

# Managing Risk in Force Planning

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**T**he United States is a global power with global commitments. As such, it cannot focus on a single problem or threat to the exclusion of others, nor can it seek to minimize risk across the board. To do so would be financially infeasible. Instead, the United States must seek to manage risk, setting priorities and allocating scarce resources to the most salient threats while accepting risk in other, less critical areas. As the United States enters another defense budget downturn, these choices become even more challenging as Congress and the Department of Defense (DOD) must grapple with what programs to cancel, curtail, or at least defer to balance the books.

Although the fiscal year (FY) 2022 defense budget request is essentially flat after accounting for inflation, rising internal costs, particularly for operations and maintenance (O&M) and compensation for U.S. servicemembers, mean that DOD must find savings elsewhere to offset this cost growth.<sup>1</sup> Congress, already aware of the many programs and expenses for which the Pentagon has requested funding, will deliberate on the implications of budgets that fall short of needs. This typically leads to hearings during which a Member asks someone from the Pentagon about the potential consequences of a loss of funding for something or another and the answer is usually, “Well, we’d have to operate at increased risk.”

Although correct in the strict sense, when the term “risk” is used repeatedly in this vague manner to explain the implications of virtually any defense cut, it quickly loses all meaning.

This lack of clarity and understanding of risk undermines effective decision-making for defense planning—something the United States cannot afford at a time of simultaneously growing threats to U.S. national security and fewer resources with which to deal with them.

## Risk to What?

The first step in reaching a more precise understanding is to clarify what is at risk. From a force planning perspective, there are two relevant types of risk: operational and strategic. When Pentagon officials testify before Congress about the potential implications of programmatic cuts, they are typically referring to a form of operational risk, which broadly refers to the probability that a military force will be unable to achieve an operational mission objective set out for it within the current defense strategy.

The objectives of a national defense strategy are operationalized in a “force planning construct” that defines the number, types, and frequency of operations for which the U.S. military should be sized and shaped to support. For example, the unclassified summary of the 2018 National Defense Strategy (NDS) outlines that the U.S. military should be sized and shaped to “deter aggression in three key regions—the Indo-Pacific, Europe, and Middle East; degrade terrorist and WMD threats; and defend U.S. interests from challenges below the level of armed conflict” in peacetime.<sup>2</sup> In wartime, “the fully mobilized Joint Force will be capable of defeating aggression by a major power;

detering opportunistic aggression elsewhere; and disrupting imminent terrorist and WMD threats.”<sup>3</sup> The strategy also requires the U.S. military to remain prepared to “deter nuclear and non-nuclear strategic attacks and defend the homeland” in both peace and wartime.<sup>4</sup>

Broadly, the U.S. military’s ability to meet these objectives can be compromised in one of two ways:

- It lacks the capability and/or capacity to achieve current and future military objectives (risk to mission), or
- It is unable to provide and sustain the force over time at an acceptable level of readiness and across the range of objectives it is expected to execute (risk to force).

**Risk to Mission.** Risk to mission reflects the force’s capability and capacity to conduct current operations at an acceptable human, material, and financial cost as well as its expected performance against emerging or anticipated threats as laid out in the defense strategy. Whereas current operations have focused on the ongoing conflicts in Iraq and Afghanistan, as well as on deterring rogue regimes such as North Korea, the 2018 NDS made clear that the priority would now be confronting Russia and/or China. However, because these are not active conflicts, risk to mission relative to these objectives must be assessed against planning scenarios.

The most important and stressing scenarios for which the 2018 NDS called on the services to prepare involve defeating the invasion of a U.S. ally or friend by China or Russia before the invader can achieve a *fait accompli*.<sup>5</sup> In this context, a *fait accompli* involves a peer adversary seizing territory before the U.S. military can respond effectively and then presenting an escalation dilemma that would coerce the United States and its allies into relenting and accepting the new status quo.<sup>6</sup>

DOD planning scenarios include a Chinese invasion to occupy Taiwan and a Russian

invasion of NATO’s eastern flank, mostly likely in the Baltic Sea region. In recent years, when DOD and others have used war games to assess these scenarios, the United States military has consistently lost.<sup>7</sup> Given these discouraging results, the question that naturally follows is: What can be done to reduce this risk to mission?

It is widely acknowledged that DOD suffers from both capability and capacity shortfalls. However, a better understanding of what they are and how to address them requires operating concepts that link DOD’s planning guidance to its resource requirements. In other words, how much of what type of military power is needed to do what the planning scenarios or strategy demand?

Operating concepts seek to solve operational challenges—in this case Russia’s or China’s *fait accompli* strategies—by describing the military objectives that military forces should achieve and how those forces should be organized and employed to achieve them in the smartest possible fashion. Critically, by describing solutions to concrete problems in terms that are understandable to all relevant stakeholders, operating concepts foster better understanding of what capabilities and force structure are needed, convey the potential implications of not resourcing a given program, and provide a foundation for an assessment of where potential tradeoffs exist—including across services—to accomplish a mission in the most effective and efficient manner possible.

The Army’s experience with its AirLand Battle doctrine provides insight into how operating concepts can help to focus attention on operational risks and close gaps between strategy and resources. In the wake of the Vietnam War, the Army found itself with a force that had hollowed out its high-end warfighting capabilities for a potential conflict against the Soviet Union to prioritize organizing, training, and equipping forces to support irregular warfare and counterinsurgency operations in Southeast Asia. To rebuild itself, the Army focused on the most salient, threat-based problem of the

day: a Soviet attack by a numerically superior force against NATO in Central Europe.

AirLand Battle, a combined-air/land doctrinal concept, sought to address this problem with land forces maneuvering in an aggressive defense while air forces attacked rear-echelon enemy forces feeding their front. By providing an understandable framework for how the services would execute the concept, AirLand Battle helped to rationalize and build support for the Army's "Big Five" modernization priorities: the M-1 Abrams tank, Bradley Infantry Fighting Vehicle, Apache attack helicopter, Black Hawk utility helicopter, and Patriot air defense system, all of which continue to be mainstays of the Army today. Critically, the concept also acknowledged the limitations of what the Army could accomplish on its own and fostered greater interservice cooperation and synchronization, recognizing that the Air Force was better suited to providing deep attacks beyond the forward edge of the battle area.

**Risk to Force.** Risk to force relates to the ability of the services to generate and sustain military forces over time. Risk to force can manifest itself in several ways. For example, the military could struggle to meet current campaign and contingency mission requirements, which could be an issue of either supply of or demand for forces. On the supply side, the force could be too small to maintain sustainable force rotations at the desired operational tempo and for all the tasks the defense strategy expects it to execute. Over time, this kind of force generation imbalance can break the force: too few people and too little equipment trying to handle too much work.

This has been a chronic problem for the Air Force, which since the end of the Cold War has received insufficient funding to modernize and recapitalize its force.<sup>8</sup> Unable to procure enough aircraft to modernize its fleet, the Air Force has had to rely on an aging and progressively smaller force, which in turn costs more to maintain and therefore crowds out even more resources that could have been used to acquire newer aircraft. The bomber force is

emblematic of this modernization death spiral. After almost three decades of budget pressures, the bomber force has dropped from a high of 422 bombers in FY 1988<sup>9</sup> to just 158 today.<sup>10</sup> At the same time, demand for bombers has risen dramatically, with one Air Force commander noting that the mission-driven need for bombers has risen 1,100 percent over a five-year period.<sup>11</sup>

The lack of sufficient funding for new aircraft combined with higher-than-expected usage of current aircraft has accelerated the wear and tear on the bomber force. This dynamic is why the Air Force felt compelled to retire 17 of its most worn B-1Bs to sustain the remaining bombers and to help fund its modernization programs.<sup>12</sup> A similar pattern holds across most of the Air Force fleet, 44 percent of which is now operating beyond its planned service life.<sup>13</sup>

The flip side of this is that the demand for forces from combatant commanders may be more than the military can support. Some analysts have recently pointed out the need to review and potentially curb combatant commanders' "unbounded demands for U.S. forces, primarily for an ever-growing list of presence missions" for which they "have no incentive to be sparing."<sup>14</sup> This puts tremendous strain on the service chiefs, who must balance meeting the demand for forces from combatant commanders with other priorities such as much-needed force modernization.

In recent years, all of the services have struggled to keep up with demand for their forces.

- To help bridge the gap between retiring its aging KC-10s and KC-135s and bringing its new KC-46s online, the Air Force was thinking of contracting privately operated tankers to help meet more than 25,000 hours of non-supported flying hours.<sup>15</sup>
- Navy aircraft carriers have repeatedly had to conduct back-to-back deployments without major maintenance periods. Last year, the USS *Stout*, a guided missile

destroyer, spent a record 215 straight days at sea, reflecting a U.S. Navy without enough ships to execute the tasks required of it.<sup>16</sup>

- The Army has struggled with deployment to dwell time ratios far above what is sustainable in the long term for the current force.<sup>17</sup>

Another way risk to force can manifest itself is through attrition in the execution of missions that leaves forces vulnerable or unable to respond to other challenges. Over the past several decades of operating against less capable adversaries, the U.S. military has grown accustomed to astonishingly low attrition rates. Quite simply, this would not be the case in the event of a peer conflict. For context, during the 1973 Yom Kippur War, the Israeli Air Force (IAF) lost 102 of its 390 aircraft in 19 days of operations against a peer adversary (a collection of Arab countries led by Egypt and Syria) and suffered a total aircraft lost or damaged rate of 4.8 percent during the first week of fighting.<sup>18</sup>

If the U.S. Air Force continues to skew its forces toward older aircraft that lack the degree of survivability that will be needed to operate in future threat environments, it should expect to experience similar loss rates or worse in a conflict with China or Russia. A recent analysis by the Mitchell Institute for Aerospace Studies shows that if a similar 5 percent attrition rate were applied to U.S. fighters in a simulated conflict with China, a U.S. force of 791 combat-coded fighters could be reduced to 236 fighters remaining available after just 19 days of combat.<sup>19</sup>

Lacking any spare capacity, it would take years to recover from such losses, during which time the United States would be exceedingly vulnerable to other threats. For example, a recent study determined that it would take the industrial base an average of 8.4 years at surge production rates to replace current inventories of combat aircraft, ships, and other major weapons systems.<sup>20</sup>

Of course, this risk is not limited to platforms. The Air Force has an ongoing shortage of pilots that, despite reduced competition from airlines due to the COVID-19 pandemic, has not abated.<sup>21</sup> The lack of sufficient pilots even during a time of relative peace means that virtually no elasticity exists to replace highly trained combat pilots in the event of combat casualties. As with aircraft, it would take years and significant investments to replace these lost pilots. According to a recent RAND study, it costs between \$5.6 million and \$10.9 million to train a basic qualified fighter pilot.<sup>22</sup> Replacing potentially hundreds of pilots lost in battle would be enormously expensive just in dollars, not to mention the time it takes to train new pilots.

Shortfalls in munitions and other expendables are also a perpetual concern.<sup>23</sup> In a peer conflict, current inventories of preferred munitions such as Advanced Medium-Range Air-to-Air Missiles (AMRAAM) and Joint Air-to-Surface Standoff Missiles (JASSM) would be expended rapidly and could not be replenished quickly. Once depleted, U.S. forces would have to reduce their operational tempo or revert to less effective and shorter-range weapons that expose the launching aircraft to greater risk from enemy defenses.

## Risk to National Interests

Strategic risk relates to threats posing dangers directly to the United States including its population, territory, civil society, critical infrastructure, and/or interests. The 2018 NDS encapsulates what this means in practice for the Department of Defense as being “prepared to defend the homeland, remain the preeminent military power in the world, ensure the balances of power remain in our favor, and advance an international order that is most conducive to our security and prosperity.”<sup>24</sup>

Assessing strategic risk involves a complex cumulative judgement based on the priorities assigned to various objectives within a given strategy as well as the aggregated operational risk. As noted, there is strategic risk inherent in every defense strategy: There simply are not

enough resources to minimize risk across the board. Instead, a well-crafted defense strategy manages risk by establishing priorities based on its assessment of what the most salient threats are and, by extension, accepting more risk in areas deemed less critical. For example, the 2018 NDS prioritizes confronting China and Russia at the expense of dedicating a greater share of resources to combating terrorism.

Whereas the prioritization and reorientation of DOD's planning and resourcing toward great-power competition are reasonable and long overdue, other strategic risks accepted by the 2018 NDS warrant greater scrutiny. One notable example is the fact that its force planning construct requires the services to organize, train, and equip to fight either China or Russia—not both. This single-war condition represents a significant break from previous post-Cold War defense strategies, all of which considered it critical that the U.S. maintain the capacity to fight two wars nearly simultaneously. The logic of the two-war strategy was to have sufficient capacity and capability to deter a second opportunistic aggressor from taking advantage of a U.S. military that is already engaged against a different adversary in another theater.

The timing of the shift to a single-war construct is perplexing, considering that the United States faces more threats today than at any other time since the end of the Cold War. Rather than being strategy based, this situation was driven by arbitrary budgets set by Congress without any relationship to the content of the national security and national defense strategies. The reality is that senior DOD leaders have concluded that a two-war force cannot be achieved with the budget constraints imposed by Congress.<sup>25</sup> Unfortunately, the current DOD budget does not even support the projected cost of rebuilding the U.S. military to win a single war against a great-power adversary at a moderate level of confidence.

Simply put, the U.S. military today lacks the capacity and capability to defeat China in a military conflict.<sup>26</sup> Although perhaps understandable from a budgetary perspective, this

also increases the strategic risk that a second adversary could launch a major military operation that threatens America's vital interests. For example, the United States risks failing to defend NATO from opportunistic Russian aggression if U.S. forces are already locked in an existential fight with China in the Indo-Pacific theater.

The DOD leadership has a responsibility to make clear to the current Administration, the Congress, and the American people the shortfalls and risks to readiness of a defense budget that is unable to meet the requirements of the national defense strategy, and this requires a clear problem statement. For example, the Air Force's 2018 statement of need for 386 operational squadrons—24 percent larger than the 312 that exist today—made clear what was necessary to meet the demands of the national defense strategy. That requirement has not changed.

The services must submit budgets in accordance with directed guidance from the White House, but they also have a responsibility to advocate for what they need to execute the defense strategy. Conflating budget submissions with the actual defense strategy requirement can give the false impression that missions can be met no matter how small the budget may be.

Historically, the military services recognized a *planning force* (what it needed) and a *programming force* (what the budget allowed). The space between the two was a measure of risk. The planning force was eliminated in the late 1990s, and there is now no easy means to recognize the gap between what the military needs to execute the defense strategy and what it can field with the budget that it is issued.

The Biden Administration should reinstate the process of submitting both a planning force and a programming force. The formal re-establishment of the planning force on an annual basis would provide a visible measure of risk between what the military has and what it needs.

Given its more abstract nature, strategic risk is rarely discussed in the context of programmatic or capability decisions. One notable exception to this rule is the United States'

nuclear forces. Since the 1960s, the nuclear triad and its associated nuclear command, control, and communications (NC3) system have served as the bedrock of U.S. national security by providing a continuous deterrent to nuclear-armed adversaries who pose an existential threat to the United States and its allies. Over the past 30 years, however, nuclear modernization programs have repeatedly been truncated, deferred, or cancelled in favor of other programs that were deemed higher priority at the time.

