to US commanders but are no substitute for the mass and efficiency that maritime barges, tankers, and other delivery systems (and commensurate over-the-shore fuel transfer systems) can bring.[195] Using transport aircraft to deliver fuel also robs them of the opportunity to perform other missions, such as transporting supplies, munitions, or forces; conducting aeromedical evacuation; or delivering palletized munitions.

In response, Blue 3's proposed architecture fields hardened constructed and expeditionary fuel storage, and redundant over-the-shore distribution systems, at 40 airfields. It will also be incumbent on the Air Force to vociferously articulate the need for Defense Logistics Agency (DLA) Energy to rapidly field necessary maritime fuel distribution capacity. To improve within a year, the DoW could source 100 percent of outside the continental United States tanker-delivered fuel from US refineries (and in turn have them transported on an additional 10 US-flag tankers). In addition, DLA Energy could raise the working capital fund rates it charges the services to reflect that it will need to pay more to transport fuel, field redundant over-the-shore fuel distribution systems, and construct hardened defense fuel support points.[196] Legislative proposals in the SHIPS for America Act could also grow capacity over time.[197] Unless the DoW addresses the glaring bulk fuel gap, regardless of everything else in this report, it is reasonable to expect US forces to suffer defeat in conflict.

Collaborating with Allies and Partners

The United States is blessed with allies and partners with whom it shares interests and values. By collectively addressing security concerns, they can mutually advance their security and prosperity. Working with other countries, the Air Force plays an important role in confronting adversary aggression and meeting a range of other national security demands.

To do so, the Air Force depends on allies and partners. Access to allied and partner territory is essential for both forward-operating Air Force units and deploying ones. For example, in Operation Midnight Hammer, a small-scale US attack on Iranian nuclear facilities, US forces operated from at least five airfields in Europe and the Middle East.[198] Large-scale operations could require significantly more locations. Operation Midnight Hammer also highlighted the global character of modern long-range air operations—the strikes required airfields in North America, the Pacific, Europe, and the Middle East. Operations against potent foes such as the PRC or Russia would likely require operations in and across multiple theaters. Accordingly, allies and partners in one region are instrumental to counter aggression in others. For instance, responding to a PRC attack against Korea would likely involve US air operations not only from the Indo-Pacific but also from Europe. Conversely, a Russian attack on a NATO state would likely involve US air operations not only in Europe but also from Korea and other Indo-Pacific states.

The military forces of allies and partners play an invaluable role in defending their own territories (and in turn the airfields and operating areas the Air Force depends on), defending US territory, and attacking enemy forces. The interoperability of the USAF

Figure 36. A Multinational Aircrew Operates a NATO E-3

Source: "NATO AWACS," NATO, November 2, 2016, https://www.nato.int/cps/en/natohq/declassified_137124.htm.

with the air forces of allies and partners generates a far larger and more capable force that can deter aggression and defeat it if necessary. The United States has also depended on the capacity and capability of allies' airpower in its times of need. For example, in the wake of the September 11, 2001, terrorist attacks on the United States, NATO launched Operation Eagle Assist, which deployed seven NATO E-3 AWACS aircraft (such as the one shown in figure 36) with 830 crew members from 13 NATO countries to patrol US skies.[199] These forces plugged gaps in US air surveillance, defending the US homeland, and allowed US E-3 aircraft to deploy to the Middle East.[200]

Furthermore, industrial cooperation with allies and partners provides the United States with a larger industrial base and force structure to tap into in peacetime and in conflict, when demands could skyrocket. In a protracted conflict with the PRC, the world's manufacturing powerhouse, raising allied production capacity could be critical. For example, allies could transfer aircraft or munitions to the Air Force to backfill attrition losses and expenditures in a major conflict. They could also manufacture new aircraft, munitions, sensors, or other systems and sell or donate them to the United States. For instance, the Final Assembly and Checkout Plant in Cameri, Italy, could manufacture more F-35As that the USAF needs to replace conflict losses.

Allied and partner investment also helps lower the cost to develop or modernize US systems, as it did for F-15s and F-16s. Given US fiscal constraints, leveraging allied investment will be critical to maximize the capability of US and allied and partner forces in the future. For instance, the Air Force had planned to leverage $9 billion in investment (plus 30 orders) from Australia, Saudi Arabia, and NATO for E-7 radar and system upgrades.[201] Until the program was altered, this investment could have provided the USAF with a more capable and less expensive E-7A and increased commonality among allies and partners. The Air Force could leverage investment in the E-7A by acquiring its own and pursue other opportunities for allied investment to modernize and field new aircraft, sensors, and weapons.

Moreover, as the Air Force advances its emerging force design, it should incorporate interoperability from the start. The service should deepen interoperability through continued commonality of assets (such as the F-16C, F-35A, F-15EX, KC-46A, E-7A, EA-37B, and MQ-9), improved machine-to-machine mission integration and procedural interoperability, and new intelligence sharing and communications links. The Air Force should also pursue commonality in aircraft among its new high-end designs and offer B-21, F-47, and P-ISR aircraft to Australia and other close allies, particularly when allied investment would allow US production rates to scale or would modernize US systems. Munitions are another area for industrial cooperation—especially new classes of modular munitions, sensors, and weapons that allies and partners could produce at scale and then integrate into their militaries.

Furthermore, Edge Force capabilities should be a prime area for cooperation. Western Pacific, European, and Middle Eastern allies and partners face similar operational problems and could buy, codevelop, or coproduce systems that are the same as or similar to those the Air Force uses. Operationally, more Edge Forces from allies and partners would bring more capacity to bear. It would also enhance the US Air Force's ability to operationalize some of the more promising TTP to enhance the survivability of units. For example, allies, partners, and the Air Force could exercise the tactical mobility of Edge Force units throughout a host country. Industrially, the ability of allies and partners in one theater to manufacture Edge Force systems for a conflict in another would ensure that forces could sustain a protracted conflict, which would likely contribute to deterrence.

Lastly, a new force design requires a shift in paradigm for how to deter adversaries and reassure allies and partners. Rather than forward-deploying a large fraction of Core Force aircraft in a crisis, US forces would instead forward-posture numerous resilient airfields and Edge Force units and a moderate amount of theater-assigned Core Force units. In a crisis, the US would send some additional Core Force units forward, but much of the country's ability to promptly defeat enemy attacks would already be set in the theater. This design challenges the approaches that the PLA (or other adversaries, such as Russia) could use to conduct surprise attacks to neutralize deploying forces as part of an opening gambit. Allies and partners will also need to understand that the low-signature Edge Force units and moderate number of Core Force units operating from their territory would be complemented by a large mass of Pulsed Force and Core Force units over the horizon, which could sustain operations regardless of enemy attacks. In essence, large flights of aircraft would not be the only way to deter or reassure.

Accordingly, in peacetime, the operating patterns of aircraft would change. For example, rather than frequently employing bombers to signal, the Air Force would likely take a more measured approach to rebuild readiness to ensure that it had enough mission-capable aircraft and parts to rapidly surge operations and pulse power in a crisis or conflict. Bomber exercises with allies and partners would continue but would likely diminish in frequency in the near term. By privately sharing the rationale for these moves with allies and partners, Washington could convey how these shifts will actually boost the readiness of units to contribute to the collective security of the United States and its allies and partners.

Recommendations: Begin Implementation Today

The Air Force can pursue a new, viable force design and implement it. Neither practical levels of funding, nor personnel, nor technology, nor alliances and partnerships stand in its way. We recommend that the Air Force, DoW, and Congress start with the following steps.

1. Pursue a force design that prioritizes Edge Force and Pulsed Force initiatives, and key enablers—especially counter-C5ISRT and Resilient Airfields.

The Air Force should pursue a balanced force design that enables the Air Force to deter aggression and fulfill global commitments. Prioritizing Edge Force and Pulsed Force initiatives and key enablers allows the Air Force to address the changing character of warfare and seize the initiative.

2. Revise the initial One Force design.

The Air Force's current force design, One Force, captures most elements of how the service should evolve. However, rather than the current construct of Mission Areas 1, 2, and 3, the Air Force could also name the mission areas to more clearly convey their roles. We propose Edge Force, Pulsed Force, and Core Force, in that order. Moreover, the Air Force should articulate the essential roles of the Core Force in competition and conflicts, including from contested forward, intermediate, and distant airfields. Lastly, a revised iteration should recognize the role of key enablers, principally counter-C5ISRT and Resilient Airfields.

3. Prioritize funding the establishment of the Edge Force, the expansion and improvement of the Pulsed Force, a targeted set of counter-C5ISRT and Resilient Airfields investments, and then other areas.

Our analysis concludes that a comprehensive suite of investments in Resilient Airfields—especially infrastructure, logistics, and passive defenses—could greatly improve the Air Force's performance in stressing scenarios against the PRC. With accelerated review and contracting processes, many of these projects and acquisitions could start at scale within 24 months. The rapid fielding of more and new counter-C5ISRT enablers could also yield major positive dividends.

Similarly, Edge Force capabilities had an outsized impact on campaign success and ability to counter enemy aircraft. By using off-the-shelf technologies and focusing on a limited set of functions, the Air Force could field some Edge Force elements (such as anti-ship munitions, forward ground-based surveillance and targeting units, and stratospheric balloons) within 24 months. It could field others, such as ground-launched counter-air UAVs and VLR SAMs, in significant numbers in less than five years.

The Air Force could pursue additional prioritized investments in parallel, including more and new munitions, boosts to readiness, and hardening of mobility aircraft with improved C3 and self-defense capabilities. It could develop and start fielding a new medium-sized BWB aerial refueling tanker, additional B-21 and other Pulsed Force systems (in particular, dynamic C3 and battle management capabilities), and, finally, more uncrewed and crewed fighter aircraft. Our list is not meant to be comprehensive, but overall, with guidance from its revised force design and support from Air Force Futures analysis, the Air Force can sequence and prioritize investments and communicate their impact to DoW leadership and Congress.

4. Address acute gaps in joint support to Air Force operations, in particular Army air and missile defense and bulk fuels.

To operate Resilient Airfields, the Air Force requires more Army ADA capacity. DoW leadership should direct the Army to continue to expand the ADA branch. It should also define whether and how the Air Force should field its own active defenses. Past DoD leadership has temporized on this. The Secretary of War should study this question in a timely manner and reach a decision, such as continued Air Force reliance on Army ADA active air and missile defenses, some Air Force active defenses (such as counter-ISRT systems, some counter-drone defenses, or some other defenses against munitions and aircraft), or a transfer of the Army ADA Branch to the Air Force. Similarly, the DoW should quickly sort out any roles and missions disagreements over the Air Force adopting surface-to-surface fires.

Bulk fuels are another critical enabler. The Air Force should field its own Resilient Airfields improvements to its surface bulk fuels architecture. But Air Force leadership should also vociferously articulate to DoW leadership the need for DLA Energy to rapidly field necessary maritime fuel distribution capacity and other changes necessary to support contested operations. This includes changing DoW bulk fuel sourcing and the rates that DLA Energy charges the services for fuel. Unless DoW shores up this egregious gap, regardless of the other proposed changes in this report, it can reasonably expect defeat in a major conflict against the PRC.

5. Ensure the Chief Modernization Officer assesses Air Force logistics, engineering, and force protection activities and the nuclear enterprise.

Within Air Force Futures (A5/7), the Air Force plans to create a new Chief Modernization Officer position, which will lead the Air Force's work on strategy and force design, mission integration and mission threads, capability development and requirements, and modernization investment prioritization.[202] Given the criticality of Resilient Airfields to effectively accomplish those and other tasks, the Chief Modernization Officer's ambit should encompass Air Force logistics, engineering, and force protection activities. It should also include the nuclear enterprise. By effectively integrating conventional and nuclear operations, it can assess and improve the Air Force's ability to defend the homeland and maintain strategic deterrence through its mission areas and key enablers.[203]

6. Define opportunities for deeper collaboration with allies and partners.

A new force design brings new opportunities to deepen operational, programmatic, and industrial collaboration with allies and partners across mission threads. Resilient Airfields and the Edge Force are prime places to start. The US should also pursue commonality and integration within Core Force networks, aircraft, and munitions (and the Pulsed Force for close allies).

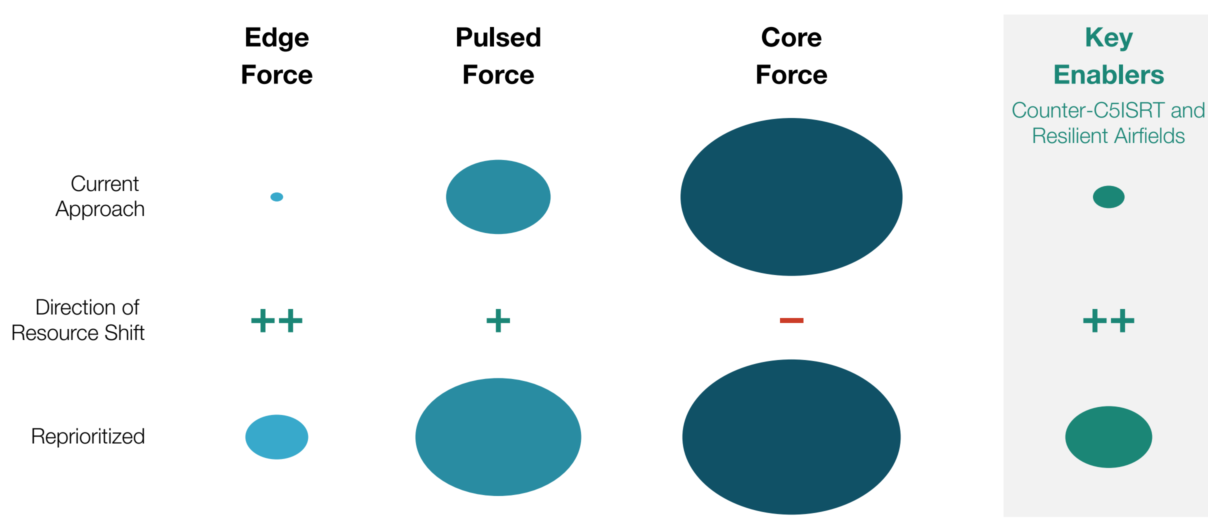
7. The DoW and Congress should increase funding for the Air Force to accelerate the transition to the new force design.

The Air Force has a promising force design that it can further improve. Quickly fielding it, though, will require additional funding. Based on our simulations of a 2035 conflict with the PRC, we estimate that an additional $85–$100 billion over a decade to the Air Force would transform the DoW's performance from defeat to a resounding victory. Budget neutral "balanced" force architectures could also possibly triumph. Given the maturity of many of the most impactful options available to the Air Force, additional funding could even have an earlier, near-term impact. It could deter aggression and significantly alter the operational environment in favor of the United States and its allies and partners.

The Air Force is likely the service that has the most mature and promising concepts for defending the homeland, maintaining strategic deterrence, and projecting power, particularly by denying PRC aggression. The National Defense Strategy should highlight this, and DoW leadership and Congress should steer additional funding to raise USAF capability, capacity, and readiness.

However, in a tight fiscal environment, the Air Force will likely need to make difficult choices to fund the new design, which it should pursue regardless of topline funding levels, in order to deter and fight effectively. As depicted in figure 37, the Air Force should prioritize its resources to create the Edge Force, which does not exist today, substantially grow and improve the Pulsed Force, transform the Core Force, and fund a targeted set of counter-C5ISRT and Resilient Airfields elements that enable the other mission areas. In the near term, it should retire outdated fighter, attack, and support aircraft in the Core Force to free up funding for the Core Force's modernization, for mission integration and C3 across the force, and for other elements of the necessary transition.

Figure 37. Relative Resource Shifts to Implement the Proposed Force Design (Not to Scale)



Source: Authors.

Table 8. Blue 4’s “Balanced”, Budget-Neutral Force Architecture

FORCE ALTERNATIVE	BUILDS UPON BLUE 1 BY ADDING THE FOLLOWING:
Changes in composition compared to planned forces	Boosts resilience of 20 Regular and 10 Dispersal Airfields with about half as much additional infrastructure, logistics, and passive defenses as Blue 3, prioritizing intermediate strongpoints. Adds $1 billion in counter-UAS air defense procurement (and additional associated O&S costs).
	Fields Edge Force approximately half the size of Blue 3’s.
	A lower fraction of the Pulsed Force bomber fleet operates from intermediate strongpoints compared to Blue 3.
	Maintains F-35A procurement at 24 per year.
	F-16 TAI is reduced to 450 by 2032. All 608 F-16 PoBIT upgrades are completed. The 158 surplus F-16s are kept as attrition reserves and/or sold to allies and partners.
	The development and fielding of an NGAS tanker is delayed by three years, with aircraft procurement commencing in 2034.
	The profile for conversion of units from the EC-130J/H to the EA-37B is accelerated by a year, which slightly reduces O&S costs.
	OA-1K Skyraider II program that provides light attack and armed ISR in uncontested or lightly contested airspace is cancelled.
	No additional funding is devoted to readiness, weapons procurement, or optionality reserve.