The culmination of these decisions that used nuclear modernization as a “bill payer” is a triad that is on the brink, with nearly all of its major systems operating well beyond their original planned service lives. Although the same critics who argued against previous nuclear modernization initiatives are once again arguing against the need to modernize DOD’s nuclear enterprise,<sup>27</sup> the reality is that failure to modernize America’s nuclear forces in a timely manner would diminish the nation’s strategic nuclear deterrence posture even as the international security environment grows more dangerous, punctuated by Russia and China continuing to invest significant resources into their nuclear forces.

### Risk in Time?

There is also a temporal element to risk: For a given decision, there can be tradeoffs in risk across time. One of the fundamental tradeoffs that defense planners must confront is that between investment in readiness, capability, and capacity.

- Readiness is the condition of forces with respect to their equipment, personnel, skills, proficiency, and sustainment necessary to fight and win the nation’s wars.
- Capability in this context refers not only to old equipment that may still be effective, but also to investments in the future force and is generally reflected in the budgets for modernization and research, development, test, and evaluation (RDT&E).

- Capacity relates to the size of the force, typically measured in terms of end strength or operational units.

The task that confronts the service chiefs and defense planners is attempting to find the proper balance among these three factors, making decisions on when and where to take risk in the current force to prepare for the future or else taking risk in future capabilities if they assess that the demand for current capabilities cannot be put in jeopardy.

Deputy Secretary of Defense Kathleen Hicks has referred to this balancing act as the “iron triangle of painful trade-offs” because defense planners “can nuance the edges of the dilemma, but for the most part, the [triangle] forecloses radical changes in the defense strategy.”<sup>28</sup> She further adds that, in general, as long as U.S. forces are engaged in active conflicts, investments in future capabilities are the most easily deferred.

Two change-minded leaders, Air Force Chief of Staff General Charles “CQ” Brown and Marine Corps Commandant General David H. Berger, recently co-wrote an op-ed that attempts to tilt the readiness balance in favor of modernization by introducing the future into the readiness part of the equation. In line with the 2018 NDS’s decision to accept more risk in the near term to modernize for future conflicts, the service chiefs argue that “we, as members of the Joint Chiefs of Staff, should embrace a framework for readiness that manages the relationship between today’s combatant command requirements with the modernization imperatives required to enable tomorrow’s combatant commanders.”<sup>29</sup>

In other words, they are attempting to reframe readiness in terms of readiness to execute the mission from a capability perspective, which in their assessment requires placing more emphasis on future combat readiness and capabilities even at the expense of current readiness.

On the one hand, they have a valid point. Critical elements of readiness include sufficient and capable forces that can meet the anticipated

threats. Decades of deferred, truncated, or cancelled modernization mean that in the event of a major conflict, the United States would have to rely predominantly on 1970s and 1980s technology. Today, for example, the average Air Force tanker is more than 50 years old, and less than 20 percent and 13 percent of the fighter and bomber fleets, respectively, are stealthy.<sup>30</sup>

Simply put, in view of the way that the character of the threat is advancing, the United States would not be able to sustain the fight against a peer adversary with such outdated equipment even if it achieved 100 percent readiness across its forces. In this sense, the effort by Generals Brown and Berger to redefine readiness to place greater emphasis on modernization has significant merit.

On the other hand, although this effort to change the framework is clever rhetorically, it does not provide a fundamental escape from the iron triangle of painful tradeoffs. The services are making big bets on future technologies that hold potential, such as artificial intelligence and hypersonic weapons, in the hope that they ultimately will help the United States to maintain its comparative military advantage against such peer competitors as China and Russia. Secretary of Defense Lloyd Austin has remarked that the FY 2022 defense budget includes “the largest-ever request for RDT&E for development of technologies,” with Joint Chiefs of Staff Chairman General Mark Milley adding that the budget “biases the future, slightly” over the present.<sup>31</sup>

However, in the rush to modernize, the challenge remains: How well will the military transform for an uncertain future as well as hedge for unexpected contingencies in the present? What remains unsaid is that these investments in the future are coming at the cost of having to divest existing force structure and current combat-credible readiness. Furthermore, budget constraints are compelling the services to divest current forces on the bet that their replacements will be fielded sometime in the next 10 years rather than waiting until the new capabilities have entered the force and demonstrated their combat relevance.

In the hope of staying ahead of the technology curve, the services are also forgoing sufficient procurement of capabilities that are available today. For example, instead of increasing procurement of F-35As to 80 per year as it once intended, the Air Force has requested only 48 F-35As per year in its three most recent budgets. At that rate, the Air Force will not fully field its planned F-35A force until the mid-2040s.<sup>32</sup> Although preparing the force for the future as technology advances is critical, this approach dramatically increases the risk that the United States will lose a peer conflict if it occurs in the near term—something of which potential adversaries are undoubtedly aware and are monitoring closely.

Ideally, the services would be able to fund current combat-credible readiness *and* make significant investments in future capabilities. However, this would be executable only if the military received significant funding increases. Instead, the services are constrained by the current budget environment, and this places them in the uncomfortable position of trying to choose the least bad option. Ultimately, it is up to Congress and the American people to decide whether they are willing to provide the military with the additional resources it needs. But regardless of the outcome, these decisions should be made with a full appreciation of the risks involved in not doing so.

### How Much Risk?

Obviously, not all risks are created equal. The level of risk associated with a given threat or hazard is a function of two variables: the probability that a negative event will occur and the expected severity of the resulting harm. A greater level of risk is assumed either when it becomes more likely that a negative event will occur or when the likely harmful consequences of such an event become more severe. The potential harm or consequences of such an event are in turn estimated by considering the value of the interest at stake, the extent of the damage that can be done, and the permanence of the potential damage inflicted.

Based on the assessed probability and potential consequences of a negative event occurring, each potential threat is characterized with an associated level of risk ranging from low to high. Although bounded to the extent possible by empirical data, risk judgment is ultimately a qualitative effort that depends upon, among other things, the relative importance that a decision-maker assigns to more likely or more consequential threats.

By its nature, risk assessment is an inexact science hampered by a combination of the complexity of the subject matter, uncertainty driven by incomplete knowledge, and the ambiguity that can result in competing yet equally reasonable interpretations of the same sources of risk. However, current defense planners suffer from another, more avoidable challenge: The gap in threat perception between themselves and the broader American public they serve has grown alarmingly wide.

In this sense, the U.S. military has been a victim of its own success. For 30 years, the United States has had the uncontested ability to do virtually whatever it wanted militarily anywhere in the world. Additionally, the size of the force needed for post-Cold War operations in which the United States has engaged was such that the U.S. military could sustain those deployments indefinitely. The result of this recent dominance is that many can no longer conceive of a world in which U.S. military supremacy is not a given, and this has biased the perception of both inputs to the calculation of risk.

*First*, having grown accustomed to U.S. military superiority over lesser adversaries and not having experienced a larger, conventional war in more than 30 years, the public's perception of the likelihood of armed conflict between the United States and a peer competitor such as China or Russia is that it is highly unlikely. Furthermore, the public believes that the United States far outpaces any other power in defense spending—though the margin has in fact narrowed significantly<sup>33</sup>—and this reinforces the belief that even should a conflict occur, it would be virtually impossible for the United States to lose. The reality, however, is

that both the possibility of war and the possibility that the United States might lose are very real and continue to grow more likely as the United States' military advantage in key regions continues to erode.

*Second*, the public also tends to underestimate the potential consequences of the risk posed by China and Russia. Reminiscent of debates during the Cold War over whether the United States would be willing to trade New York for Paris in a potential nuclear exchange, there is significant handwringing today over public willingness to go to war with a major power over Taiwan or Estonia, neither of which is perceived as a vital U.S. national interest. However, the potential consequences are profound. As the 2018 NDS points out, "failure to meet our defense objectives will result in decreasing U.S. global influence, eroding cohesion among allies and partners, and reduced access to markets"<sup>34</sup> that for decades have helped make Americans secure, prosperous, and free.

The fear is that it is going to require a significant defeat to wake up Congress and the American people to the danger. The United States could very well lose the next battle—and perhaps the next war—if it does not change course. Perhaps only then will the Administration, Congress, and the American people realize that the only thing more expensive than a first-rate military is a second-rate one. Unfortunately, by then, it may be too late to reverse the damage.

## Conclusion

Making better-informed decisions about the acceptability of risk and, by extension, what should be done about it requires better communication among all relevant stakeholders: the Administration, defense planners in the Office of the Secretary of Defense, the armed services, Congress, and the American public. Effective communication should aim to reduce potential misunderstandings and potential surprises as they relate to risk.

The single most important step that DOD could take to improve the understanding of



both the nature and the extent of risk would be to require the services to release both a planning force that is sized to meet the demands of the national defense strategy and a programming force that reflects what can be achieved within the constraints of congressional appropriations. In this construct, the difference between the two equates to risk. This would dramatically improve transparency and insight into the degree of risk the U.S. military faces because of differences between what America's armed services need and what they are allocated.

## Endnotes

1. For example, see Congressional Budget Office, *Trends in Spending by the Department of Defense for Operation and Maintenance*, January 2017, p. 2, <https://www.cbo.gov/sites/default/files/115th-congress-2017-2018/reports/52156-omchartbook.pdf> (accessed June 24, 2021).
2. James Mattis, Secretary of Defense, *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge*, U.S. Department of Defense, p. 6, <https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf> (accessed June 24, 2021).
3. Ibid.
4. Ibid.
5. Statement of Elbridge A. Colby, Director, Defense Program, Center for a New American Security, and former Deputy Secretary of Defense for Strategy and Force Development, in stenographic transcript of *Hearing to Receive Testimony on China and Russia*, Committee on Armed Services, U.S. Senate, January 29, 2019, p. 13, [https://www.armed-services.senate.gov/imo/media/doc/19-02\\_1-29-19.pdf](https://www.armed-services.senate.gov/imo/media/doc/19-02_1-29-19.pdf) (accessed June 27, 2021).
6. Dan Altman, "By Fait Accompli, Not Coercion: How States Wrest Territory from Their Adversaries," *International Studies Quarterly*, Vol. 61, No. 4 (December 2017), pp. 881–891, <https://academic.oup.com/isq/article/61/4/881/4781720> (accessed June 27, 2021).
7. Sydney J. Freedberg Jr., "US 'Gets Its Ass Handed to It' in Wargames: Here's a \$24 Billion Fix," *Breaking Defense*, March 7, 2019, <https://breakingdefense.com/2019/03/us-gets-its-ass-handed-to-it-in-wargames-heres-a-24-billion-fix/> (accessed June 27, 2021).
8. Col. Mark A. Gunzinger, USAF (Ret.), and Col. Carl Rehberg, USAF (Ret.), "Moving Toward the Air Force We Need? Assessing Air Force Budget Trends," Mitchell Institute for Aerospace Studies *Policy Papers*, Vol. 21, December 2019, [https://docs.wixstatic.com/ugd/a2dd91\\_65de89ab71114804ae653e7bf95715.pdf](https://docs.wixstatic.com/ugd/a2dd91_65de89ab71114804ae653e7bf95715.pdf) (accessed June 27, 2021).
9. Appendix B, "USAF Total Active Inventory by Aircraft Category, 1950–2016," in Col. James C. Ruehrmund Jr. USAF (Ret.) and Christopher J. Bowie, *Arsenal of Airpower: USAF Aircraft Inventory 1950–2016* (Arlington, VA: Mitchell Institute for Aerospace Studies, 2018), pp. 22 and 28, [http://docs.wixstatic.com/ugd/a2dd91\\_5ddb04fd26e4f72aef6cfd5ee87913f.pdf](http://docs.wixstatic.com/ugd/a2dd91_5ddb04fd26e4f72aef6cfd5ee87913f.pdf) (accessed June 29, 2021).
10. Table 6, "U.S. Air Force Total Aircraft Inventory (Page 1 of 3)," in John Venable, "U.S. Air Force," in *2021 Index of U.S. Military Strength*, ed. Dakota L. Wood (Washington: The Heritage Foundation, 2021), p. 417, [http://thf\\_media.s3.amazonaws.com/2020/Index%20of%20Military%20Strength/PDFs/FINAL/2021\\_IndexOfUSMilitaryStrength\\_WEB.pdf](http://thf_media.s3.amazonaws.com/2020/Index%20of%20Military%20Strength/PDFs/FINAL/2021_IndexOfUSMilitaryStrength_WEB.pdf) (accessed June 29, 2021).
11. Douglas A. Birkey and Lt. Gen. David A. Deptula USAF (Ret.), "Building the Air Force We Need," *Air Force Magazine*, April 15, 2019, <https://www.airforcemag.com/article/Building-the-Air-Force-We-Need/> (accessed June 29, 2021). See also John A. Tirpak, "USAF to Retire B-1, B-2 in Early 2030s as B-21 Comes On-Line," *Air Force Magazine*, February 9, 2018, <https://www.airforcemag.com/USAF-to-Retire-B-1-B-2-in-Early-2030s-as-B-21-Comes-On-Line/> (accessed June 27, 2021).
12. Valeria Insinna, "The 'Bone' Heads to the Boneyard," *Defense News*, February 18, 2021, <https://www.defensenews.com/air/2021/02/18/the-bone-heads-to-the-boneyard/> (accessed June 27, 2021).
13. John A. Tirpak, "Air Force Wants to Cut 421 Old Fighters, Buy 304 New Ones," *Air Force Magazine*, May 14, 2021, <https://www.airforcemag.com/air-force-wants-to-cut-421-old-fighters-buy-304-new-ones/> (accessed June 27, 2021).
14. Mackenzie Eaglen, "Putting Combatant Commanders on a Demand Signal Diet," *War on the Rocks*, November 9, 2020, <https://warontherocks.com/2020/11/putting-combatant-commanders-on-a-demand-signal-diet/> (accessed June 27, 2021).
15. Brian W. Everstine, "Private Tankers Could Help USAF Keep up with Demand," *Air Force Magazine*, March 26, 2020, <https://www.airforcemag.com/private-tankers-could-help-usaf-keep-up-with-unrelenting-need-for-booms/> (accessed June 27, 2021).
16. Megan Eckstein, "No Margin Left: Overworked Carrier Force Struggles to Maintain Deployments After Decades of Overuse," U.S. Naval Institute NI News, November 12, 2020, <https://news.usni.org/2020/11/12/no-margin-left-overworked-carrier-force-struggles-to-maintain-deployments-after-decades-of-overuse> (accessed June 27, 2021).
17. Meghann Myers, "With Retention up and Recruiting down, Here's How the Army Plans to Add 7,500 More Soldiers to the Ranks," *Army Times*, May 7, 2018, <https://www.armytimes.com/news/your-army/2018/05/08/with-retention-up-and-recruiting-down-heres-how-the-army-plans-to-add-7500-more-soldiers-to-the-ranks/> (accessed June 27, 2021).
18. The loss and damaged rate of 4.8 percent and total number of losses were derived from data in Table 2, "Israeli Aircraft Losses, by Date, by Battlefield, and by Aircraft Type, 16–24 October 1973, and Loss Rates as a Percentage of Total Sorties," and Table 4, "Israeli Aircraft Damaged, by Date, by Battlefield, and by Aircraft Type, 16–24 October 1973, and Damage Rates as a Percentage of Total Sorties," in U.S. Central Intelligence Agency, *The 1973 Arab–Israeli War: Overview and Analysis of the Conflict*, Intelligence Report, September 1975, approved for release September 4, 2021, pp. 34 and 42, <https://www.cia.gov/readingroom/docs/1975-09-01A.pdf> (accessed June 28, 2021).

19. Figure 3, "Attrition in a Conflict with China Could Quickly Deplete the USAF's Undersized Fighter Force," in Col. Mark Gunzinger, USAF (Ret.), and Lukas Autenried, *Building a Force that Wins: Recommendations for the 2022 National Defense Strategy* (Arlington, VA: Mitchell Institute for Aerospace Studies, 2021), p. 14, <https://mitchellaerospacepower.org/wp-content/uploads/2021/06/Building-a-Force-that-Wins-FINAL.pdf> (accessed June 27, 2021).
20. Mark Cancian, Adam Saxton, Owen Helman, Lee Ann Bryan, and Nidal Morrison, *Industrial Mobilization: Assessing Surge Capabilities, Wartime Risk, and System Brittleness*, Center for Strategic and International Studies, International Security Program Report, December 2020, pp. ix, 40, and 41, [https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/210108\\_Cancian\\_Industrial\\_Mobilization.pdf](https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/210108_Cancian_Industrial_Mobilization.pdf) (accessed June 27, 2021).
21. Tobias Switzer, "The Air Force Pilot Retention Crisis Is Not Over," War on the Rocks, October 20, 2020, <https://warontherocks.com/2020/10/the-air-force-pilot-retention-crisis-is-not-over/> (accessed June 27, 2021).
22. Michael G Mattock, Beth J. Asch, James Hosek, and Michael Boito, *The Relative Cost-Effectiveness of Retaining Versus Accessing Air Force Pilots* (Santa Monica, CA: RAND Corporation, 2019), pp. xii and 35, [https://www.rand.org/pubs/research\\_reports/RR2415.html](https://www.rand.org/pubs/research_reports/RR2415.html) (accessed June 27, 2021).
23. Aaron Mehta, "The US Is Running out of Bombs—and It May Soon Struggle to Make More," *Defense News*, May 22, 2018, <https://www.defensenews.com/pentagon/2018/05/22/the-us-is-running-out-of-bombs-and-it-may-soon-struggle-to-make-more/> (accessed June 28, 2021).
24. Mattis, *Summary of the 2018 National Defense Strategy of the United States of America*, p. 4.
25. For example, see Jim Mitre, "A Eulogy for the Two-War Construct," *The Washington Quarterly*, Vol. 41, No. 4 (Winter 2019), pp. 7–30.
26. James Kitfield, "'We're Going to Lose Fast': U.S. Air Force Held a War Game that Started with a Chinese Biological Attack," Yahoo News, March 10, 2021, <https://www.yahoo.com/entertainment/were-going-to-lose-fast-us-air-force-held-a-war-game-that-started-with-a-chinese-biological-attack-170003936.html> (accessed June 27, 2021).
27. David Deptula, "Five Persistent Misconceptions About Modernizing the U.S. ICBM Force," *Forbes*, December 22, 2020, <https://www.forbes.com/sites/davedeptula/2020/12/22/five-persistent-misconceptions-about-modernizing-the-us-icbm-force/?sh=4c1054a93ba7> (accessed June 27, 2021).
28. Kathleen H. Hicks, "Defense Strategy and the Iron Triangle of Painful Trade-offs," Center for Strategic and International Studies, International Security Program, June 22, 2017, p. 2, [https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/170622\\_Hicks\\_DefenseStrategy\\_Web.pdf?gt9Hy9FEzDPK408FsFG4KFZJ\\_bPDqJLW](https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/170622_Hicks_DefenseStrategy_Web.pdf?gt9Hy9FEzDPK408FsFG4KFZJ_bPDqJLW) (accessed June 28, 2021).
29. Gen. Charles Q. Brown, Jr., and Gen. David H. Berger, "Redefine Readiness or Lose," War on the Rocks, March 15, 2021, <https://warontherocks.com/2021/03/redefine-readiness-or-lose/> (accessed June 28, 2021).
30. Table, "Aircraft Total Inventory (TAI) (As of Sept. 30, 2019)," in "Air Force & Space Force Almanac 2020," *Air Force Magazine*, Vol. 103, No. 6 (June 2020), p. 63, [https://www.airforcemag.com/app/uploads/2020/06/June2020\\_Fullissue5.pdf](https://www.airforcemag.com/app/uploads/2020/06/June2020_Fullissue5.pdf) (accessed June 28, 2021). Of U.S. Air Force fighters and bombers, only the F-22A and F-35A in the fighter/attack inventory (386 aircraft out of 2,056), and 20 B-2A bombers out of an inventory of 157 aircraft that include the B-1B, the B-2A, and the venerable B-52H are considered stealthy.
31. Paul McLeary, "SecDef: 'Largest-Ever' R&D Spending in '22 Budget," *Breaking Defense*, May 27, 2021, <https://breakingdefense.com/2021/05/secdef-rd-spending-to-skyrocket-in-22-budget/> (accessed June 27, 2021).
32. John A. Tirpak, "TacAir Study Will Determine If F-35 Production Surge Needed," *Air Force Magazine*, February 25, 2021, <https://www.airforcemag.com/tacair-study-will-determine-if-f-35-production-surge-needed/> (accessed June 27, 2021).
33. Carla Babb, "China, Russia Military Budgets Combined Exceed US Spending, Top General Says," Voice of America, June 10, 2021, <https://www.voanews.com/usa/us-politics/china-russia-military-budgets-combined-exceed-us-spending-top-general-says> (accessed June 27, 2021).
34. Mattis, *Summary of the 2018 National Defense Strategy of the United States of America*, p. 1.



# Understanding Risk in the Great Competition with China

Sarah Kirchberger, PhD

**O**n Christmas Day 2018, during an awards ceremony for Chinese military industry leaders, retired People’s Liberation Army (PLA) Major General Luo Yuan gave a speech discussing China’s options for dealing with its main strategic rival, the United States of America. That speech soon made headlines because Luo, a deputy secretary-general of the Chinese Academy of Military Sciences, seemed to be advocating a preemptive attack on U.S. aircraft carriers as a way to shock the U.S. into retreat.<sup>1</sup>

During earlier parts of his speech, Luo suggested attacking the opponent’s weak spots with China’s own superior forces:

[W]hen our soldiers are fighting, they should use our own strengths to attack the enemy’s weak spots. Whatever the enemy fears for, we should attack! Wherever the enemy is weak, we will expand there! So, what exactly is the US afraid of?... I feel we have not done enough serious thinking and research on this question.... I am not an expert in this area, nor can I answer this question accurately myself. I do remember a saying by Mao Zedong though: “Imperialism is a paper tiger.” So what are the characteristics of a paper tiger? Outwardly it looks strong, but it’s weak on the inside; its appearance is severe, but it is devoid of substance. We don’t know where their weaknesses are, but we do know where

their strengths are. And if you puncture their strengths, just like when puncturing a paper window, the weaknesses will be revealed.

Luo further elaborated on the specifics of how a “puncturing of US strengths” could be conducted:

Historical experience tells us that the United States is most afraid of people dying. We now have the DF-21D and the DF-26 missiles, these are aircraft carrier killers. If we sank one of their carriers, this would cause 5,000 casualties; if we sank two: 10,000 casualties—don’t you think America would be afraid?<sup>2</sup>

Luo’s suggestion does not necessarily represent the mainstream thinking among China’s leadership. Nevertheless, such rhetoric coming from a seasoned military official signals a new low in the war of words that increasingly characterizes China–U.S. relations. If nothing else, Luo’s ideas are a vivid example of the risk of escalation through miscalculation. Already in 2014, the influential navalist Zhang Wenmu of Beihang University had put forward the idea that China should adapt Vladimir Putin’s hybrid strategy for occupying Crimea as a promising way to take Taiwan. He argued that China would certainly succeed because the collective West would not care enough to intervene.<sup>3</sup>

Though it remains difficult to assess how prevalent such ideas are, it would be dangerous to assume that they are shared only by a few rogue thinkers.<sup>4</sup> During the preceding decade, popular Chinese writings had increasingly featured aggressive statements toward the U.S. and questioned the international order shaped by it. Such publications, among them “China Can Say No,” “Unhappy China,” “China’s Maritime Rights,” “China Dream,” and “Wolf Totem,” typically emphasized Chinese grievances.

In 2011, in an insightful analysis of what he calls the “geopolitik turn” in Chinese politics, Christopher Hughes traced in all of these texts a “morbid fascination with the relationship between violence and power,” notions of a Chinese “moral exceptionalism,” and the idea that China asserting its sovereignty over territories such as Taiwan or the South China Sea (SCS) is “no more than a form of restorative justice.” Consequently, “China’s use of force and expansion is...always judged to be defensive,” and if such notions were to become more influential, the result would be “an increasingly zero-sum approach to international politics.”<sup>5</sup>

### Challenges from Probing Behavior

Developments since Xi Jinping’s rise to power in 2012 have largely borne out this analysis. The disruptive communication style adopted by Beijing’s “Wolf Warrior” diplomats all over the world also appeared during the 2021 U.S.–China summit in Alaska when China’s most senior foreign affairs official disregarded previously agreed rules on speaking time limits and berated his American hosts.

Rhetoric aside, a multitude of actions taken by China’s military and paramilitary forces in the Western Pacific reveal a pattern of gray-zone activity that seems designed to disrupt the status quo. By conducting threatening actions below the threshold of military aggression on a steadily increasing scale and frequency, China seems determined to test the willingness and capacity of neighboring states and the U.S. to respond effectively. There is a risk that China could succeed in numbing foreign observers into indifference in the face of

ever more transgressions, permanently shifting the boundaries of the “normal.”

This is a method China shares with Russia and Iran, as Jakub J. Grygiel and A. Wess Mitchell observe in *The Unquiet Frontier: Rising Rivals, Vulnerable Allies, and the Crisis of American Power*. They note that “probing” behavior, defined by them as a “test aimed at gauging the opposing state’s power and will to maintain security and influence over a region,” seems to have become a tool used increasingly “by revisionist powers for pushing the existing boundaries of their influence.”<sup>6</sup>

China’s probing has consisted so far of air incursions into Taiwan’s air defense identification zone (ADIZ) paired with exercises in the maritime space around Taiwan and in the SCS and also includes increased Maritime Militia activity around contested features in the South and East China Seas. The successful seizure of Scarborough Shoal from the Philippines in 2012 and the subsequent land reclamation and militarization of occupied Paracel and Spratly features can also be classified as “probing.” From China’s viewpoint, those attempts to create a new status were vastly successful.

The PLA derives a number of benefits from disruptive actions. Each air incursion into Taiwan’s ADIZ not only exerts psychological pressure on Taiwan’s public, but also provides valuable intelligence on terrain and on electronic signatures of Taiwanese defensive weapon and sensor systems. Further, by forcing the Republic of China (ROC) Air Force to intercept intruding aircraft, they are prematurely wearing down Taiwan’s aging fighter aircraft fleet. The strain may already have been responsible for several accidents that led to the loss of pilots and aircraft.

Steadily enhanced pressure from China’s Maritime Militia on the Senkaku Islands or on Philippine-occupied or Vietnamese-occupied reefs in the SCS has similar effects of combining intimidation tactics with intelligence collection and is similarly wearing down opponents’ capacities to respond. The downside for the PLA is a heightened China-related threat perception among affected countries that may

yet lead to enhanced military spending and better readiness on their part and incentivizes them to balance China by cooperating more closely with the U.S.

### **China's Capacity to Shape the Global Playing Field**

China's increasingly disruptive behavior has been accompanied by an exceptionally fast growth in military capability. Investments that have poured into China's military buildup for three decades have borne fruit and threaten to tilt the conventional military power balance in the Western Pacific in China's favor much faster than most analysts had previously anticipated.<sup>7</sup> Backed by an increasing capacity to cause harm, China's assertive actions signal its resolve to use that capacity when whatever Beijing defines as its "core interests" at any given time are threatened.

Meanwhile, China's ability to pressure the West has increased dramatically since the financial crisis of 2008. In a world that is characterized by interdependent markets and globalized supply chains, the Communist Party-led brand of Chinese state capitalism has not just been able to survive; it has thrived. Due to party-state control of the Chinese financial sector, bolstered by the PRC's large foreign reserves, and by following a state-capitalist approach, China was able to weather the financial crisis better than most and could even serve as an anchor of stability for other countries that were not so fortunate. This had a remarkable effect on the attitudes displayed by Chinese functionaries and diplomats abroad, who began to behave more assertively toward Western counterparts, and has bought China lasting leverage in Europe where its supportive role during the European debt crisis left a legacy, notably in Germany and Greece. It also has enhanced the attractiveness of the "Chinese Model of development" to some developing countries.

Making use of party-state control of strategic economic sectors, China nurtured its leading state-owned enterprises (SOEs) into industrial giants through a combination of subsidies and domestic protectionism while bolstering

their worldwide business outreach activities financially and politically, including through its Belt and Road Initiative (BRI).<sup>8</sup> In port infrastructure investments such as the state-owned shipping giant COSCO's 67 percent stake in the port of Piraeus in Greece, according to the European Chamber of Commerce, a strategy of "vertical integration" is typically followed:

Chinese shippers use ports built and run by SOEs (State-Owned Enterprises) using steel and cement provided by SOEs; they use vessels built by the newly created shipbuilding behemoth [...] using steel made by SOEs, which is provided using iron and coal from SOEs; all of which is financed by SOE banks.<sup>9</sup>

The BRI fulfills multiple functions for China's Grand Strategy of making the world secure for the Chinese Communist Party (CCP). It allows China to hedge against the threat of blockade, generates dependencies and political support within key regions and within the U.N., and helps to market the Chinese business and investment models as well as cyber and space technologies abroad while its infrastructure investment projects help to make inroads into NATO's own backyard.

All of this has led to a situation in which key U.S. allies in Europe and the Indo-Pacific have become intertwined economically with China as closely as or even more closely than they are with the U.S. This has created openings for authoritarian influencing campaigns, coercive diplomacy, and elite capture, while the relative openness of Western high-tech research has given the PLA easy access to military and dual-use technologies that would otherwise be unavailable.<sup>10</sup> The one-sided dependence of entire business sectors on access to the Chinese market imposes prohibitive costs on companies and political actors that are brave enough to risk political friction in their dealings with China. This increasingly calls into question the ability and willingness of some allies to choose sides in a scenario in which tensions between the U.S. and China escalate.

When seeing the chance to drive a wedge between the U.S. and its allies, China is keen to ensure that the West cannot unify to “gang up on China.” At the same time, China is actively competing for influence with European and U.S. initiatives in Africa and the Middle East and North Africa (MENA) region, but increasingly also in South America, and is offering its surveillance technologies to non-democratic governments in an effort to check the spread of democratic values around the world—values that the CCP sees as an existential threat.<sup>11</sup>

As a result of these developments, the Western relationship with China has entered an age of uncertainty. Western leaders are facing a more complex and therefore arguably more challenging threat situation than they faced before 1989 in a world that was neatly bifurcated into opposing camps between which there was little economic exchange.