Source: Authors

To illustrate potential options for the Air Force, we created a budget-neutral plan, termed Blue 4. This architecture is the same total cost (in terms of RDT&E, procurement, and O&S costs) from FY 2026-2035 as the Blue 1 Baseline plan, and through a set of difficult trades, prioritizes funding a limited set of the most impactful elements of the “balanced” force design. Table 8 summarizes the force architecture changes in Blue 4, and a more detailed description of its composition is found in Appendix A, table A.[204]

In terms of scenario results, Blue 4’s “balanced”, budget-neutral architecture defeated the invasion and significantly improved performance over Blue 1 across the range of metrics shown in figure 38. For example, it destroyed 9 percent of Red’s aircraft inventory, mainly because of the contributions of Edge Force units and to a lesser degree Core Force fighters. However, due to a lack of sufficient Resilient Airfields infrastructure, logistics, passive, and active defenses and having a smaller Edge Force and Core Force, 13 percent of its simulated TAI was destroyed, which was only slightly better than Blue 1.

Overall, Blue 4 achieved the campaign objective but exhibited an unfavorable aircraft loss exchange ratio that could be dif-

Figure 38. Simulation Results: Four Force Architectures

	Blue 1 Baseline Air Force	**Blue 2** "More" Air Force	**Blue 3** "Balanced" Air Force	**Blue 4** "Balanced," Budget Neutral Air Force
Percent (number) of Red amphibious vessel lifts to 322 threshold	**118% (380)**	**106% (341)** 0.9x	**43% (139)** 0.4x	**64% (205)** 0.5x
Blue denies successful Red lodgment?	**NO**	**NO**	**YES**	**YES**
Cost over Baseline		**+ ~$100B over a decade**	**+ ~$100B over a decade**	**+ ~$0B over a decade**
Percent of Red total aircraft inventory destroyed	**1%**	**1%** 1.0x	**22%** 22x	**9%** 9.0x
Percent of Blue total aircraft inventory destroyed	**14%**	**16%** 1.1x	**6%** 0.4x	**13%** 0.9x
Percent of Blue airfields operational for fighters at end of scenario	**45%**	**35%** 0.8x	**95%** 2.1x	**75%** 1.7x
Mean aggregate strike and counter-air shot capacity	**577**	**726** 1.3x	**1,319** 2.3x	**725** 1.3x
Mean total effects chains that force packages can generate	**715**	**896** 1.3x	**2,631** 3.7x	**1,148** 1.6x
Sorties requiring aerial refueling that receive it	**80%**	**51%** 0.6x	**149%** 1.9x	**93%** 1.2x

Source: Authors.

ficult to sustain over a protracted conflict. The results of Blue 4 demonstrate that a "balanced" architecture significantly outperforms Blue 1's baseline plan, and even Blue 2's plan that spends an additional $100 billion. Other budget-neutral combinations could possibly generate even better outcomes. Moreover, provided it is wisely spent, the additional funding allocated to Blue 3's "balanced" architecture yields positive dividends to create a force architecture that could clearly deter and defeat aggression.

As the recently passed One Big Beautiful Bill Act demonstrates, Congress and others will continue to add funding to the same Air Force programs if USAF leaders do not explain their resource priorities based on a new force design. However, no realistic funding increase will allow the current force design to address the emergence of a peer adversary in the PRC, the proliferation of militarily relevant technology across all theaters, and growing challenges in maintaining and crewing the fleet. A new force design is crucial.

12. COUNTERARGUMENTS AND CONCLUSION

Despite the Air Force's stellar performance in recent operations, it has a geriatric fleet of aircraft, low readiness rates, and dismal prospects in a potential future conflict against the PRC, so the service could decline within a decade from invaluable to incapable. More importantly, a weak Air Force would face major challenges defending the homeland, maintaining strategic deterrence, and projecting power in support of the nation, which could increase the likelihood that the PRC starts a war in which it defeats the United States and its allies.

In response, the Air Force's current force design, One Force, sets the stage for a necessary transformation of the service, and our proposed force design aims to build on it. However, change can be difficult and face resistance.

As DoW and congressional leaders consider investments in this area, they should be cautious of three seemingly sensible counterarguments.[205]

1. "The Air Force only operates aircraft."

Proposed Edge Force units with mobile, ground-launched missiles and drones may seem at odds with an aircraft-heavy service, but the Air Force should adopt these capabilities for three reasons. First and most importantly, it is a promising class of forces that the Air Force can field in the near term to asymmetrically solve challenging operational problems and improve campaign success. Second, possessing ground-launched capabilities would align with the current reality that the Air Force operates ICBMs and its historical record of operating GLCMs (and starting development of ground-launched loitering munitions). Similar to previous changes that introduced space and cyber specialties, the Air Force will need to foster new com-

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Photo: A member of the 33rd Special Operations Squadron JUMP 20 uncrewed aerial vehicle team goes to retrieve a UAV after flying it during Exercise Coyote Dicer at Melrose Air Force Range in New Mexico on May 17, 2022. (US Air Force) munities that are not organized around pilots and aircraft. And third, the Edge Force aligns with a comprehensive conception of airpower. Integrated into broader USAF and joint operations, its capabilities offensively support central Air Force missions of air superiority, ISR, and strike.[206] The service operates more than aircraft today, and new Edge Force units can help ensure its superiority continues in the future.

2. "The Air Force should sideline the Core Force and shift to a bimodal Edge Force and Pulsed Force."

Threats to forward airfields could tempt DoW leaders to limit the role of the Core Force and instead overwhelmingly direct investment to the Edge Force and Pulsed Force, both of which could avoid the gravest threats to airfields. This approach would fail on multiple fronts. A greatly shrunken Core Force would limit the ability of US forces to deploy and operate globally, shaping a range of military and nonmilitary contingencies.

In scenarios involving the PRC, without sufficient Core Force aerial refueling capacity, Pulsed Force bombers would not be able to employ from a distance. Without sufficient Core Force ISRT and fighter aircraft and Resilient Airfields investments at intermediate strongpoints, Pulsed Force aircraft would need to operate solely from a distance, decreasing their effective capacity. And without direct and indirect counter-air activities by Core Force aircraft, Pulsed Force aircraft would take high levels of attrition in the air, and enemy aircraft could hunt down Edge Force units. Our simulations show Blue force architectures suffer defeat when they considerably cut capacity of the Core Force, or only double the capacity of the Edge Force and/or Pulsed Force.

3. "The Air Force should simply buy more of the same planned aircraft and weapons."

The Air Force has taken a rigorous approach to anticipating the future and setting requirements. This process and past decisions could steer leaders to buy more of the same current and emerging capabilities. Such an approach would modernize the Air Force and avoid spending on mission areas such as Resilient Airfields and the Edge Force, which could free up funding to increase readiness rates. However, more of the same force architecture is likely to suffer defeat in a future conflict with the PRC. Our simulations show that force architectures that simply add more of the same aircraft would suffer egregious losses—even if those architectures also fielded Resilient Airfields to better defend aircraft on the ground and operated a portion of the Pulsed Force bomber fleets from intermediate strongpoints.

As DoW and congressional leaders consider options for the Air Force, they should resist the siren song that tempts "a score more of the same aircraft, weapons, or flying hours each year will tip the scales." No, only through a major transformation of the Air Force's force design and commensurate architecture can the service position itself to deter and defeat PRC aggression while retaining the flexibility and scale to address other global demands. A balanced force design is viable and can achieve this.

APPENDIX A: FORCE ARCHITECTURES

Table A details Blue 1, 2, 3, and 4 force architectures. In addition to the entities shown, all force architectures had access to current and planned-by-2035 infrastructure and logistics that are located at airfields or would reasonably be deployed to airfields in a crisis. Table 3 lists the ground-based air and missile defenses that Blue 3 uses, which are the same as the active defenses in Blue 1 and Blue 2 except for six additional deployed PAC-3 MSE batteries.