During the Cold War, the U.S. and the Soviet Union shared an understanding of the risk from mutually assured destruction (MAD); had a reasonably clear picture of each other’s military capabilities, strategic intent, and non-negotiable red lines; and had established direct communication links as a mechanism to minimize the risk of accidental escalation. Today, the overall picture is far less clear. China’s ability to present a different face to different allies makes it hard for Western leaders to form a unified situational awareness regarding the challenges posed by China, and this alone presents significant potential for miscalculation.<sup>12</sup> In addition, while a Beijing–Washington hotline similar to the U.S.–Russian communication link has existed since 2008, reports indicate that China has cut it off several times, and U.S. attempts to communicate through that channel have typically not been answered.<sup>13</sup>

In this context, a discussion of some military risk factors in the U.S.–China relationship is necessary. An escalation could occur not only through mishap or accidents, but also if China and the U.S. were drawn into a downward spiral and began to see conflict between them as ultimately inevitable. In such a situation, China could see resorting to a preemptive strike

as a rational decision. More likely than that, however, would be accidental escalation due to miscalculation—for instance, if brinkmanship were to go wrong in one of the many hot spots where China and the U.S. compete over critical interests.

One key question is: Would nuclear deterrence put strong enough constraints in place to make scenarios of war through accidental escalation or through premeditated preemptive attack exceedingly unlikely? While it is not possible to provide any definite answers, thinking through the implications of various risk scenarios, including those that are deemed unlikely, is a necessity for the U.S., its allies, and the Chinese themselves: It is, after all, in the long-term interest of all sides *including China* to avoid a catastrophic war.

### **Can There Really Be War Between Two Nuclear-Armed Powers?**

During the Cold War, nuclear deterrence was a decisive factor that constrained both sides’ moves. Today, new technological developments have brought about shifts in the strategic balance that need to be factored into the old assumptions.

One such factor is the pace and quality of China’s military modernization, which the Chairman of NATO’s Military Committee, Air Chief Marshal Sir Stuart Peach, recently described as “shocking.”<sup>14</sup> To some degree, this effort is intended to counter American arms programs that have long worried Chinese military experts: ballistic missile defense (BMD) and conventional prompt global strike (PGS). As Lora Saalman notes:

Chinese analysts view PGS as part of a larger U.S. effort to achieve “absolute security,” with BMD as the shield and PGS as the sword, such that Washington is able to act preemptively.... Chinese analysts tend to view U.S. PGS as a threat to Beijing’s conventional and nuclear weapons systems, as well as its command and control centers.<sup>15</sup>



Notably, Chinese military commentators tend to view any U.S. program—whether real or only contemplated, whether funded or not, whether terminated or ongoing—as being factually in existence, and they react to it as a threat that requires adequate countermeasures. An abundance of technical Chinese articles dissecting PGS, for instance, have advocated that China give up on its “no first use” policy of never deploying nuclear weapons first; intensify the military use of space; enhance the resilience of its space infrastructures and global intelligence, surveillance, and reconnaissance (ISR) capabilities; and improve its space launch vehicles and offensive cyber capabilities.<sup>16</sup>

Being critical of American PGS does not preclude China from striving for similar capabilities itself, as Saalman also points out. China’s diverse ballistic missile program has been described as the most active in the world, giving China the world’s largest inventory of short-range and medium-range ballistic missiles, many of which can be either conventionally or nuclear armed. These form the backbone of China’s version of a layered defense strategy, commonly known as anti-access/area denial or A2/AD, to deter foreign interventions in its near abroad. According to a recent study by the International Institute for Strategic Studies (IISS), about 95 percent of China’s ballistic and cruise missiles (approximately 2,200 rockets) fall within the 500 km–5,500 km range prohibited by the Intermediate-Range Nuclear Forces (INF) treaty. This makes the prospects of China’s joining a comparable arms control mechanism dim.<sup>17</sup>

Meanwhile, China is working on a full nuclear triad by developing an intercontinental-range submarine-launched ballistic missile, the JL-3, which reportedly can carry up to 10 independent warheads and is intended for China’s next-generation nuclear-powered ballistic missile submarines (SSBNs). With an estimated range of 12,000 km, it would give China the option of targeting at least part of the continental U.S. from a bastion in the SCS. A first successful test firing took place on

June 2, 2019.<sup>18</sup> At the same time, two recent studies based on satellite imagery analyses noted significant new construction activity of about 250 new ballistic missile silos in Gansu and Xinjiang provinces. This amounts to a tenfold expansion of the previously operational Chinese missile silo capacity. It also “exceeds the number of silo-based ICBMs operated by Russia, and constitutes more than half of the size of the entire US ICBM force,” making it “the most extensive silo construction since the US and Soviet missile silo construction during the Cold War.”<sup>19</sup> This was not the end of the story. In August 2021, U.S. intelligence agencies identified a third, similar-sized missile silo field under construction in Inner Mongolia and estimated that the three new silos would be able to field a total of 350 to 400 new ICBMs. With 10 warheads per DF-41 missile, this would amount to space for more than 4,000 nuclear warheads—if all silos were indeed used to house missiles rather than some being left empty as part of a shell game. This would exceed America’s approximately 3,800 warheads, of which more than 2,400 are in storage. The actual number of warheads would be limited by China’s available stockpile of fissile material. Experts estimate that at present, China has enough weapons-grade uranium and plutonium “for about 730 nuclear warheads without having to build new enrichment or reprocessing facilities.”<sup>20</sup>

In addition, many Chinese military and dual-use programs, including the global SATNAV (satellite navigation) constellation BeiDou; other remote sensing and communication satellites such as Gaofen, Yaogan, Jilin, Tianlian, and Hainan; China’s own BMD program; and hypersonic glide vehicles (the DF-ZF HGV was tested in 2014) would be able to contribute to a PGS capability over time. The commercial nanosatellite Jilin-1 constellation, for instance, aims “to have 60 satellites operational by 2020, and 138 satellites in service by 2030, which will ultimately make it possible to offer a 10-minute revisit capability anywhere in the world.”<sup>21</sup> In the summer of 2020, Jilin-1’s maker, Chang Guang Satellite Technology, posted several

high-resolution videos of U.S. airports on its Weibo channel and demonstrated the system's real-time ability to identify and track individual aircraft.<sup>22</sup>

Another remote-sensing constellation under development, the Hainan-1, is intended for all-weather non-stop ship identification in all areas between latitudes 30 degrees North and 30 degrees South, which includes the entire South China Sea. A Chinese research paper indicated that simulations have already yielded 95 percent accuracy in identifying ships larger than 30 meters in length, which is sufficient for most surface warships.<sup>23</sup>

When combined with the existing military remote-sensing constellations Gaofen and Yaogan and a global network of ground stations that is also under development, such systems would enable targeting updates for an inter-continental PGS system, and the small, cheap nanosatellites especially would add a layer of resilience through redundancy and the easy replacement of lost units.<sup>24</sup> "If the same ideas on preemption are applied to China's own PGS," notes Saalman, "then its nuclear posture may change, whether declared or not."<sup>25</sup>

To counter perceived threats to its land-based nuclear-tipped missiles, China has begun to work on a full nuclear triad and the significant expansion of its warhead inventory. Other key priorities are a drive to further enhance A2/AD capabilities to discourage interventions within China's near abroad, developing the maritime domain, and building a blue-water power projection capability. A further aim is to transform the PLA from a fully mechanized force into an "informationized" (networked) force and eventually a force that has adapted to the "intelligentization of warfare" and can take full advantage of militarily focused artificial intelligence (AI).<sup>26</sup>

### The Impact of Emerging Technologies

China sees the emphasis on 4IR (fourth industrial revolution)<sup>27</sup> technologies in the military, especially AI, as a potential game-changer that could allow the PLA to leapfrog over some of its current deficiencies; ethical concerns

regarding the safe use of AI in warfare do not seem to exist at all.<sup>28</sup> China fully embraces the potential of AI for improving the accuracy and lethality of its cruise missiles. According to an account of an August 2016 interview with Wang Changqing, Director of the General Design Department at the China Aerospace Science and Industry Corporation's Third Academy:

"[O]ur future cruise missiles will have a very high level of artificial intelligence and automation," he said. "They will allow commanders to control them in a real-time manner, or to use a fire-and-forget mode, or even to add more tasks to in-flight missiles."

Chinese engineers have researched the use of artificial intelligence in missiles for many years, and they are leading the world in this field, he said.<sup>29</sup>

AI is also a key enabler of China's "blue ocean information network," a vast surveillance infrastructure deployed in the South China Sea that consists of fixed and mobile sensor arrays, unmanned systems, and communication platforms interlinking with ships, aircraft, and unmanned aerial vehicles (UAVs) that aims to render the underwater domain transparent. If successful, it could compromise the stealth of U.S. nuclear attack submarines operating in that area.<sup>30</sup>

Another application of AI is intended to network hypersonic weapons into smart swarms for coordinated attacks in order to overwhelm missile defense through saturation attack. A study from the Beijing Institute of Technology titled "Network for Hypersonic UCAV [Unmanned Combat Aerial Vehicle] Swarms" seeks to multiply the power of hypersonic weapons by having them work together. Such swarms would be far more dangerous than individual hypersonic missiles, multiplying the power of high-speed weapons.<sup>31</sup>

One reason for China's willingness to embrace AI for offensive purposes in warfare is the problem of nuclear asymmetry. Beijing's

comparatively small nuclear arsenal makes concepts that neutralize an opponent's numerical advantage especially attractive. Writes Saalman:

AI and autonomy...offer Beijing the long-term potential to disrupt Washington's traditional strengths. They open the door for swarm and other technologies that could overwhelm conventional and nuclear platforms that are larger, more cumbersome, and less agile. While China may be concerned about potential adversaries tracking its own nuclear platforms and systems, Beijing is just as likely to avail itself of these relatively inexpensive methods of disrupting US activities.<sup>32</sup>

The heavy reliance of American net-centric warfare on data links and space infrastructures for geolocation, communications, and C4ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance) has not only acted as a force multiplier; as a side-effect, it has created vulnerabilities that can be exploited through asymmetric attacks. Having analyzed American vulnerabilities, the PLA is exploring asymmetric attack vectors against the nodes that enable a networked system.

Here China is following a holistic approach of “unrestricted” (total) warfare encompassing all domains.<sup>33</sup> Bringing down a military network by jamming data links, blinding sensors, spoofing or otherwise disabling SATNAV and SATCOM (satellite communication) satellites, or physically destroying key platforms that are relied upon by other units (for instance, for area defense)—in other words, disrupting the system through cyber, electronic warfare, and kinetic attacks—is an approach long favored by PLA thinkers. In a study of PLA writings on “system destruction warfare,” Jeffrey Engstrom summarizes the concept:

[T]he PLA's very theory of victory in modern warfare recognizes *system destruction warfare* as the current

method of modern war fighting. Under this theory, warfare is no longer centered on the annihilation of enemy forces on the battlefield. Rather, it is won by the belligerent that can disrupt, paralyze, or destroy the operational capability of the enemy's operational system. This can be achieved through kinetic and nonkinetic strikes against key points and nodes while simultaneously employing a more robust, capable, and adaptable operational system of its own.<sup>34</sup>

At the same time, psychological and information warfare aimed at undermining an opponent's ability to interpret the facts correctly, arrive at a reliable situational awareness, and maintain societal resolve to resist an opponent in the face of an unclear threat situation is explicitly part of such an approach. So is “legal warfare” employed to delegitimize the opponent's actions and win international support for one's own position.

Though by no means new, information and psychological warfare has gained new traction in the age of social media. The openness of democratic societies offers multiple vectors for attacking societal cohesion, disrupting election procedures, or hindering the formation of political will in other ways, while cyberattacks on critical infrastructures have the potential to disrupt and wear down societies. Depending on the concrete circumstances, asymmetric “system destruction warfare” might be employed as a first salvo, in particular if it were possible to disguise the initial attack or make attribution to a particular perpetrator difficult.

### How High Is the Risk of a Conventional First Strike?

Jon Solomon has emphasized that naval forces have to confront the risk of possibly falling victim to a devastating first salvo. This might be fired by an enemy if he is certain that war is unavoidable. In such a case, the opponent would expect his own ISR assets to degrade sharply once the fighting starts, knowing that the “maritime picture will never be as

accurate and comprehensive at any later point in a conflict as it is during peacetime's waning moments." The awareness of a fast-closing window of opportunity for accurate targeting of capital ships might induce such an attacker to try to "maximally neutralize a defender's higher campaign-value fleet assets" as long as he still sees the chance to do so.<sup>35</sup>

Another key question is: How could a war that began with a conventional first strike remain conventional without escalating to nuclear war if it turns into a protracted fight? Depending on just how disastrous the prospect of losing would seem to those in power, it is not farfetched to consider that the danger of losing might tempt that side into using the threat of nuclear coercion to avoid such an outcome. Even though China officially adheres to a "no first use" policy, that is just a declaration of intent that could be changed at any time and should not be taken as a guarantee.<sup>36</sup>

Some analysts do not consider a nuclear escalation scenario when discussing conventional war between China and the U.S., deeming it far too unlikely, but that might be unwise.<sup>37</sup> As a RAND study cautioned in 2016, "confidence that an adversary will comply with one's script and, more generally, that the results of a decision can be controlled are tantamount to assuming away risk."<sup>38</sup> Even if the U.S. were willing to accept defeat on the battlefield at the hands of China without ever resorting to the threat of using its far superior nuclear arsenal, the assumption that playing the nuclear card would not even be contemplated by China's leaders in a desperate situation is just such an expectation of the CCP's adhering to a script. Mao's contempt for nuclear weapons as "paper tigers" is a case in point.

For the CCP, the risk of losing a conflict with the U.S. that China started might create such a harsh domestic backlash that accepting military defeat might make the CCP's position at home precarious. Given the CCP's record of defending its power position by all means possible, Beijing might very well resort to nuclear brinkmanship. Both sides in such a situation might try to find ways to employ the

threat potential of their nuclear weapons to avoid defeat while still trying to contain the risk of full-blown nuclear war—but the road to a potentially catastrophic escalation would be open, and whether an attempt to contain it would be successful is uncertain.

In one hypothetical scenario of a future great-power conflict between the U.S. and a China–Russia coalition that was developed by the authors of the 2015 sci-fi novel *Ghost Fleet*,<sup>39</sup> the risk of a nuclear escalation was artificially eliminated from the equation through a Chinese–Russian first strike that neutralized the U.S. nuclear arsenal. This plot ploy allows for a plausible scenario in which two nuclear-armed opponents engage in a full-blown, kinetic, protracted, and yet purely conventional great-power conflict.

In the book, China and Russia have formed a secret alliance and have prepared the ground for a preemptive strike against the U.S. to take Hawaii. To achieve this, the attackers use a novel, secretly developed detection technology from space to target all U.S. nuclear-powered capital warships, including all SSBNs, simultaneously while carefully placed cyber weapons paralyze the land-based and air-based nuclear forces. This leaves the U.S. unable to resort to nuclear retaliation despite having absorbed devastating losses. In that Pearl Harbor 2.0-type scenario, Hawaii is invaded and occupied.

The book's plot sketches out how the conflict continues as a conventional war in which the U.S. finds itself fighting as the underdog and China and Russia, having achieved their limited war aims, refrain from further attacking the U.S. mainland. The rest of the novel describes the process of reconquering Hawaii through guerilla warfare, tactical ingenuity, and acts of individual heroism while portraying the use of emerging technologies including sophisticated cyber weapons and autonomous systems deployed in swarm formations. The story ends with an uneasy truce.

It is worthwhile to ask what the necessary preconditions for such a *Ghost Fleet*-style first strike scenario would be. The American defenders in that case would need to have

overlooked—for several years—the forming of a secret Russian–Chinese military alliance; the successful development and deployment of a novel technology that enabled the detection and targeting of nuclear reactors from space, even aboard submerged strategic submarines; and the long-term infiltration of their own critical cyber networks through the hardware and software supply chain. A series of striking intelligence failures and massive deficiencies in early warning on the part of the U.S. would have been necessary for such a bold, high-risk preemptive strike to be secretly planned and successfully executed. It can be inferred that in the absence of such a string of failures, the odds of success would have been low—probably too low for a rational actor even to contemplate.

In other words, unerring vigilance, regular war-gaming, awareness of one’s own vulnerabilities, recognition of unlikely worst-case scenarios, incessant monitoring of all military and paramilitary activities, analyses of scientific developments in military-technological and dual-use fields and of diplomatic developments worldwide would go a long way toward averting any scenarios of this type.

### **What Might China Actually Be Planning to Do?**

One indicator that China is trying to hedge against the risk of a crippling first strike is the emphasis placed on building much larger numbers of individual weapon systems than ever before. This could be to ensure the ability not just to overwhelm an opponent, but also to create sufficient redundancy in the face of heavy losses. One particularly striking example of this is the enlargement of the PLA Navy (PLAN) fleet.

The modernization of the PLA that started in the mid-1990s was long hampered by the Western arms embargo, but it has gained unprecedented momentum under Xi Jinping. The scale and pace are highly unusual and have enabled China to replace its motley array of old and obsolete hulls with large series of far more modern and capable warships that are also significantly larger and more seaworthy overall.

- In the largest peacetime naval buildup since at least the 1930s, China has been producing warships as if it were already at war, with shipyards reportedly working around the clock seven days per week, sometimes completing hulls ahead of schedule.<sup>40</sup>
- An entirely new class of 72 corvettes was commissioned by the PLAN within just eight years alongside numerous new frigates, destroyers, submarines, amphibious assault vessels, and missile catamarans.
- Between 2014 and 2018, measured in tons of steel, China has added the equivalent of the entire Royal Navy (Europe’s largest) to its already large navy. Similarly, the Chinese Coast Guard has been massively enlarged and is now the world’s largest according to tonnage.<sup>41</sup>
- The past decade has already seen the addition of two aircraft carriers to the fleet, and more are in the pipeline. It is unclear just how many aircraft carrier groups China is planning to operate, but a retired military official has indicated that “at least six aircraft carriers” would be needed to “break through the first island chain involving South Korea, Japan, Taiwan island and the Philippines to achieve command of the sea” and that the PLAN would need “about 10 more bases for the six aircraft carriers...[h]opefully...in every continent.”<sup>42</sup> The opposite trend is the norm in Western countries, where naval programs typically suffer from cost overruns, cuts, and significant delays.

China’s huge buildup has not been accompanied by any serious attempts to defuse regional worries through strategic communication—for instance, through transparency and other trust-building measures. As with the land reclamation and island militarization frenzy in the South China Sea that China long denied, Beijing’s intentions regarding its arms

programs are typically not declared openly until irrefutable evidence exists, and details remain hard to access.

The pace of China's fleet enlargement has already allowed the PLAN to surpass the number of hulls in active service with the U.S. Navy while in the United States, the coming decade has been labeled the "Terrible 20s" because it will be characterized by an impending shortage of materiel as a result of failures in procurement planning:

Fleets of ships, aircraft, vehicles, and other equipment are reaching the end of their service lives, hitting the edge of their upgrade limits, and losing combat relevance. As great-power competition accelerates, the United States is offering a free and open window of opportunity and advantage to its adversaries. Unless policymakers take concrete steps now, defense leaders will continue America's sleepwalk into strategic insolvency and its consequences. The aptly named "Terrible 20s" have arrived.<sup>43</sup>

**Tanner Greer has elaborated on this theme by emphasizing the danger of inviting attack:**

In the mid 2020s the United States will be struggling to pay the Pentagon's "modernization crunch." *The Navy, Marine Corps, and Air Force will be midway through a transition to a new, counter-China force structure.* The number of attack submarines and stealth bombers that the United States can put in the field will be at an absolute low.

It is at this moment we project the PLA will be capable of executing a cross straits invasion.

This does not make conflict inevitable. But *if* the Chinese have concluded that military means are the only way to bring about Taiwan's integration into the People's Republic of China, Beijing's

leaders will soon face powerful pressure to escalate towards war. Waiting until the 2030s or 2040s to sabre rattle is to wait for the U.S. military's counter-China modernization and procurement programs to run their course. There will be a terrific temptation to "resolve" the problem before these programs have been implemented.<sup>44</sup>

Moreover, projected U.S. capability gaps are not the only reason why the 2020s have been labeled a "decade of concern." A thought experiment conducted by the retired U.S. Navy Captain James E. Fanell, a former Director of Naval Intelligence, Pacific Fleet, supposes that Xi Jinping aims for China to have accomplished the successful integration of Taiwan at the latest by 2049 in time for the PRC's centenary. By that time, if the great celebration is to be a festive affair attended by international dignitaries, any military and political fallout from an attack on Taiwan would need to have subsided. Having learned from the world's reaction to the 1989 Tiananmen massacre, the hypothesis goes, Beijing likely concluded that the world needs about 20 years to forgive and forget—as the widespread international participation in the 2008 Beijing Olympics showed. Meanwhile, suppressing potential insurgencies on Taiwan might also take several years.<sup>45</sup>

If such a timetable is indeed in existence, the implication would be that this decade is a particularly tempting time in which to attempt a military change in the Taiwan Strait, and impending U.S. capability gaps during the 2020s could enhance this appeal.

Such sobering thought experiments can help to develop an awareness of how Western shortcomings might be seen by Beijing as a window of opportunity that could make an attempt on Taiwan seem tempting enough to face the risk of escalation rather than missing the chance once and for all. This means that the current situation calls for extreme watchfulness, clear signaling, and the enhancement of deterrence by all necessary means to ensure that it does not fail. Taiwan itself plays a key

role in this, as the most effective deterrence would be Taiwan's ability to defend itself.

Worryingly, RAND analyst David Ochmanek recently reported that U.S. war-gaming exercises simulating an attack on Taiwan over the years have consistently indicated that the U.S. would lose if it followed its standard approach and that American attempts to counter Chinese military advances were still falling short of the required goal. Ochmanek attributes this to "attention deficit disorder," a result of concentrating on counterterrorism and counterinsurgency wars for the past two decades.<sup>46</sup>

However, a recent Pentagon war game in which U.S. forces changed their approach and integrated emerging technologies into a changed posture yielded decidedly more promising results. This time, "a more defensive and dispersed posture less reliant on large, vulnerable bases, ports and aircraft carriers" was adopted. To make the posture more resilient, this strategy employed "large numbers of long-range, mobile strike systems, to include anti-ship cruise missile batteries, mobile rocket artillery systems, unmanned mini-submarines, mines and robust surface-to-air missile batteries for air defense," while focusing strongly on "surveillance and reconnaissance capabilities for both early warning and accurate intelligence to enable quicker decisions by U.S. policymakers, and a more capable command-and-control system to coordinate the actions of more dispersed forces." In that particular war game, the dispersed, resilient U.S. posture reportedly dissuaded the opponent from risking an attack in the first place.<sup>47</sup>

### **How Can Risk Be Mitigated?**

Navigating the challenges of the 2020s and managing the military risk ensuing from China's rise and increasingly assertive stance will require vigilance and wisdom. If history can be seen as a path-dependent process that is shaped by the interactions of all parties, it is important for the West to get its part of the interaction right.

As the experiences of Pentagon war games show, there is a strong necessity to enhance

the state of readiness; improve early warning and intelligence (as well as intelligence sharing among allies); create redundancies in key military systems and weapon platforms; develop resilient postures relying on dispersed rather than concentrated forces; strengthen industry and logistic capabilities; enhance the resilience of critical infrastructures; and—above all—bolster threatened allies' abilities to defend themselves. The aim should be to eliminate as many attack vectors as possible.

Such an approach would have the added benefit of signaling resolve and demonstrating the ability to adapt. It would counter the other side's misperceptions of an irreversible Western decline.

The current dynamic calls for close cooperation among all powers that have a stake in maintaining the rules-based international order and deterring China from risking military adventurism. To be effective, such a Western approach needs a combination of credible capacity-building, clearly communicated strategic intentions and priorities, and measured yet determined reactions to individual rogue actions that are aimed at slowly hollowing out the status quo.

Allies should use different countries' experiences, best practices, capabilities, and strengths to create a sum that is larger than its parts. The goal should be to signal to China's military planners and political leadership the costs and dangers of engaging in brinkmanship while at the same time pointing out a possible way to peaceful coexistence with the large community of democratic nations—if and when China's leaders drop their threatening behavior and adopt a more reasonable path.

It is ultimately not in China's interest to challenge the U.S. militarily as long as China cannot be assured of victory. Risking a humiliating defeat would endanger CCP rule within China and would certainly disrupt China's economic growth, which still depends on exchanges with the outside world. The West therefore needs to make sure that China can never be certain of victory.

## Endnotes

1. See Jamie Seidel, "'Sink Two Aircraft Carriers': Chinese Admiral's Chilling Recipe to Dominate the South China Sea," *News.com.au*, January 2, 2019, <https://www.news.com.au/technology/innovation/military/sink-two-aircraft-carriers-chinese-admirals-chilling-recipe-to-dominate-the-south-china-sea/news-story/aaa8c33d57da62e7d5e28e791aa26e0f> (accessed July 4, 2021).
2. "Major General Luo's Speech at the 2018 Military Industry Awards Ceremony and Innovation Summit," Shenzhen, December 20, 2018, <https://www.kunlunce.com/ssjj/guojipinglun/2018-12-25/130147.html> (accessed July 23, 2021). Trans. Sarah Kirchberger. See also J. D. Simkins, "'We'll See How Frightened America Is'—Chinese Admiral Says Sinking US Carriers Key to Dominating South China Sea," *Navy Times*, January 4, 2019, <https://www.navytimes.com/news/your-navy/2019/01/04/well-see-how-frightened-america-is-chinese-admiral-says-sinking-us-carriers-key-to-dominating-south-china-sea/> (accessed July 21, 2021).
3. Lyle J. Goldstein, "Get Ready: China Could Pull a 'Crimea' in Asia," *The National Interest*, April 11, 2015, <https://nationalinterest.org/feature/get-ready-will-china-pull-crimea-asia-12605> (accessed July 4, 2021). For the full text of Zhang's essay, see Zhang Wenmu, "The World Significance of the Events in Ukraine and Its Warning to China," December 28, 2014, [http://www.guancha.cn/ZhangWenMu/2014\\_12\\_28\\_304621.shtml](http://www.guancha.cn/ZhangWenMu/2014_12_28_304621.shtml) (accessed July 21, 2021).
4. See the sobering examples in Orianna Skylar Mastro, "The Taiwan Temptation: Why Beijing Might Resort to Force," *Foreign Affairs*, July/August 2021, pp. 58–67, <https://www.foreignaffairs.com/articles/china/2021-06-03/china-taiwan-war-temptation> (accessed September 11, 2021).
5. Christopher Hughes, "Reclassifying Chinese Nationalism: The Geopolitik Turn," *Journal of Contemporary China*, Vol. 20, No. 71 (2011), pp. 601–620.
6. Jakub J. Grygiel and A. Wess Mitchell, *The Unquiet Frontier: Rising Rivals, Vulnerable Allies, and the Crisis of American Power* (Princeton and Oxford: Princeton University Press, 2016), pp. 43–44.
7. Sarah Kirchberger and Johannes Mohr, "China's Defence Industry," Chapter 3 in *The Economics of the Global Defence Industry*, ed. Keith Hartley and Jean Belin (London and New York: Routledge, 2019), pp. 35–68.
8. The World Bank, "Belt and Road Initiative," *Brief*, March 29, 2018, <https://www.worldbank.org/en/topic/regional-integration/brief/belt-and-road-initiative> (accessed July 4, 2021).
9. Erik Kravets, "Sea Change: Can the E.U. Reverse Its Declining Fortunes—and the Growing Influence of China and Russia?" *The Maritime Executive*, June 7, 2021, <https://maritime-executive.com/magazine/sea-change> (accessed July 4, 2021).
10. Alex Joske, "Picking Flowers, Making Honey: The Chinese Military's Collaboration with Foreign Universities," Australian Strategic Policy Institute, International Cyber Policy Center *Policy Brief*, Report No. 10/2018, October 2018, [https://s3-ap-southeast-2.amazonaws.com/ad-aspi/2018-10/Picking%20flowers%2C%20making%20honey\\_0.pdf](https://s3-ap-southeast-2.amazonaws.com/ad-aspi/2018-10/Picking%20flowers%2C%20making%20honey_0.pdf) (accessed July 4, 2021).
11. "Document 9: A ChinaFile Translation: How Much Is a Hardline Party Directive Shaping China's Current Political Climate?" *ChinaFile*, November 8, 2013, <https://www.chinafile.com/document-9-chinafile-translation> (accessed July 4, 2021).
12. Hans Binnendijk, Sarah Kirchberger, James P. Danoy, Franklin D. Kramer, Connor McPartland, Christopher Skaluba, Clementine G. Starling, and Didi Kirsten Tatlow, *The China Plan: A Transatlantic Blueprint for Strategic Competition*, Atlantic Council, Scowcroft Center, March 2021, <https://www.atlanticcouncil.org/wp-content/uploads/2021/03/The-China-Plan-A-Transatlantic-Blueprint.pdf> (accessed July 4, 2021).
13. David Brunnstrom and Michael Martina, "Strategic Clarity on Taiwan Policy Carries 'Significant Downsides'—U.S.," Reuters, May 4, 2021, <https://www.reuters.com/world/asia-pacific/significant-downsides-strategic-clarity-over-taiwan-us-2021-05-04/> (accessed July 4, 2021).
14. Helen Warrell and Michael Peel, "Senior Nato Officer Warns of China's 'Shocking' Military Advances," *Financial Times*, June 25, 2021, <https://www.ft.com/content/8a0b3975-1938-4815-af3b-22b5d3e6aca4> (accessed July 4, 2021).
15. Lora Saalman, "Prompt Global Strike: China and the Spear," U.S. Department of Defense, Daniel K. Inouye Asia-Pacific Center for Security Studies, April 2014, p. 1, [https://apcss.org/wp-content/uploads/2014/04/APCSS\\_Saalman\\_PGS\\_China\\_Apr2014.pdf](https://apcss.org/wp-content/uploads/2014/04/APCSS_Saalman_PGS_China_Apr2014.pdf) (accessed July 5, 2021).
16. Cf., for example, Ningbo Yuwen and Liwen Tang, "Discussion and Inspirations About Prompt Global Strike of the US," in *Journal of the Academy of Equipment Command & Technology*, Vol. 22, No. 3 (June 2011), pp. 58–61.
17. Mike Yeo, "China Could Lose 95% of Ballistic, Cruise Missiles Under Strategic Arms Control Pact, Says New Analysis," *Defense News*, June 5, 2020, <https://www.defensenews.com/global/asia-pacific/2020/06/05/china-could-lose-95-of-ballistic-cruise-missiles-under-strategic-arms-control-pact-says-new-analysis> (accessed July 4, 2021).
18. Dylan Malyasov, "New Chinese Submarine-Launched Ballistic Missile Spotted on Test in the Bohai Bay," *Defence Blog*, June 2, 2019, <https://defence-blog.com/new-chinese-submarine-launched-ballistic-missile-spotted-on-test-in-the-bohai-bay/> (accessed July 3, 2021).