Table A. Four Force Architectures

	BLUE 1: "BASELINE" AIR FORCE		BLUE 2: "MORE" AIR FORCE		BLUE 3: "BALANCED" AIR FORCE		BLUE 4: "BALANCED", BUDGET-NEUTRAL AIR FORCE	
	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN
Edge Force								
Anti-ship Munition Launcher Group	0	0	0	0	7	5	5	3
Stratospheric Balloon Squadron	0	0	0	0	7	4	7	4
Forward Ground-Based Targeting System Squadron	0	0	0	0	30	20	10	6
Very Long Range Surface-to-Air Missile Squadron	0	0	0	0	15	6	10	4
Ground-Launched Counter-Air UAS Squadron	0	0	0	0	7	4	0	0
Pulsed Force								
B-52H	76	21	76	21	76	21	76	21
B-21	63	18	90	27	63	18	63	18
B-2	20	6	20	6	19	6	19	6
Core Force								
F-15E	99	27	99	27	99	27	99	27

	BLUE 1: “BASELINE” AIR FORCE		BLUE 2: “MORE” AIR FORCE		BLUE 3: “BALANCED” AIR FORCE		BLUE 4: “BALANCED”, BUDGET-NEUTRAL AIR FORCE	
	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION’S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION’S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION’S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION’S DIRECT CAMPAIGN
F-15EX	129	36	207	78	129	36	129	36
F-16C	608	0	608	0	608	0	450	0
F-22A	185	52	185	52	185	52	185	52
F-35A	825	232	975	274	825	232	765	215
F-47	55	15	55	15	55	15	55	15
CCA Increment 1	150	91	332	182	150	91	150	91
E-7A	26	5	26	5	26	5	26	5
MQ-9A	130	66	130	66	130	66	130	66
KC-46A	239	63	239	63	239	63	239	63
KC-135R/T	227	59	227	59	227	59	227	59
Developing improved large aircraft mission systems, including countermeasures, and incorporating improved large aircraft self-defense systems on 140 large aircraft, such as but not limited to KC-46A	No	N/A	No	N/A	Yes	N/A	Yes	N/A
Medium-sized BWB NGAS Tanker	No	N/A	No	N/A	Developed and being procured	0	3-year development delay and being procured	0
EA-37B	10	3	10	3	10	3	10	3

	BLUE 1: "BASELINE" AIR FORCE		BLUE 2: "MORE" AIR FORCE		BLUE 3: "BALANCED" AIR FORCE		BLUE 4: "BALANCED", BUDGET-NEUTRAL AIR FORCE	
	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN
Resilient Airfields								
Small Aircraft Hardened Aircraft Shelters (12 per Regular Airfield)	0	0	0	0	240	240	120	120
Large Aircraft Hardened Aircraft Shelters (3 per Regular Airfield)	0	0	0	0	60	60	30	30
Hardened Fuel Storage and Distribution (set of 3 25,000 bbl USTs or capped cut and cover tanks and pumps, 10 100,000 gallon expeditionary fuel bladders and pumps, 10 R-11 trucks, 2 IPDS, and 2 OPDS) (1 per Regular Airfield)	0	0	0	0	20	20	10	10
Expeditionary Fuel Storage and Distribution (set of 10 100,000 gallon expeditionary fuel bladders and pumps, 10 R-11 trucks, 1 IPDS, and 1 OPDS) (1 per Dispersal Airfield)	0	0	0	0	20	20	10	10
Munitions Magazines (10 per Regular Airfield)	0	0	0	0	200	200	100	100

	BLUE 1: "BASELINE" AIR FORCE		BLUE 2: "MORE" AIR FORCE		BLUE 3: "BALANCED" AIR FORCE		BLUE 4: "BALANCED", BUDGET-NEUTRAL AIR FORCE	
	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN
Expeditionary Munitions Storage Units (10 per Dispersal Airfield)	0	0	0	0	200	200	100	100
Small Bunker (10 per Regular Airfield)	0	0	0	0	200	200	100	100
Large Bunker (2 per Regular Airfield)	0	0	0	0	40	40	20	20
RADR Kits (2 per Regular Airfield; 1 per Dispersal Airfield)(one additional RADR / RED HORSE construction engineer units per airfield)	0	0	0	0	60	60	30	30
Additional RADR Supply Sets (2 per Regular Airfield; 1 per Dispersal Airfield)	0	0	0	0	60	60	30	30
Passive Defense CCD Kit for Airfield (2 per Regular Airfield; 1 per Dispersal Airfield)	0	0	0	0	60	60	30	30
Short-to-Medium Range Air and Missile Defense Battery (PAC-3 MSE)	0	6	0	6	15	6	$1 billion in counter-UAS	N/A

	BLUE 1: "BASELINE" AIR FORCE		BLUE 2: "MORE" AIR FORCE		BLUE 3: "BALANCED" AIR FORCE		BLUE 4: "BALANCED", BUDGET-NEUTRAL AIR FORCE	
	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN	TOTAL INVENTORY	NUMBER OF ENTITIES AVAILABLE FOR SIMULATION'S DIRECT CAMPAIGN
Other budgetary priorities								
Additional Munitions ($2 billion per year for 10 years)	No	No	Yes	N/A	Yes	N/A	No	No
Additional Readiness Funding	No	N/A	Increase flight hours by 15% and procure 10 weeks of WSS parts	N/A	Increase flight hours by 15% and procure 10 weeks of WSS parts	N/A	No	N/A
Additional budget available to dynamically allocate	No	N/A	No	N/A	Yes, $10 billion	N/A	No	N/A
Joint Forces								
US Army Ground Anti-Ship Launchers		20		20		20		20
US Marine Corps Ground Anti-Ship Launchers		18		18		18		18
US Navy DDGs		2		2		2		2
US Navy SSNs		6		6		6		6
US Navy CSGs		2		2		2		2
ROC Ground Anti-Ship Launchers		200		200		200		200

Source: Authors.

APPENDIX B: OTHER ANALYTIC EXCURSIONS

Using Blue 3 as a baseline, table B shows how changes in Blue and Red capabilities and capacities in the scenario affected Blue 3's level of campaign success and Red:Blue loss ratios. Of note, Red delivery of 322 amphibious vessel loads of forces equates to an impact on campaign success of 132 percent. Therefore, the only case in table B in which Red succeeds in establishing a lodgment is when it fields 50 percent more Red total vessels, inclusive of amphibious vessels, escorts, and decoy vessels. In this case, it delivers 350 amphibious vessel loads, resulting in an impact on campaign success of -151.07 percent. Amassing more vessels for an invasion would likely increase the warning to Blue of a possible impending invasion, which could allow Blue to posture more forces or better prepare its capabilities. Additionally, other elements of the joint force could possibly address this potential risk to mission. For example, US Indo-Pacific Command's Hellscape could help destroy Red vessels.

Table B. Impact of Changes in Blue and Red Capability/Capacity on Blue 3's level of Campaign Success and Red:Blue Aircraft Loss Ratio

DESCRIPTION OF EXCURSION	CHANGE	IMPACT ON CAMPAIGN SUCCESS	IMPACT ON RED:BLUE AIRCRAFT LOSS RATIO
Size of the Red PLARF launcher and missile inventory	50% smaller	0.07%	28.05%
	50% larger	-7.26%	-42.67%
Effectiveness of Red vessel missile defenses	50% lower	28.49%	-12.51%
	50% higher	-75.57%	3.27%
Number of Red vessels	50% fewer	77.59%	-14.10%
	50% more	-151.07%	-12.78%
Number of Red aircraft	50% fewer	1.99%	-28.56%
	50% more	-1.73%	-55.26%
Effectiveness of Blue ground-based air and missile defenses	50% lower	-4.74%	-28.30%
	50% higher	4.87%	35.41%
Number of F-47	50% fewer	0.05%	-3.23%
	50% more	-0.19%	1.59%
Capacity of the Edge Force	50% smaller	-1.23%	-68.19%
	50% larger	0.28%	28.64%
Number of CCA Increment 1	50% fewer	-1.54%	-10.96%
	50% more	1.41%	5.14%
Number of B-21	50% fewer	-4.44%	2.77%
	50% more	4.40%	-4.78%

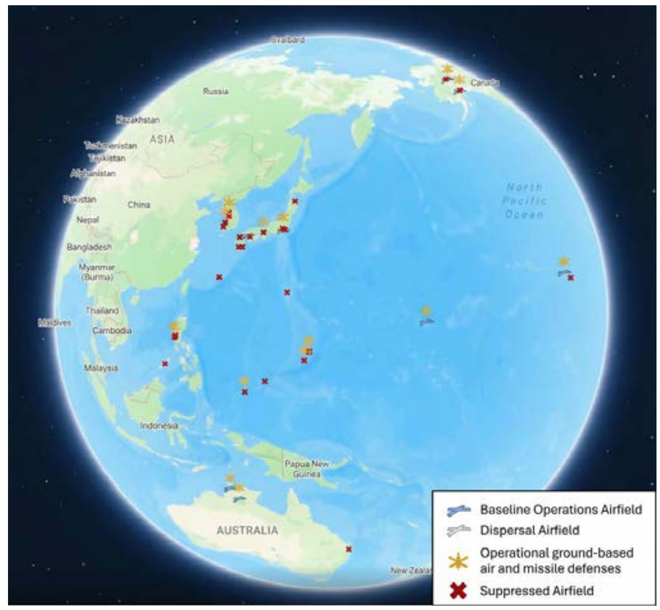
DESCRIPTION OF EXCURSION	CHANGE	IMPACT ON CAMPAIGN SUCCESS	IMPACT ON RED:BLUE AIRCRAFT LOSS RATIO
Number of Red decoy vessels	50% fewer	7.92%	-2.41%
	50% more	-0.97%	0.57%
Blue's ability to discriminate target vessels from decoys	50% worse	-8.04%	-6.02%
	50% better	12.93%	-15.02%