19. Hans M. Kristensen, "China's Expanding Missile Training Area: More Silos, Tunnels, and Support Facilities," Federation of American Scientists, Strategic Security Blog, February 24, 2021, <https://fas.org/blogs/security/2021/02/plarf-jilantai-expansion> (accessed July 3, 2021), and Matt Korda and Hans Kristensen, "China Is Building a Second Nuclear Missile Silo Field," Federation of American Scientists, Strategic Security Blog, July 26, 2021, <https://fas.org/blogs/security/2021/07/china-is-building-a-second-nuclear-missile-silo-field/> (accessed August 5, 2021).
20. Bill Gertz, "Exclusive: China Building Third Missile Field for Hundreds of New ICBMs," *The Washington Times*, August 12, 2021, <https://www.washingtontimes.com/news/2021/aug/12/china-engaged-breathtaking-nuclear-breakout-us-str/> (accessed September 11, 2021), and Malcolm Davis, "China Military Watch," Australian Strategic Policy Institute, *The Strategist*, August 20, 2021, <https://www.aspiratelist.org.au/china-military-watch-10/> (accessed September 11, 2021).
21. Ma Si and Liu Mingtai, "Jilin Group Sets Goal of Putting 60 Satellites in Orbit by 2020," *China Daily*, updated March 28, 2017, [https://www.chinadaily.com.cn/newsrepublic/2017-03/28/content\\_28714354.htm](https://www.chinadaily.com.cn/newsrepublic/2017-03/28/content_28714354.htm) (accessed July 5, 2021).
22. Chang Guang Satellite Technology Co., Ltd., official Weibo channel, <https://m.weibo.cn/u/5838191069> (accessed July 21, 2021).
23. L. Wang, G. Q. Li, X. M. Li, and T. L. Yang, "Design of Hainan Satellite Constellation and Applications for Ocean Observations," in IOP Conference Series: Earth and Environmental Science, Vol. 502, *Proceedings of the First China Digital Earth Conference*, November 18–20, 2019, Beijing, China, p. [5], <https://iopscience.iop.org/article/10.1088/1755-1315/502/1/012002/pdf> (accessed July 5, 2021), and Guo Silu, "Hainan Satellite Constellation System Provides Shield for South China Sea," China Military Online, January 3, 2018, [http://eng.chinamil.com.cn/view/2018-01/03/content\\_7894167.htm](http://eng.chinamil.com.cn/view/2018-01/03/content_7894167.htm) (accessed July 5, 2021).
24. Rear Admiral Monty Khanna, "Get Ready for the Next RMA at Sea," U.S. Naval Institute *Proceedings*, Vol. 146/1/1,403 (January 2020), <https://www.usni.org/magazines/proceedings/2020/january/get-ready-next-rma-sea> (accessed July 5, 2021).
25. Saalman, "Prompt Global Strike: China and the Spear."
26. Tate Nurkin and Ryo Hinata-Yamaguchi, "Emerging Technologies and the Future of US–Japan Defense Collaboration," Atlantic Council, Scowcroft Center for Strategy and Security, April 2020, p. 7, <https://www.atlanticcouncil.org/wp-content/uploads/2020/04/Emerging-Technologies-and-the-Future-of-US-Japan-Defense-Collaboration.pdf> (accessed July 5, 2021).
27. For an overview of 4IR, see World Economic Forum, "Fourth Industrial Revolution," <https://www.weforum.org/focus/fourth-industrial-revolution> (accessed July 5, 2021).
28. Elsa Kania, *Battlefield Singularity: Artificial Intelligence, Military Revolution, and China's Future Military Power*, Center for a New American Security, November 2017, p. 6, <https://s3.us-east-1.amazonaws.com/files.cnas.org/documents/Battlefield-Singularity-November-2017.pdf?mtime=20171129235805&focal=none> (accessed July 5, 2021).
29. Zhao Lei, "Nation's Next Generation of Missiles to Be Highly Flexible," *China Daily*, updated August 19, 2016, [https://usa.chinadaily.com.cn/china/2016-08/19/content\\_26538878.htm](https://usa.chinadaily.com.cn/china/2016-08/19/content_26538878.htm) (accessed July 5, 2021).
30. Center for Strategic and International Studies, Asia Maritime Transparency Initiative, "Exploring China's Unmanned Ocean Network," June 16, 2020, <https://amti.csis.org/exploring-chinas-unmanned-ocean-network/> (accessed July 5, 2021); DM Chan, "China Launches Drones to Monitor South China Sea," *Asia Times*, September 12, 2019, <https://asiatimes.com/2019/09/china-launches-drones-to-monitor-south-china-sea/> (accessed July 5, 2021); Jun Wang et al., "Design and Realization of Underwater Environment Real-time Monitoring System for Ocean Observatory Network," *Journal of Zhejiang University (Engineering Science)*, Vol. 50, No. 2 (February 2016), pp. 193–200; and Su Zhen-Dong, Liu Fan, Yang Rui-Ping, and Wang Fei-Yue, "Architecture of Marine Environmental Parallel Monitoring System Based on the Lanhai Information Network," *Acta Automatica Sinica*, Vol. 46, No. 8 (August 2020), pp. 1582–1591.
31. Shixun Luo, Zhongshan Zhang, Shuai Wang, Shuo Zhang, Jibo Dai, Xiangyuan Bu, and Jiangping An, "Network for Hypersonic UCAV Swarms," *Science China Information Sciences*, Vol. 63, Issue 4 (April 2020), Article No. 140311, <http://scis.scichina.com/en/2020/140311.pdf> (accessed July 5, 2021), and David Hambling, "China Developing Hypersonic Swarms to Overwhelm Missile Defenses," *Forbes*, March 18, 2021, <https://www.forbes.com/sites/davidhambling/2021/03/18/china-developing-hypersonic-swarms-to-overwhelm-missile-defenses/> (accessed July 5, 2021).
32. Lora Saalman, "Fear of False Negatives: AI and China's Nuclear Posture," *Bulletin of the Atomic Scientists*, April 24, 2018, <https://thebulletin.org/2018/04/fear-of-false-negatives-ai-and-chinas-nuclear-posture/> (accessed July 5, 2021).
33. Col. Qiao Liang and Col. Wang Xiangsui, *Unrestricted Warfare: Translated from the Original People's Liberation Army Documents* (Brattleboro, VT: Echo Point Books & Media, 2015). See also Qiao Liang and Wang Xiangsui, *Unrestricted Warfare* (Beijing: PLA Literature and Arts Publishing House, February 1999), <https://www.c4i.org/unrestricted.pdf> (accessed July 5, 2021).
34. Jeffrey Engstrom, *Systems Confrontation and System Destruction Warfare: How the Chinese People's Liberation Army Seeks to Wage Modern Warfare* (Santa Monica, CA: RAND Corporation, 2018), p. iii, [https://www.rand.org/pubs/research\\_reports/RR1708.html](https://www.rand.org/pubs/research_reports/RR1708.html) (accessed July 4, 2021). Emphasis in original.

35. Jon Solomon, "Parrying the 21st Century First Salvo," Center for International Maritime Security *Capability Analysis*, July 7, 2016, <https://cimsec.org/parrying-21st-century-first-salvo/> (accessed July 5, 2021).
36. Peter Pry, "China's 'No First Use' Nuclear Fiction," *The Hill*, June 24, 2020, <https://thehill.com/opinion/international/502503-chinas-no-first-use-nuclear-fiction> (accessed July 4, 2021).
37. Cf. David C. Gompert, Astrid Stuth Cevallos, and Cristina L. Garafola, *War with China: Thinking Through the Unthinkable* (Santa Monica, CA: RAND Corporation, 2016), p. ix, [https://www.rand.org/pubs/research\\_reports/RR1140.html](https://www.rand.org/pubs/research_reports/RR1140.html) (accessed July 4, 2021).
38. David C. Gompert, Hans Binnendijk, and Bonny Lin, *Blinders, Blunders, and Wars: What America and China Can Learn* (Santa Monica, CA: RAND Corporation, 2014), p. 192, [https://www.rand.org/pubs/research\\_reports/RR768.html](https://www.rand.org/pubs/research_reports/RR768.html) (accessed July 4, 2021).
39. P. W. Singer and August Cole, *Ghost Fleet: A Novel of the Next World War* (Boston: Houghton Mifflin Harcourt, 2015).
40. David Lague and Benjamin Kang Lim, "The China Challenge: Ruling the Waves," Reuters, April 30, 2019, <https://www.reuters.com/investigates/special-report/china-army-navy/> (accessed July 21, 2021), and Vinayak Bhat, "High-Speed Production: Chinese Navy Built 83 Ships in Just Eight Years," *The Print*, September 20, 2017, <https://theprint.in/defence/chinese-navy-built-83-ships-8-years/10416/> (accessed July 4, 2021).
41. Nick Childs and Tom Waldwyn, "China's Naval Shipbuilding: Delivering on Its Ambition in a Big Way," International Institute for Strategic Studies, Military Balance Blog, May 1, 2018, <https://www.iiss.org/blogs/military-balance/2018/05/china-naval-shipbuilding> (accessed July 4, 2021), and Lyle J. Morris, "Blunt Defenders of Sovereignty—The Rise of Coast Guards in East and Southeast Asia," *Naval War College Review*, Vol. 70, No. 2 (Spring 2017), Article 5, pp. 79 and 84, <https://digital-commons.usnwc.edu/cgi/viewcontent.cgi?article=1016&context=nwc-review> (accessed July 4, 2021).
42. Liu Xin and Liu Caiyu, "China Eyes Building More Aircraft Carriers," *Global Times*, April 20, 2017, <http://www.globaltimes.cn/content/1043455.shtml> (accessed July 22, 2021).
43. Mackenzie Eaglen with Hallie Coyne, *The 2020s Tri-Service Modernization Crunch* (Washington: American Enterprise Institute for Public Policy Research, March 2021), p. 1, <https://www.aei.org/wp-content/uploads/2021/03/The-2020s-Tri-Service-Modernization-Crunch-1.pdf?x91208> (accessed July 4, 2021).
44. Tanner Greer, "Welcome to the Decade of Concern," The Scholar's Stage Blog, April 1, 2021, <https://scholars-stage.blogspot.com/2021/04/welcome-to-decade-of-concern.html> (accessed July 22, 2021). Emphasis in original.
45. James E. Fanell, "Now Hear This—The Clock Is Ticking in China: The Decade of Concern Has Begun," U.S. Naval Institute *Proceedings*, Vol. 143/10/1,376 (October 2017), pp. 10–11.
46. James Kitfield, "'We're Going to Lose Fast': U.S. Air Force Held a War Game that Started with a Chinese Biological Attack," Yahoo News, March 10, 2021, <https://news.yahoo.com/were-going-to-lose-fast-us-air-force-held-a-war-game-that-started-with-a-chinese-biological-attack-170003936.html> (accessed July 4, 2021).
47. Ibid.

# What We Risk If We Fail to Fully Modernize the U.S. Nuclear Deterrent

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Central to the effectiveness of U.S. strategic deterrence is convincing our enemies of our resolve to defend American vital interests from aggression with whatever combinations of weapons are necessary. Weapons within the arch of strategic deterrence include conventional and missile defenses, but the nuclear deterrent is the keystone.

The primary purpose of U.S. nuclear weapons, as expressed in the 2018 Nuclear Posture Review (NPR), is to deter a nuclear attack, whether small or large in scale, against a U.S. ally or the United States itself. But that is not their sole purpose. They are also intended to prevent large-scale conventional warfare that threatens U.S. vital interests, as well as a chemical and biological weapons attack, and provide assurances to allies who have chosen not to acquire their own nuclear capabilities, which is more conducive to preventing a nuclear exchange.

At the heart of effective nuclear deterrence is the credible threat that the United States is willing to employ nuclear weapons to defend its vital interests when absolutely necessary. By maintaining a force that could reliably contribute to terminating a war with as little damage as possible, should deterrence fail, on terms most favorable to the United States, the United States strengthens deterrence.

Since the end of the Cold War, the United States has sought to move away from nuclear weapons in its national defense strategy, and as recently as the Administration of

President Barack Obama, U.S. leaders downplayed major-power conflict as a thing of the past.<sup>1</sup> Regrettably, adversaries of the U.S. have not agreed and have invested in the weapons they deem most able to thwart U.S. aims and threaten U.S. security. The global threat environment is more complex and more dynamic than at any time since the end of the Cold War, and the peace that America has enjoyed for 70 years is tenuous.

There are many factors that have led us here, but the crux of the problem is that as our enemies become more able to challenge the United States, they simultaneously perceive an inverse correlation in the strength of American resolve to defend its stated vital national interests. Their doubt in U.S. resolve is abetting the deterioration of the credibility of strategic deterrence that has underpinned the post-World War Two order.

The United States, by failing to invest sufficiently in a modern nuclear enterprise and a reliable triad of modern nuclear delivery systems, has given adversaries reason to doubt. An American observer might enthusiastically disagree with the notion that American resolve has weakened, but what matters for deterrence is *our adversaries'* perception of our resolve, and the United States has given them reason to doubt.

When the stakes are as high as they are, especially in the context of competition against two adversaries—China and Russia—contesting the

United States in multiple theaters, the risk of a regional conventional conflict escalating with dire implications increases. While the focus of much public commentary is on how the United States ought to shift and add conventional firepower and defensive systems, we cannot miss the salience of the unique contributions of our nuclear deterrent in today's dynamic threat context.

Our nuclear forces complement our conventional forces and provide a backstop to their use. Our nuclear deterrent signals to adversaries that should they decide to attack U.S. interests with conventional weapons and then escalate to a larger-scale conventional war with strategic effects, they will not be able to do so with a reasonable hope that the United States will ultimately back down. Our nuclear deterrent therefore strengthens the deterrent effect of our conventional weapons and strategies. This means that U.S. military planners and operators, whether they realize it or not, rely heavily on the effectiveness of nuclear deterrence when they project power in the face of our adversaries' provocations and threats. Our nuclear deterrent is therefore in use every minute of every day, and the importance of the deterrent effect's remaining sound cannot be overstated.