APPENDIX C: DESCRIPTION OF SIMULATION

Simulating a modern, large-scale conflict in the Indo-Pacific region demands approaches that capture both the firepower and vulnerabilities of advanced military forces. To do so, we constructed a simple tool called AVENTOR (Advanced Virtual Environment for Operations Research) with deterministic and stochastic elements. At a theater level, these elements simulate many-on-many engagements, incorporate time-and-distance considerations associated with the Pacific theater, and factor in dynamics such as but not limited to the following:

1. Airfield operations. Red PLARF launchers and PLAAF strike aircraft attack Blue airfields as well as the aircraft and other assets they host. Blue defends against attacks from the ground and air and attempts to reconstitute and sustain air operations. This includes elements such as PLARF battery locations, inventories, and reload times by type; PLAAF strike capacity; runway, taxiway, and ramp space characteristics; aircraft shelters; fuel storage and distribution; munitions storage; ground-based air and missile defenses; and runway repair characteristics and operation.
2. Air combat. Blue aircraft and Blue ground-based counter-air Edge Force units engage and are engaged by Red aircraft.
3. Naval combat. Blue aircraft and Blue and ROC ground launchers and vessels attack Red surface naval forces. Red naval forces can engage Blue aircraft and defeat inbound munitions.
4. Amphibious assault. Red amphibious forces attempt to deliver enough forces to establish a successful lodgment.

Figure C. Image from Blue 1 "Baseline" Simulation Result



5. Operational phasing. Red forces can vary the intensity and geographic distribution of their counter-airfield and air combat attacks and operations. Blue forces can vary the deployment timelines, intensity, and geographic distribution of their Edge Force and aircraft operations.

The tool and its associated results are not intended to predict conflict outcomes. Instead, our goal with the simulation and its use in this report is to capture sensitivities and trade-offs in force architectures and operational employment, and in turn their implications for force design. Figure C depicts high-level results from a simulation run.

ABBREVIATIONS

AAM: air-to-air missile

ADA: air defense artillery

AEW: airborne early warning

AEWC: airborne early warning and control

AMTI: airborne moving target indication

APKWS: Advanced Precision Kill Weapon System

ASM: anti-ship missile

BRICS: Brazil, Russia, India, China, and South Africa

BWB: blended wing body

C2: command and control

C3: command, control, and communications

C5ISRT: command, control, communications, computers, cyber, intelligence, surveillance, reconnaissance, and targeting

CAP: combat air patrol

CCA: collaborative combat aircraft

CCD: camouflage, concealment, and deception

CCP: Chinese Communist Party

CRAF: Civil Reserve Air Fleet

CSG: carrier strike group

CSIS: Center for Strategic and International Studies

DARPA: Defense Advanced Research Projects Agency

DCA: defensive counter-air

DDG: guided missile destroyer

DEAD: destruction of enemy air defense

DLA: Defense Logistics Agency

DoD: US Department of Defense

DoW: US Department of War

FAMM: Family of Affordable Munitions

FY: fiscal year

GLCM: ground-launched cruise missile

HAS: hardened aircraft shelter

HVAA: high-value airborne asset

IADS: integrated air defense system

ICBM: intercontinental ballistic missile

IFPC: Indirect Fire Protection Capability

IPDS: Inland Petroleum Distribution System

ISR: intelligence, surveillance, and reconnaissance

ISRT: intelligence, surveillance, reconnaissance, and targeting

JLO: Joint Long-Range Kill Chain Organization

LRASM: Long Range Anti-Ship Missile

LWIR: long-wave infrared

MSE: Missile Segment Enhancement

MTI: moving target indication

NATO: North Atlantic Treaty Organization

NDS: National Defense Strategy

NGAD: Next Generation Air Dominance

NGAS: Next Generation Air-Refueling System

NRO: National Reconnaissance Office

O&S: operations and support

OPDS: Offshore Petroleum Distribution System

OV: Operational View

PLA: People's Liberation Army

PLAA: PLA Army

PLAAF: PLA Air Force

PLAN: PLA Navy

PLARF: PLA Rocket Force

PMAI: primary mission aircraft inventory

PRC: People's Republic of China

RADR: rapid airfield damage recovery

RDT&E: research, development, testing, and evaluation

RED HORSE: Rapid Engineer Deployable Heavy Operational Repair Squadron Engineer

ROC: Republic of China (Taiwan)

S/DEAD: suppression/destruction of enemy air defense

SAM: surface-to-air missile

SOF: Special Operations Forces

SSN: nuclear-powered submarine

TAI: total aircraft inventory

THAAD: Terminal High Altitude Area Defense

TOC-L: Tactical Operations Center–Light

TTP: tactics, techniques, and procedures

UAS: uncrewed aircraft system

UAV: uncrewed aerial vehicle

USAF: US Air Force

VLR SAM: very long-range surface-to-air missiles

WSS: weapon system sustainment

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111 Our estimates suggest the Pulsed Force could deliver 75–180 percent of the munitions deliveries of the Core Force's fighter aircraft in a notional Taiwan scenario, depending on the fraction of Core Force aircraft a combatant commander devotes to strikes and other factors. This estimate excludes any potential mobility aircraft with palletized munitions.

112 Jennifer DiMascio, "US Air Force Collaborative Combat Aircraft (CCA)," IF12740, Congressional Research Service, August 15, 2024, https://www.congress.gov/crs_external_products/IF/PDF/IF12740/IF12740.2.pdf.

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128 Timothy A. Walton and Shane Dennin, *Resuscitating NGAS and Charting a Path to a Resilient Aerial Refueling Architecture* (Hudson Institute, forthcoming 2026).

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130 Walton and Shugart, *Concrete Sky*, 29.

131 Walton and Shugart, *Concrete Sky*, 28.

132 In challenging scenarios, Resilient Airfields are necessary for three main campaign-level classes of activities. First, in deploying aircraft and other forces into and from the theater, some aircraft will be forward deployed, while more will likely need to be rapidly deployed in a crisis. Other joint forces will also require deployment. Such deployments will count on not only a robust and ready mobility aircraft fleet but also networks of airfields along multiple paths with pre-positioned equipment and supplies throughout the region. Pre-positioning appropriate levels can reduce the amount of cargo that must be transported to deploy aircraft and in turn increase the speed of combat-credible deployments. Secondly, Resilient Airfields support the employment of forces from range. Pulsed Forces such as bombers and Core Force aircraft such as fighters rely on networks of airfields to generate their own aircraft and to generate the aerial refueling tankers necessary to enable them to fly long distances. Lastly, Resilient Airfields allow employment of forces directly from airfields to conduct missions. Resilient networks of prepared fighting positions can allow aircraft to distribute and disperse forces at scale to increase the difficulty of adversary attacks.

133 Walton and Shugart, *Concrete Sky*, 20.

134 Sean M. Zeigler et al., *Assessing Progress on Air Base Defense: Past Investments and Future Options* (RAND, 2025) https://www.rand.org/pubs/research_reports/RRA3142-1.html.

135 Zeigler et al., *Assessing Progress on Air Base Defense*; Christopher Lynch et al., *Operational Imperative: Investing Wisely to Bolster US Air Bases Against Chinese and Russian Attacks* (RAND, 2023), 10, https://www.rand.org/pubs/perspectives/PEA1996-1.html; Stacie L. Pettyjohn, "Spiking the Problem: Developing a Resilient Posture in the Indo-Pacific with Passive Defenses," *War on the Rocks*, January 10, 2022, https://warontherocks.com/2022/01/spiking-the-problem-developing-a-resilient-posture-in-the-indo-pacific-with-passive-defenses; and Walton and Shugart, *Concrete Sky*, 28.

136 Walton and Shugart, *Concrete Sky*, 28.

137 Walton and Shugart, *Concrete Sky*, 24–25.

138 Walton and Shugart, *Concrete Sky*, 28.

139 Greg Hadley, "Silver Star Airpower: Airmen and Guardians Take on Iran," *Air and Space Forces*, February 7, 2025, https://www.airandspaceforces.com/article/silver-star-airpower-airmen-and-guardians-take-on-iran; and Greg Hadley, "Silver Star Airpower: Inside an F-15 Mission to Block an Attack on Israel," *Air and Space Forces*, November 15, 2024, https://www.airandspaceforces.com/silver-star-air-action-usaf-defense-of-israel-part-1.