To demonstrate a real, as opposed to merely rhetorical, commitment to America's nuclear deterrent and do so clearly, the United States must fully modernize its nuclear capabilities, especially given the actions of our adversaries. Failing to do this with a sense of urgency and willingness to adapt risks three major outcomes:

- Adversaries could employ nuclear weapons, whether in a regional context because they believe that a nuclear employment, however small in scale, will cause the United States to back down and sue for peace or, in the case of rogue nations, against U.S. soil.
- Adversaries could either initiate a conventional war against U.S. vital interests that

could escalate to nuclear employment or employ chemical or biological weapons.

- Allies could doubt the U.S. commitment to their security and acquire their own nuclear weapons, tempting other nations to do the same and creating a far more precarious global security environment.

### Adversaries Are Emphasizing Nuclear Weapons

The security environment continues to increase in complexity and volatility. While the thought of a nuclear exchange today might seem to some too horrible even to contemplate, it is a possibility, and we must think seriously about how we might prevent it. It is imperative that we take a clear-eyed assessment not only of other nations' nuclear capabilities, but also of their national agendas as well as other factors such as the willingness of those who threaten the United States to threaten our way of life and the relative peace and security that the United States has helped to maintain for the past seven decades. It is only when we do this that we can most effectively deter major war and, should deterrence fail, win as quickly as possible on terms favorable to the United States.

**China.** The Chinese Communist Party (CCP), led by President Xi Jinping, has become more willing to threaten to use force to carry out its national agenda. That is because since the 1990s, when the United States sat at the apex of its global power both economically and militarily, the CCP has invested in the kinds of weapons it needs to coerce and threaten the United States. When Xi came to power, as explained by Oriana Mastro:

[He ordered the most] ambitious restructuring of the PLA since its founding, aimed specifically at enabling Chinese forces to conduct joint operations in which the air force, the navy, the army, and the strategic rocket force fight seamlessly together, whether during an amphibious landing, a blockade, or a missile

attack—exactly the kinds of operations needed for armed unification.<sup>2</sup>

Importantly, China is focusing on cyber operations and space and counterspace operations as well.<sup>3</sup> Chinese leaders have also engaged in nuclear threats, have practiced employing nuclear weapons against U.S. bases in China’s military exercises, and have significantly increased the tempo of China’s military provocations against U.S. assets (forces and bases), partners, and allies.<sup>4</sup>

The CCP’s national ambition and willingness to threaten military force to challenge U.S. vital interests underscore the significance of China’s nuclear program. Although China will not reveal details of its nuclear program, senior U.S. military officials have informed Congress that China is investing significantly in its nuclear weapons at a serious pace. As stated in 2019 by Lieutenant General Robert T. Ashley, then the Director of the Defense Intelligence Agency, “[T]heir trajectory is consistent with President Xi’s vision for China’s military, which was laid out at the 19th Party Congress, and stated that China’s military will be fully transformed into a first-tier force by 2050.”<sup>5</sup>

The U.S. should be concerned not only about the quantity of nuclear warheads China is producing, but also about the increasing quality of China’s military. As recently summarized by Admiral Charles Richard, Commander of U.S. Strategic Command:

[China’s] strategic dyad of ICBMs and SLBMs will soon become a triad, with the completion of a nuclear-capable long-range bomber. China is building new land-based, road-mobile ICBMs, providing its forces more flexibility and capability. The PLA Navy Jin-class ballistic-missile submarines carry up to 12 SLBMs each. China has built new warning and [command and control] capabilities and improved its readiness. Further, China’s nuclear weapons stockpile is expected to double (if not triple or quadruple) over the next decade.<sup>6</sup>

China’s economic and political pressure and military intimidation of Taiwan has led to a growing consensus that Taiwan is the most likely near-term flashpoint between the United States and China. China is using “gray zone tactics”<sup>7</sup> against Taiwan, meant to exhaust and intimidate the Taiwanese so that when the People’s Republic of China (PRC) makes its big move, Taiwan will lack the political will to fight back.<sup>8</sup> The PRC hopes that if Taiwan does not fight as though its very existence depends on it, and if the United States has not adapted its weapons deployments in time to win against the PRC at acceptable costs, the United States will not come to Taiwan’s defense.

But the security and sovereignty of democratic Taiwan *is* vital to America’s interest and is a linchpin of the U.S.-led order. China scholar Michael Mazza articulates the stakes in play should the PRC conquer Taiwan:

The PLA would for the first time have unimpeded access to the Pacific Ocean, allowing it more easily to threaten Guam, Hawaii, and the continental United States. PLA ballistic missile submarines might ply the waters of the Western Pacific, allowing China to pose a more potent nuclear weapons threat to the United States.<sup>9</sup>

The U.S. also has an interest in trading and traveling safely in a region that will generate two-thirds of the global economy in the next 10 years<sup>10</sup> and will want to do so without having to obtain permission from the Chinese.

China’s willingness to prevent Taiwan’s indefinite security as a free and democratic state has been demonstrated by the kinds of weapons China has recently unveiled, such as its nuclear-capable DF-26 that can conduct medium-range and long-range precision strikes against targets at sea and on land.<sup>11</sup> Chinese officials have periodically threatened explicitly to attack not just U.S. aircraft carriers, but also allies who might side with and assist the United States in a regional war with China—and even U.S. cities—with nuclear weapons.<sup>12</sup> Such audacious threats apply even to

what could be a purely conventional conflict over the fate of democratic Taiwan's security. Recent reports reveal that China is building more than 250 new intercontinental ballistic missile (ICBM) silos, which brings greater clarity from unclassified sources to Admiral Richard's warnings that China is undertaking a "breathtaking" expansion of delivery systems.<sup>13</sup> In a not-so-discreet warning, China also conducted war-gaming exercises as recently as 2020 during which it flew nuclear-capable H-6 bombers in what appeared to be a simulated bombing of Guam, a U.S. territory.<sup>14</sup>

It is because the stakes over the fate of Taiwan are so high for the United States and the CCP that the possibility of a military conflict is not only real, but becoming more acute and, because of the strategic nature of an all-out conventional conflict, runs the risk of escalating to the employment of nuclear weapons.

Last (but certainly not least), militarily threatening the U.S. against intervening on behalf of allies and partners in the region would also seriously impede the ability of the U.S. to provide credible security assurances to allies like Japan, South Korea, and the Philippines. Ending U.S. extended deterrence would be in line with China's stated national interests. Chinese writers have revealed that China is hostile to U.S. extended deterrence in Asia. There exists in China a belief that U.S. extended deterrence is an unnecessary holdover from the Cold War that bespeaks a hostile approach toward China and that, rather than diminishing in strength as we move further away from the Cold War, it is growing stronger. As evidence of this, for example, they have pointed to the 2010 Japanese Defense Program Guidelines, which stated that Japan "will continue to maintain and improve the credibility of US extended deterrence, with nuclear deterrent as a vital element, through close cooperation with the US."<sup>15</sup>

**Russia.** The North Atlantic Treaty Organization (NATO), though never without political challenges for the United States, remains a salient alliance protecting and promoting U.S. interests and security. Russia continues

to identify both the alliance and the United States as its primary foes. Russia, led by President Vladimir Putin, uses a variety of means to create and stoke divisions in the alliance, to weaken it, and to undermine U.S.-led initiatives that seek to support NATO.

In 2012, the U.S. National Intelligence Council reported that "[n]uclear ambitions in the United States and Russia over the last 20 years have evolved in opposite directions" and that "[r]educing the role of nuclear weapons in US security strategy is a US objective, while Russia is pursuing new concepts and capabilities for expanding the role of nuclear weapons in its security strategy."<sup>16</sup> Nearly a decade later, this has been made all the clearer.

In the wake of the Russian Federation's invasion of Ukraine in 2014, senior Russian officials repeatedly made statements referencing Russia's nuclear forces in an effort to intimidate U.S. allies, challenge the NATO alliance, and weaken the U.S. commitment to security on the European continent. Russian officials, for example, have repeatedly threatened preemptive nuclear attack against purely defensive U.S. systems deployed with NATO forces on Polish territory.<sup>17</sup> Russia also recently announced that it will deploy 20 additional military units in Western Russia using the pretense that it is countering NATO.

Despite the relief of some on the U.S. political left and various liberal internationalist analysts, the New Strategic Arms Reduction Treaty (New START) has not moderated Russia's aggressive, illegal, and abusive behavior against other nations, nor has it stopped the growth of Russia's nuclear weapons program. Setting aside for a moment the accounting problems in New START, Russia has simply gone around New START parameters to build delivery systems that are not limited by the treaty. As the Trump Administration's 2019 Missile Defense Review explains:

Moscow is fielding an increasingly advanced and diverse range of nuclear-capable regional offensive missile systems, including missiles with unprecedented

characteristics of altitude, speed, propulsion type, and range. These missile systems are a critical enabler of Russia's coercive escalation strategy and nuclear threats to U.S. allies and partners.<sup>18</sup>

The kinds of nuclear weapons in which Russia has chosen to invest raise serious concerns that they are regarded as warfighting weapons. Russia has built a large and diverse arsenal of theater and tactical nuclear weapons and delivery systems. As assessed by the U.S. intelligence community, Russia also believes that the ranges and types of those systems may give it an escalation advantage.<sup>19</sup> The nature of this category of weapons intensifies the concern of U.S. military strategists that Moscow has lowered the threshold for employment of a nuclear weapon by embracing escalate-to-deescalate doctrine.<sup>20</sup> This concept holds that Russia may employ a low-yield nuclear weapon in a purely conventional conflict in the hope that the United States would simply back down and concede Russia's victory.

Importantly, despite regularly opposing missile defense advancements by the U.S. and its allies, Russia and China are investing in significant missile defense systems of their own. Both are developing anti-satellite systems (ASATs).<sup>21</sup> In addition, Russia has modernized its missile defense system deployed around Moscow and throughout Russia, including 68 nuclear-armed interceptors and other mobile missile defense systems. The Trump Administration wisely included these advances in the 2019 Missile Defense Review against the backdrop of Russian and Chinese opposition to modest U.S. developments.<sup>22</sup>

**North Korea.** North Korea remains an authoritarian state and commits some of the world's worst atrocities against its own people. The rogue regime remains desirous of bringing democratic South Korea under dictator Kim Jong-un's rule. North Korea presents a long-standing proliferation concern. It has developed a nuclear missile capability and tests missiles to intimidate the United States and its allies in the region.

At the start of the last U.S. Administration, Kim Jong-un was repeatedly testing nuclear weapons and missiles, flying them over Japanese territory, and threatening to shoot at Guam, home to American citizens and an island on which U.S. military operations in the region rely. In 2017, North Korea successfully tested the Hwasong-14 ICBM, demonstrating that it could likely deliver a nuclear warhead all the way to the American Midwest. Since the summits with President Donald Trump, Kim Jong-un has not resumed testing of ICBMs, but he has tested other missiles in violation of United Nations Security Council Resolutions 1718 and 1874.<sup>23</sup>

**Iran.** Iran is ruled by a terrorist regime and proliferates weapons to proxy states and terrorist entities. It continues to threaten the existence of Israel, a U.S. ally, has demonstrated a commitment to improving its nuclear program, and has a record of hiding work and lying about the nature of its nuclear weapons program.<sup>24</sup> The Iranian regime also has sought to extort the United States for sanctions relief by threatening further work on nuclear weapons.

At the same time, Iran continues to improve its massive missile arsenal. In 2020, the Islamic Revolutionary Guard Corps conducted a successful satellite launch, and the regime's space-launch program is developing capabilities that are directly applicable to the advancement of an ICBM program. Also, Iran has shown that it is willing to proliferate SCUD missiles to its proxies in Yemen, to be used against Saudi Arabia, and to launch other kinds of missile attacks against U.S. partner and even ballistic missiles against U.S. bases.

### **Risk in the Reluctance to Modernize**

The threat environment is far more complex than it was during the Cold War, and adversaries are thinking about the employment of nuclear weapons in different and alarming ways. This is true despite actions by the U.S. to move away from nuclear weapons in its defense strategy. Some of those actions include reducing, at times unilaterally, the number of nuclear weapons in the U.S. arsenal (the United

States has reduced its stockpile by 25 percent since 2010, a time of rapid nuclear advancement by adversaries); committing to a unilateral testing moratorium; and committing, as the Obama Administration's Nuclear Posture Review did, to considering the employment of nuclear weapons in more limited scenarios, accelerating the dismantling of retired warheads, and not developing new nuclear weapons.<sup>25</sup>

Despite the Obama Administration's ambition to lead the world down to fewer nuclear weapons, it did commit to modernizing the U.S. nuclear stockpile and its delivery systems. Thus, there are ongoing efforts in the Department of Defense (DOD) and the National Nuclear Security Administration (NNSA) to modernize nearly every aspect of the U.S. nuclear arsenal over the next two decades. This includes ensuring the safety and reliability of the stockpile, improving the NNSA's infrastructure, overhauling the nuclear command and control architecture, and recapitalizing all three legs of the nuclear triad.

The price for maintaining and modernizing the U.S. nuclear deterrent mission is about 7 percent of the national defense budget at its highest peak.<sup>26</sup> The Trump Administration agreed to continue the modernization effort, and the Biden Administration appears poised to do the same, barring a change that could be outlined in the forthcoming NPR.<sup>27</sup> But there is already pressure to delay aspects of the modernization project, either by insisting on more studies before moving forward with various components, by delaying replacement of aging systems in favor of another service life extension, by going down to fewer numbers of deployed weapons, and by shelving various commitments altogether.

President Joe Biden's Interim National Security Strategic Guidance, while recognizing deepening "rivalries" with China and Russia, aims to reduce the role of nuclear weapons, elevate arms control initiatives, and avert an "arms race."<sup>28</sup> To be sure, it also commits to ensuring that the U.S. strategic deterrent remains safe, secure, and effective, but the document's emphasis does not instill confidence that the

Biden Administration appreciates the imperative need to shore up the credibility of the nuclear deterrent.

Slowing or stopping modernization can jeopardize the United States' ability to maintain a safe and reliable nuclear enterprise. It also incurs increased operational and technical risk and can undermine confidence in America's ability to deliver a particular nuclear payload to a desired target accurately at a time of its choosing. U.S. adversaries and allies are watching.

### **Risks to the Nuclear Stockpile and NNSA Infrastructure**

A safe, responsive, and resilient nuclear weapons infrastructure enables the United States to adapt to shifting requirements in the dynamic threat context. Although the NNSA has been able to certify the safety and reliability of the stockpile to the President, its infrastructure is decades-old, continues to age, and in some cases is deteriorating.

Unlike what the United States did during the Cold War and what adversaries like Russia, for instance, are doing now, the United States does not maintain a fully functional nuclear weapons design, development, test, and manufacturing enterprise capable of annually producing significant quantities of nuclear warheads to meet its national security requirements.<sup>29</sup> During the Cold War, the U.S. nuclear industrial infrastructure included active design and engineering laboratories and testing facilities. Warheads were developed with an intended service life of 10–15 years.<sup>30</sup>

The United States has been under a unilateral underground explosive testing ban since the 1990s when President George H. W. Bush halted it and 1993 when President William Clinton announced an indefinite moratorium that remains in place today. It is also worth noting that North Korea tests, and there is reason to believe that Russia and China have tested above a zero yield. As the U.S. nuclear stockpile ages and the U.S. continues to refrain from testing, the pressure to be able to certify that the stockpile is safe and reliable builds.