140 Walton and Shugart, *Concrete Sky*, 28–29.

141 Walton and Shugart, *Concrete Sky*, 29.

142 Walton and Shugart, *Concrete Sky*, 22, 28–29.

143 Walton and Shugart, *Concrete Sky*, 29.

144 Walton and Shugart, *Concrete Sky*, 21.

145 The force architectures included fighter and attack, armed reconnaissance, bomber, AEWC, electronic attack, and aerial refueling aircraft. Transport aircraft were accounted for in force deployment modeling to assess how many forces could be deployed under desired deployment timelines, but were not simulated. The force architectures also included airfield infrastructure and logistics, ground-based air defenses (provided by the US Army ADA branch, or possibly the US Air Force), and Blue 3's proposed Edge Force units. Lastly, the force architectures in the scenario accounted for joint US Army, US Marine Corps, US Navy, and ROC contributions to the campaign.

146 This assessment used the president's budget proposal for FY 2025 as a baseline.

147 Unless otherwise indicated, costs are expressed in constant FY 2026 dollars throughout this report. For Blue 3, if the Army fielded other elements of the proposed Edge Force, the cost difference would be even greater.

148 This is compared to the Air Force's $210 billion FY 2026 budget request, exclusive of reconciliation or pass-through funding to other agencies. Rachel S. Cohen, "A Budget Season Like No Other," *Air and Space Forces*, July 25, 2025, https://www.airandspaceforces.com/article/a-budget-season-like-no-other.

149 For example, with an additional $2 billion per year, the Air Force could acquire 1,000 AAMs ($250,000 each), 1,000 anti-ship missiles ($250,000 each), 500 AAMs ($2 million each), and 100 weapons ($5 million each). For a discussion of approaches to scaling weapons production, see Clark et al., *Ending Self-Imposed Scarcity*; and Nadia Schadlow, Brayden Helwig, Bryan Clark, and Timothy A. Walton, *Rocket's Red Glare: Modernizing America's Energetics Enterprise* (Hudson Institute, 2022), https://www.hudson.org/supply-chains/rockets-red-glare-modernizing-americas-energetics-enterprise.

150 The 15 percent real increase would result in an average of 130 fully funded flight hours per pilot. This assessment was inspired by the assessments conducted by David A. Deptula and Mark A. Gunzinger, "Air Force and Space Force Vectors for the Incoming Trump Defense Team," Policy Paper 59, Mitchell Institute for Aerospace Studies, February 2025, 8, https://www.mitchellaerospacepower.org/app/uploads/2025/02/Air_and_Space_Vectors_Policy_Paper_59-WEB.pdf.

151 In terms of RDT&E, this consists of $0.25 billion for anti-ship munitions launcher groups, $1 billion for stratospheric balloon squadrons, $2.25 billion for VLR SAM squadrons, and $2.25 billion for ground-launched counter-air UAS squadrons.

Anti-ship munitions launcher groups: The force is organized into seven groups with 100 personnel each, and five groups are forward-stationed or deploy in time for the simulation. Each group has 30 launch vehicles, organized into three squadrons. Each launch vehicle can launch five large anti-ship munitions (or a higher number of smaller UAVs or decoys). Therefore, each group can launch up to 150 anti-ship munitions simultaneously. Each unit has two reloads. Therefore, each unit can fire a total of 450 anti-ship munitions, each costing $125,000. The per-group costs consist of five lethal anti-ship munitions per containerized launcher truck (each anti-ship munition costing $125,000 and each launch vehicle costing $500,000), two $5 million command vehicles, and $10 million in additional costs. In total, the anti-ship munitions launcher group costs $639 million to procure and $81 million in annual O&S costs.

Forward ground-based targeting system squadrons: Each unit requires 26 direct personnel and costs $10.2 million. Of the 30 units, 20 are forward-stationed or forward-deploy in time. In total, the forward ground-based targeting systems cost $307 million to procure and $145 million in annual O&S costs.

Stratospheric balloon squadrons: The Air Force would field seven units (with 38 personnel each), of which four would be forward-stationed or deployed with their commensurate balloons and launchers. The total of 38 personnel is relatively low, which reflects that balloon or very-long-endurance UAV (if used as a substitute or complement) launch cycles would occur in initial bursts and then ebb because the assets have endurance of weeks to months. In total, the stratospheric balloon force costs $1.2 billion to procure and $42 million in annual O&S costs.

Procurement and O&S costs: Each VLR SAM squadron costs $376 million, with four missiles per launcher, six launchers per squadron, $4 million per missile, one missile on launcher and two reloads, six other $5 million vehicles, $10 million for short-range sensor(s), and $10 million in additional costs. In total, each squadron has 24 missiles on the launchers and 72 missiles including reloads and requires 70 direct personnel. The Air Force fields 15 VLR SAM squadrons, of which it can forward-station or deploy six in time for the simulation. In total, the VLR SAM squadrons cost $5.6 billion in procurement and $236 million in annual O&S costs. Offensive VLR SAMs are similar to the defensive counter-air SAMs that the US Army ADA branch fields and could be operated as Army ADA batteries.

Ground-launched counter-air UAS squadrons: The force is organized into seven squadrons that each have a total of 142 UAS and 70 personnel. Four squadrons are forward-stationed or deploy in time for the campaign. Each squadron has six launcher trucks. Each launcher truck has five UAS. Therefore, 30 UAS can be launched per squadron salvo. In total, the counter-UAS force costs $4.1 billion in procurement and $113 million in annual O&S costs.

152 The Army recently announced a plan to add two more Patriot battalions (equivalent to eight batteries), which would partially overlap with the proposed force. Todd South and Jen Judson, "Army Plans to Grow Patriot Battalions, Plus One for Guam," *Defense News*, August 4, 2025, https://www.defensenews.com/land/2025/08/04/army-plans-to-grow-patriot-battalions-plus-one-for-guam/.

153 The airfields used in the simulation are not intended to be comprehensive. One airfield in the contiguous United States, Ellsworth Air Force Base, serves to represent air operations from the lower 48 states and has unique airfield database characteristics to enable that in the simulation.

154 Caitlin Lee, "Beyond the Taiwan Scenario: Applying the Dark Arts of Force Planning to Long-Term US-China Competition," Perry World House, University of Pennsylvania, May 21, 2025, https://perryworldhouse.upenn.edu/news-and-insight/beyond-the-taiwan-scenario-applying-the-dark-arts-of-force-planning-to-long-term-u-s-china-competition.

155 Zhang, *Science of Campaigns*.

156 Of the PLARF's launcher inventory by type, US leaders assume 95 percent are available (and the remainder are unavailable due to maintenance or other factors) and the simulation tasks 90 percent to this campaign. It tasks the remaining 10 percent to support nuclear coercion/deterrence (wēishè), discourage opportunistic actions by other countries (e.g. India), and serve as a reserve. Of the launchers available and tasked to this campaign, it devotes two-thirds to counter–US Air Force airfield strike missions. It assumes the remaining third will focus on attacking non–US Air Force enemies, such as Australia, ROC, Japan, Republic of Korea, New Zealand, Philippines, Thailand, and other US Army, US Marine Corps, US Navy, or US Space Force targets. In terms of missiles, the simulation tasks two-thirds of the PLARF inventory for expenditure in the campaign, and the remainder support ***wēishè***, discourage opportunistic actions by other countries, and serve as a reserve. Of the tasked inventory, it allocates two-thirds to attack US Air Force airfields within the first week of the conflict. Of the forces employed in the simulation, PLARF units and their missiles are geographically distributed among 22 brigades sited at known operating areas, and they fire and reload from those areas.

157 Zhang, *Science of Campaigns*.

158 In terms of non–amphibious lift vessels, this force consists of four aircraft carriers, 47 cruisers/destroyers, 84 corvettes/guided missile frigates, and 100 other large vessels and decoys. In terms of amphibious lift vessels, it consists of four amphibious assault ships, nine amphibious transport docks, 46 medium and tank landing ships, 38 large commercial vessels such as roll-on/roll-off ships, cargo ships, and landing platform utility.

159 The PLA has the following units available for the campaign: three PLAN marine brigades (out of six PLAN marine brigades), six PLAA amphibious combined arms brigades, 48 PLAA combined arms brigades (drawn from the eight group armies in the eastern and southern theaters and northern theater commands, which is a subset of the 83 total in the PLAA), and 19 special operations forces (SOF) brigades. We estimate the employment in the initial campaign of three PLAN marine brigades, six PLAA amphibious combined arms brigades, 36 PLAA combined arms brigades, and eight SOF brigades. This amounts to a total of 53 brigades, a portion of which the PLA could deliver by air or by other non–amphibious vessel means that we do not account for. This force is a subset of the larger 1.5–2 million active and reserve ground unit PLA personnel. A full amphibious combined arms brigade amounts to an estimated 5,000 personnel and 400 vehicles.

Information used to generate these estimates was drawn from Dennis J. Blasko, *The PLA Army Amphibious Force*, China Maritime Report No. 20 (China Maritime Studies Institute, 2022), https://digital-commons.usnwc.edu/cgi/viewcontent.cgi?article=1019&context=cmsi-maritime-reports; J. Michael Dahm, *More Chinese Ferry Tales: China's Use of Civilian Shipping in Military Activities, 2021–2022*, China Maritime Report No. 25 (China Maritime Studies Institute, 2023), https://digital-commons.usnwc.edu/cgi/viewcontent.cgi?article=1024&context=cmsi-maritime-reports; and *Military and Security Developments Involving the People's Republic of China*.

The lifts-per-day estimate assumes an average distance of 200 nm to landing zones, a transit speed of 15 knots, two hours for marshaling, two hours for unloading, and eight hours for entering and exiting port, loading, refueling, and other demands.

160 This assessment accounts for the number of ROC Army Active Component, Army Reserve-B, Army Reserve-C, and Marine Corps units. It then applies factors to consider the fraction of forces that the ROC would successfully activate and that would reach their mission locations. It assumes the ROC would divide its defending forces among six general invasion defense sectors (one on offshore islands, two in north, one in central west, one in east, and one in southwest) and that the PLA focuses its attack on two sectors. It estimates that 74,128 ROC defenders would be ready to counter attacks. Furthermore, the assessment uses a conservative threshold of one soldier greater than a 1:1 ratio, which is less than historic 3:1 or more attacker-to-defender ratios. Despite the many advantages that accrue to defending forces, we took this conservative approach since PLA forces may have enormous fires and capability advantages over defending ROC forces. If ROC forces could fight even more effectively, then the number of amphibious vessels that the PLA would need to land would be even higher. Information about ROC forces drawn from Ian Easton, Mark Stokes, Cortez A. Cooper III, and Arthur Chan, *Transformation of Taiwan's Reserve Force* (RAND, 2017), https://www.rand.org/pubs/research_reports/RR1757.html.

161 Table 5 lists Blue other-service and ROC anti-ship forces employed in the simulation. Other forces would likely be conducting anti-ship operations not accounted for in the simulation. For example, although two or more carrier strike groups (CSGs) may be available to conduct operations in the Pacific, only one is assumed to be

conducting attacks against the amphibious invasion fleet and its surrounding screening formations. Thus, only one CSG is shown in table 5. Of note, the simulation does not account for the important contributions of non–aircraft carrier naval aviation, such as Marine Corps aviation assets operating from amphibious vessels or from shore, or other naval aviation aircraft operating from shore.

162 Unless otherwise indicated, outputs over time show the average results over six-hour periods. Moreover, given that the simulation uses probability functions to evaluate some engagements, each scenario was run 1,000 times, and the mean of the outputs is shown. Percentages and numbers are rounded to whole numbers.

163 In both cases, Red's success was narrow and could possibly have failed due to a variety of unexpected conditions from weather to other allied or joint force contributions.

164 Depending on its architecture, Blue could kill up to 1,330 Red flight crew; an estimated 75,870 maritime personnel and 68,550 amphibious assault troops would be onboard vessels that Blue mission-killed or destroyed, a large portion of which would perish.

165 Cancian et al., *The First Battle of the Next War*.

166 Airfields were considered suppressed when, due to attacks, they lacked any usable runways or taxiways of at least 5,000 ft. Airfields were considered destroyed when, due to attacks, their runways and taxiways were too damaged to support fighter operations and could no longer be reconstituted (due to a lack of RADR kit supplies) or their fuel stores were eliminated.

167 Bill Gertz, "Indo-Pacific Commander Plans 'Hellscape' for China's Military in Taiwan Strait," *Washington Times*, June 14, 2024, https://www.washingtontimes.com/news/2024/jun/14/indo-pacific-commander-plans-hellscape-chinas-mili.

168 The weighted average mission radius for aerial refueling tankers was 2,750 nm. At that distance, single KC-135 or KC-46A tankers could deliver fewer than 50,000 lb of offload to receivers, which necessitated force extension missions in many cases.

169 In response, Red could reduce the number of escort vessels that guard the fleet at any one time and cycle ships on station. But this would reduce the number at the start of the conflict, which would decrease amphibious vessel survivability. Alternatively, Red could field more weapons with deeper magazines, such as higher-capacity missiles, guns, or directed energy systems.

170 Although modeled as a limit on deployment amounts and timelines (but not simulated), Core Force transport aircraft deployed surging units into the theater during the crisis and would continue to fly forces and supplies into and out of the theater during the campaign.

171 Clark et al., *Ending Self-Imposed Scarcity*.

172 R. Z. Alessi-Friedlander, "Learning to Win While Fighting Outnumbered: General Donn A. Starry and the Challenge of Institutional Leadership During a Period of Reform and Modernization," *Military Review*, April 26, 2017, https://www.armyupress.army.mil/Journals/Military-Review/Online-Exclusive/2017-Online-Exclusive-Articles/Learning-to-Win-While-Fighting-Outnumbered.

173 PLAAF flight hour estimate was drawn from Venable, "USAF's Capacity, Capability, and Readiness Crisis."

174 Bryan Clark, Dan Patt, and Timothy A. Walton, *Can the US Regain Battlefield Superiority Against China? Applying New Metrics to Build an Adaptable and Resilient Military* (Hudson Institute, 2022), https://www.hudson.org/national-security-defense/can-the-u-s-regain-battlefield-superiority-against-china-applying-new-metrics-to-build-an-adaptable-and-resilient-military.

175 The tankers were estimated to cost $250 million each, or approximately $25 million more than a KC-46A bridge tanker.

176 The acceptable level of risk to tankers on the ground was modeled as 1 percent or less of the tanker fleet committed to the campaign per day. Tanker laydowns were developed using modeling in Walton and Dennin, *Resuscitating NGAS*. Other benefits of medium-sized BWB designs could include lighter deployment force package footprints, which could reduce the tanker fleet's demand on cargo mobility aircraft.

177 The analysis assessed KC-46A, KC-46B (notional variant of a KC-46 with 10 percent lower fuel flow engines), a notional 777-800 tanker, large-sized BWB, medium-sized BWB, medium-sized reduced signature tanker, and collaborative tanker aircraft in direct delivery and shuttle tanking modes of operation. Aircraft laydowns were optimized to maintain expected attrition on the ground at 1 percent of the committed force per day or less. For more information, see Walton and Dennin, *Resuscitating NGAS*.

178 The simulation uses Blue 1's baseline force and laydown as a point of comparison. It assumes a 70 percent PMAI rate for tankers, that 25 percent of the PMAI fleet is held in reserve, and that 50 percent of the force dedicated to the campaign are engaged in non-simulation relevant tasks (i.e., maintaining strategic deterrence, defense of the homeland, and other operations in other theaters). New tanker types are assumed to replace KC-135s on a 1:1 basis. The baseline TAI consists of 239 KC-46A and 227 KC-135, which results in 63 KC-46A and 59 KC-135 employed in the simulation. In terms of Alternative 1, KC-46A and medium-sized BWB mostly operate in direct delivery mode, with some medium-sized BWB being force extended by KC-46A. In terms of Alternative 2, some KC-46A operate in direct delivery mode, while others act as parent tankers for child medium-sized reduced signature tankers that shuttle tank. In terms of Alternative 3, some KC-46A operate in direct delivery mode, while others act as parent tankers for child collaborative tanker aircraft that shuttle tank. In terms of standback distances from threats, medium-sized BWB is assumed to be able to deliver fuel 200 nm closer to threats than the KC-46A, medium-sized reduced signature is assumed to be able to deliver fuel 400 nm closer to threats than the KC-46A, and collaborative tanker aircraft is assumed to be able to deliver fuel 300 nm closer to threats than the KC-46A. In terms of the simulation results, the medium-sized reduced signature design surprisingly generated a negative result in terms of the number of Red amphibious vessel loads that land on Taiwan as a result of it requiring a considerable number of KC-46A parent tankers to supports its shuttling oper-

ations, which in turn reduces the number of KC-46A available to support other tasks. Although this result merits critical examination, it illustrates how shuttle tanking requires a significant number of parent tankers. For more information, please see Walton and Dennin, *Resuscitating NGAS*.

179 Even greater improvements in performance were observed for runs involving Blue 1 and Blue 2—especially in cases in which medium-sized BWB and Resilient Airfields investments were funded.

180 Of note, the risk to different classes of aircraft varies across strategies. In general, in Early Core Force commitment cases, Red destroys relatively more Core Force non-mobility aircraft at airfields and in the air, while it destroys fewer bomber aircraft. This occurs mostly as a result of less attrition in the air thanks to Core Force counter-air actions, and partly because of a slightly lower Red targeting of intermediate and distant strongpoint airfields due to the need to allocate more Red strike sorties to attack forward and intermediate airfields with Core Force aircraft. In contrast, in Delayed Core Force commitment cases, bomber attrition relatively increases (because there is less Blue counter-air activity by the Core Force and because Red can devote more strike sorties to attacking bomber airfields) and Core Force aircraft attrition decreases. For example, in the 25 percent reserve and Early Core Force commitment strategy, on average Blue 3 loses 170 Core Force aircraft and eight bombers. In the 50 percent reserve and Delayed Core Force commitment strategy, Red destroys only 98 Core Force aircraft but 22 bombers. The early strategy results in slightly fewer personnel casualties but a greater loss in strike potential. These two cases are but some of the types of trade-offs that commanders will need to consider.

181 Other joint forces could also play a similar role. For example, Navy uncrewed surface vessels with sensors and SAMs could also engage enemy aircraft.

182 Charles Q. Brown, "Accelerate Change or Lose," US Air Force, August 2020, https://www.af.mil/Portals/1/documents/2020SAF/ACOL_booklet_FINAL_13_Nov_1006_WEB.pdf; and "CSAF Releases Action Orders to Accelerate Change Across Air Force," US Air Force, December 10, 2020, https://www.af.mil/News/Article-Display/Article/2442546/csaf-releases-action-orders-to-accelerate-change-across-air-force.

183 For more information, see chapter 9, "Force Architectures and Insights from Scenario Analysis."

184 The 2025 USAF & USSF Almanac reported that in 2024 there were 137 9T5 basic special warfare enlisted airmen, 540 19Z special warfare personnel, and 1,288 1Z3 tactical air control party personnel for a total of 1,965 personnel. The 3,358 direct personnel required for the Edge Force exceeds the pool of Air Force special tactics personnel. But a portion of the special tactics community could take on Edge Force capabilities, while the Edge Force cadre grows. Resilient Airfields would require an additional 5,200 RED HORSE personnel, which would more than double the force; up to 1,489 additional personnel for infrastructure and logistics; and 1,500 personnel for air and missile defense. These significant numbers will need to come from a mix of force structure rebalancing and growth in the Air Force.

185 John A. Tirpak, "Air Force: Test B-21s Could Fly Combat Missions, Northrop Can Expand Production at Plant 42," *Air and Space Forces*, July 14, 2025, https://www.airandspaceforces.com/air-force-test-b-21s-could-fly-combat-missions-northrop-can-expand-production-at-plant-42.

186 "The Path to the Blended Wing Body Demonstrator Is Reaching New Heights," Assistant Secretary of the Air Force for Energy, Installations, and Environment, US Department of the Air Force, May 13, 2025, https://www.safie.hq.af.mil/news/article-display/article/4183729/the-path-to-the-blended-wing-body-demonstrator-is-reaching-new-heights.

187 Costs consider RDT&E, procurement, and O&S over 15 years.

188 "About the DAF Battle Network," Air Force Material Lifecycle Management Center, US Air Force, https://www.aflcmc.af.mil/c3bm/daf-battle-network/; Greg Hadley, "Air Force Buys More Mobile Command Centers That Fit in a C-130," *Air and Space Forces*, August 12, 2025, https://www.airandspaceforces.com/air-force-buys-more-mobile-command-centers-that-fit-in-a-c-130/?src=dr.

189 For example, development and incorporation of the Adaptive Engine Technology Program (AETP) engine on new or existing F-35A could extend the organic range of the aircraft by up to 30 percent, reducing the fleet's reliance on aerial refueling and improving its combat performance. Cole Massie, "The Real Deal: GE Aerospace's XA100 Campaign Lays the Foundation for Next-Gen Engines," GE Aerospace, April 24, 2025, https://www.geaerospace.com/news/articles/real-deal-ge-aerospaces-xa100-campaign-lays-foundation-next-gen-engines.

190 For example, fielding high-volume, longer-range weapons could provide new ways to operate the force. These weapons could create a virtuous cycle in which enemies' search volume to locate and attack aircraft would increase, in turn reducing strike aircraft escort burdens, reducing mission times (and increasing sortie rates), and reducing aerial refueling demands of strike and escort aircraft, which increases aerial refueling sorties available for other demands. Conversely, high-capacity, short-range weapons could increase the defenses of critical assets.

191 Frank Kendall, "By Cutting Science, the Defense Department Is Eating Its Seed Corn", *Defense News*, July 24, 2025, https://www.defensenews.com/opinion/2025/07/24/by-cutting-science-the-defense-department-is-eating-its-seed-corn/.

192 Heather R. Penney, *Want Combat Airpower? Then Fix the Air Force Pilot Crisis* (Mitchell Institute for Aerospace Studies, 2025), https://www.mitchellaerospacepower.org/want-combat-airpower-then-fix-the-air-force-pilot-crisis. Venable, "USAF's Capacity, Capability, and Readiness Crisis"; Martin et al., "Births in the United States, 2024."

193 This estimate assumes the US Air Force will require additional personnel for all of the new infrastructure, logistics, passive defense, and active defense assets it fields. This includes the 1,500 direct personnel that Blue 3 requires to field 15 additional PAC-3 MSE (or comparable) batteries.

194 In the baseline Blue 1 force, the number of Red amphibious vessel loads that land would reach 578, which is 52 percent more than Blue 1's baseline case. For Blue 3, the number of Red amphibious vessel loads nearly doubles from 139 to 266, which is still less than the required 322 but much closer.

195 Maritime modes of delivery, such as medium-range tankers, shallow draft tankers, and articulated tug barges, could deliver from relevant ports on the West Coast of the contiguous United States to the Western Pacific two or more orders of magnitude more fuel than transport aircraft such as C-130s and C-17s, even when operations extend over the course of a month.

196 Timothy A. Walton, "Resilient Refueling Beyond Red Hill," *RealClearDefense*, March 14, 2022, https://www.realcleardefense.com/articles/2022/03/14/resilient_refueling_beyond_red_hill_821616.html.

197 SHIPS for America Act of 2024, H.R.10493, 118th Cong. (2024), https://www.congress.gov/bill/118th-congress/house-bill/10493/text/ih.

198 Stefano D'Urso, "Operation Midnight Hammer: How US B-2 Bombers Struck Iran Undetected," The Aviationist, June 22, 2025, https://theaviationist.com/2025/06/22/operation-midnight-hammer/.

199 "Collective Defence and Article 5," NATO, July 4, 2023, https://www.nato.int/cps/en/natohq/topics_110496.htm.

200 "Operation Eagle Assist," Global War on Terrorism, June 17, 2023, https://gwot.org/docs/operation-eagle-assist.

201 Rebecca Grant, "E-7 Wedgetail Shock Threatens Air Superiority in the Pacific," National Security Journal, August 1, 2025, https://nationalsecurityjournal.org/e-7-wedgetail-shock-threatens-air-superiority-in-the-pacific.

202 Michael Marrow, "Air Force reverses course on Integrated Capabilities Command," *Breaking Defense*, October 15, 2025, https://breakingdefense.com/2025/10/air-force-reverses-course-on-integrated-capabilities-command/.

203 Mitchum and Walton, "Building a Force That Wins," 11:15.

204 Of note, Blue 4 fields a smaller Edge Force of 10 VLR SAM squadrons, 5 anti-ship munition groups, 10 forward ground-based targeting system squadrons, and 300 stratospheric balloons. Moreover, the OA-1K Skyraider II program, which would provide light attack and armed ISR in uncontested or lightly contested airspace, has been cancelled. See Greg Hadley, "SOCOM Cuts Armed Overwatch Buy from 75 to 62 Aircraft," March 19, 2024, https://www.airandspaceforces.com/socom-oa-1k-armed-overwatch-cut-2026/.

205 This section and its prompt mimic the language in Walton and Shugart, *Concrete Sky*, 28.

206 "Air Force Core Missions," US Air Force, August 15, 2013, https://www.af.mil/News/Article-Display/Article/466868/air-force-core-missions.

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