The NNSA continually assesses each nuclear weapon to determine its reliability and detect problems with components caused by aging. Part of routine maintenance includes the disposal of components that must be retired in a way that both protects the health of NNSA personnel and avoids creating an environmental hazard. Compounding the challenge of maintaining a reliable and safe stockpile is the fact that the U.S. is unable to produce the core component of warheads—plutonium pits—in sufficient quantities.<sup>31</sup> Russia, China, and North Korea also produce plutonium pits.

Without a change in policy, degradation from plutonium will cause the stockpile to atrophy. Being able to produce at least 80 plutonium pits per year is the minimum requirement articulated by the nation’s senior military and civilian leaders across Administrations and is legally required. The NNSA’s highest infrastructure priority should be to reconstitute plutonium pit production so that the number of pits produced is enough to meet security requirements.<sup>32</sup> The new production capabilities would also enhance safety protections to keep the radioactive material from harming U.S. personnel.

The risks involved in failing to reconstitute this capability at two sites range from jeopardizing the health of U.S. citizens working in the labs, to not being able to certify to the President that the stockpile is safe and reliable, to failing to produce and sustain the stockpile at numbers necessary to carry out the nation’s deterrent objectives. In particular, a delay in the pit production plan would render the NNSA unable to meet the DOD nuclear deterrent mission requirement to field the Minuteman III (MMIII) W78 warhead replacement for the Ground-Based Strategic Deterrent (GBSD) system by the end of this decade. To put a finer point on it, the U.S. could lose the ability to threaten adversaries with ICBMs credibly by the end of the decade and go unilaterally from a triad of delivery systems to a dyad simply by attrition.<sup>33</sup>

A modern, reliable industrial infrastructure must be able to maintain existing capabilities

and flexibility and manufacture new or replacement components in a timely manner. Failing to allocate the necessary funds as scheduled would strain the NNSA’s ability to certify to the President through the Stockpile Stewardship Program that the nuclear weapons stockpile is safe, secure, and reliable. Successive extensions of the service life of the current inventory of warheads will inevitably decrease confidence in the quality of the nuclear stockpile as the warheads deviate further from designs that scientists had validated by using data collected from actual explosive nuclear tests.

### Risks to the Triad of Delivery Systems

Nuclear delivery systems rely on decades-old technology.<sup>34</sup> The 2018 Trump Nuclear Posture Review agreed with the Obama NPR that a nuclear triad, complemented by NATO’s dual-capable aircraft and a nuclear command, control, and communications system, is the most cost-effective means of meeting deterrence and assurance aims. As stated in the 2018 NPR, “The triad provides the President flexibility while guarding against technological surprise or sudden changes in the geopolitical environment.”<sup>35</sup> But to remain credible, we must implement the Obama and Trump Administrations’ commitments to recapitalization of each leg and do so without unnecessary delays prompted by yet another study.

**The Land-Based Leg.** The land-based leg of the triad is the most reliable and responsive of the three. Comprised of ICBMs, it serves a great deterrent purpose by significantly raising the threshold for a would-be enemy’s nuclear first strike on the United States. Currently, there are 450 MM III silos—400 ICBMs that are operational and 50 silos in what is called “warm” status (meaning that they do not contain missiles)—and 45 launch sites, located in five states. The United States’ Minuteman III ICBMs entered service in 1970. The plan at the time was to retire them after a decade. The Ground-Based Strategic Deterrent will replace the Minuteman III by the end of this decade—40 years later than intended—and its service life is expected to stretch into 2075.

Numerous government and non-government agencies have concluded that extending the life of Minuteman III yet again would be unwise. For example, General Timothy M. Ray, Commander of Air Force Global Strike Command, has testified that “indefinite sustainment is impractical, unaffordable, and ineffective due to age-related deterioration, the evolution of the industrial base, and the expanding technical capabilities of our adversaries.”<sup>36</sup> In other words, pursuing GBSD is more affordable than extending the MMIII again. Extending the MMIII again would also deprive the United States of a more effective, versatile, adaptable missile with a modularity that enables it to respond more flexibly to a dynamic threat environment.

General Ray urged Congress to continue funding on schedule and in the full amount to “mitigate risk for the transition from MMIII to GBSD. Maintaining GBSD schedule momentum and reducing schedule risk is critical to avoiding capability shortfalls to warfighter requirements during transition.”<sup>37</sup> Schedule risk always entails unplanned cost increases as well as potential holes in capability at any given time.

Although MMIII has gone through various life extension programs and replacements of component parts, the Obama Administration recognized that it was untenable. There are significant concerns regarding the degradation of certain parts of the system and the challenge of repairing or replacing them.<sup>38</sup> By failing to keep GBSD on schedule to replace aging MMIIIs, the U.S. could well find itself with fewer than 400 ICBMs to deploy. As nuclear strategist Dr. Matthew Kroenig has warned:

Reducing numbers [of ICBMs] would make an enemy first strike more effective, allow larger adversaries to consider a nuclear first strike while holding a larger nuclear force in reserve, and place a first strike within reach for smaller powers, such as North Korea. Most importantly, deep ICBM reductions conflict with another important U.S. goal: achieving its objectives if deterrence fails.<sup>39</sup>

It is also important to keep in mind that although the current fleet of ICBMs cannot be intercepted by the missile defense systems employed by adversaries of the U.S., this might not always be the case. Moreover, cyber threats and other new technologies could also pose a challenge for the MMIII. The 2018 NPR warned that “Minuteman III will have increasing difficulty penetrating future adversary defenses.”<sup>40</sup>

**The Air Leg.** As with the land-based leg of the triad, the air leg must be recapitalized. The air leg is comprised of bombers with air-launched cruise missiles (ALCMs) and gravity bombs. The Air Force is developing the B61-12 guided bomb, which will be used on the F-35A (Air Force variant) and stealthy bombers. Nuclear-capable bombers assist in a crisis by providing the United States with a highly visible means of signaling resolve. This can both deter adversaries and reassure allies. Because bombers can be called back once deployed, the air leg of the triad can also have a strong de-escalatory impact.

The current AGM-86B ALCM carried by U.S. bombers is scheduled to retire in 2030, and the Long Range Stand Off (LRSO) weapon (assuming that Administrations and Congresses maintain support) will replace it. The ALCM now in use is becoming obsolete against both current and evolving enemy air defenses. The B-52 cannot (and the B-2 probably cannot) continue dependably in the nuclear mission beyond 2030 without the LRSO.<sup>41</sup> It is too early to know how survivable the B-21 will be against enemy air defenses in 2030.

Thus, by permitting the LRSO to slip in schedule, the United States faces the real possibility of losing a reliable air leg of the nuclear triad. This is a matter of particular concern in the context of the great-power contest, when the LRSO could play a leading role in deterring and—if deterrence fails—retaliating against Russian use of low-yield weapons. This makes the LRSO a leading guarantor of the credibility of extended deterrence because it provides a credible, tailored retaliatory response option in a regional context. But the LRSO is not the

only weapon system that is meant to fill this role in the current dynamic threat context.

The Trump Administration's 2018 review of the nuclear landscape and threats concluded that "in the near-term, the United States will modify a small number of existing SLBM warheads to provide a low-yield option, and in the longer term, pursue a modern nuclear-armed sea-launched cruise missile (SLCM)."<sup>42</sup> Rather than relying solely on the low-yield options provided by the Dual-Capable Aircraft (DCA), which may not be in an acceptable state of readiness, these modest changes would provide the United States with appropriate options to disabuse the Russians of the idea that they could launch a low-yield attack against a NATO ally and that the United States would not have a prompt, reliable, and proportional response at hand that could penetrate ever-changing and improving air defenses.

In 2020, the United States made good on its intent to field the low-yield W76-2 warhead on the SLBM.<sup>43</sup> Having these additional options either deployed or planned for deployment to locations near allied countries as a forward presence offers important additions in terms of assurance and deterrence. In 2019, then-presidential candidate Joe Biden said he opposed the low-yield adaptations.<sup>44</sup>

The publicly released version of the NPR discussed these adaptations as appropriate and tailored responses to Russia's changing nuclear strategy and doctrine. They are certainly that, but they should also be understood as necessary additions to the tailored response options in the Asia context as well. By maintaining these two modest changes and including them in the Biden Administration's NPR, the United States has the ability to bolster the credibility of its response to a potential nuclear employment in the regional context, thereby raising the nuclear thresholds that adversaries are lowering. On the other hand, failing to maintain these options:

- Risks tempting a peer adversary that is in danger of losing a conventional war to employ nuclear weapons,

- Could cause allies under the U.S. deterrence umbrella to doubt America's resolve and ability to end a disastrously escalating war as quickly as possible and with the least amount of damage, and
- Could tempt allies to eschew U.S. guarantees and acquire their own nuclear deterrents.

**The Sea-Based Leg.** The sea-based leg of the triad is the nation's most survivable nuclear platform. It consists of 14 *Ohio*-class ballistic missile submarines (SSBNs) armed with the intercontinental-range Trident II D5 missile and constitutes 70 percent of the nation's operational nuclear weapons.<sup>45</sup> SSBNs are also key contributors to regional nuclear assurances of allies under the U.S. nuclear umbrella. U.S. SSBNs patrol the world's oceans and—for now—can do so undetected. For just one nuclear-capable submarine to be destroyed or lose communication, however, could imply that this most secure of the legs has been fundamentally compromised and that the nation has lost its entire sea-based leg.

Like the ALCM and Minuteman III, the *Ohio*-class SSBNs face real challenges because of component part obsolescence. They are scheduled to be retired and replaced by the *Columbia*-class SSBNs at some point around 2031. The *Columbia*-class SSBNs are the U.S. Navy's number one priority and are expected to operate well into the 2080s—a fantastic value.<sup>46</sup>

It is impossible to anticipate the advancements of our adversaries' anti-submarine warfare capabilities throughout the decade and into the 2030s, but it would be prudent to assume that they possess far more advanced detection capabilities that threaten the stealth of our submarines and would weaken the survivability of our current fleet. The disarmament advocacy group Global Zero acknowledged this risk in its 2012 report, stating that within the next several decades, detection technology could advance to the point where submarines might be discoverable.<sup>47</sup> The *Columbia* SSBN is designed to take such advancements into

account, but the entire *Ohio*-class fleet must be retired by 2039 regardless of whether the *Columbia*-class SSBNs are ready. One can deduce that if the *Columbia*-class's funding slips and its deployment is delayed, one leg of the U.S. nuclear triad—at least for a time—could be underprepared.

The United States is at a crossroads. If it fails to keep the modernization plan on schedule and across multiple Administrations and Congresses, it could drop below necessary deployed levels of delivery systems. As President Obama's Secretary of Defense Ash Carter said in 2016:

The fact is, most of our nuclear weapon delivery systems have already been extended decades beyond their original expected service lives. So it's not a choice between replacing these platforms or keeping them; it's really a choice between replacing them or losing them. That would mean losing confidence in our ability to deter, which we can't afford in today's volatile security environment.<sup>48</sup>

## Risks in Missile Defense

Maintaining the credibility of our strategic deterrent will necessarily require a refocused effort to bring about qualitative improvements in missile defense. Missile defense enjoys greater support among policymakers now than it did during the Cold War. Homeland missile defense protects Americans at home from rogue nations' ICBMs, and regional missile defense systems protect U.S. bases and allies abroad. However, Cold War ideas about how missile defense might affect "strategic stability" with peer adversaries help to prevent the United States from pursuing homeland defenses against anything other than rogue-state ICBMs. The 2018 Trump Missile Defense Review clearly states that:

While the United States relies on deterrence to protect against large and technically sophisticated Russian and Chinese intercontinental ballistic missile threats to

the U.S. homeland, U.S. active missile defense can and must outpace existing and potential rogue state offensive missile capabilities. To do so, the United States will pursue advanced missile defense concepts and technologies for homeland defense.<sup>49</sup>

It does not say the United States is unwilling to improve its systems so that they can provide some defense against Russian and Chinese ICBMs; it merely notes the reality that the current deployments and capabilities are scaled to stay ahead of the rogue threat. But the variety of threats and the dangerous trends for missile development and proliferation are blurring and eventually could erase the line that separates what is considered a limited threat and a more expansive one.

Moreover, it would be wise not to put even unofficial constraints on U.S. missile defense deployments that could provide a defense against some plausible Chinese or Russian missile attacks against the U.S. homeland even if this seems unlikely. Lower-level conflicts at the regional level could escalate to outright conventional war but—as noted in the beginning of this essay—with strategic consequences, and the likelihood of an attack against the U.S. homeland increases in such a scenario. A more robust missile defense system that builds on the current homeland defense system but takes advantage of the space domain, including space-based interceptors, would likely strengthen U.S. strategic deterrence.

Even if policymakers do not make the concerted (and prudent) policy commitment to provide a defense against a small attack from China or Russia, the threats from North Korea and even Iran make it necessary that U.S. missile defense advance faster. The Missile Defense Agency is already asked repeatedly to do more but with a painfully small budget that does not grow with the increased responsibilities.

For example, assuming that Administrations and Congresses support and sustain it, the Next Generation Interceptor will be

added to missile fields in Alaska by the end of the decade, and this will affect America's entire Ground-Based Midcourse Defense (GMD) missile defense system. In a January 2020 House Armed Services Committee hearing, Congressman Doug Lamborn (R-CO) asked then-Undersecretary of Defense for Policy John C. Rood:

According to NORTHCOM [U.S. Northern Command], while we can be confident in our current GMD posture to counter a North Korean threat for the next 5 to 6 years, at the rate North Korea is developing their ICBM capabilities, we must begin assuming increased risks around 2025 and beyond. Do you agree with that assessment?<sup>50</sup>

Rood did agree: "I do share that assessment."<sup>51</sup> What that means in blunt terms is that North Korea could overwhelm the homeland missile defense system by 2025 if the United States does not commit to improving the system.

## Conclusion

Bolstering the credibility of our strategic deterrent will require bold, coordinated moves across Administrations to signal adversaries that the United States is willing and able to do whatever is necessary to defend its citizens and vital interests and that, should deterrence fail, America will fight to make sure that the costs an adversary sustains far outweigh any conceivable gains.

The various elements of the nuclear deterrent are interdependent; slowing down or (worse) eliminating one will weaken the entire force. Moreover, if the United States loses entire legs of the nuclear triad through

obsolescence, adversaries will be tempted to exploit perceived U.S. weakness and vulnerability.

The United States must maintain consistent, full, and timely funding across Administrations and Congresses to ensure a safe, reliable, and flexible modern nuclear enterprise. Likewise, nuclear delivery systems must be modernized and, in some cases, replaced to ensure that the United States can credibly threaten to deliver nuclear payloads on desired targets in a timely manner. This capability will disabuse adversaries of the notion that the United States has only limited and unreliable options to retaliate in a proportional way if they attack U.S. vital interests with a nuclear weapon.

Failing to do this not only risks adversaries employing nuclear weapons, but also tempts allies under the nuclear deterrent umbrella to acquire their own nuclear weapons. Nuclear proliferation, even by an ally, could tempt other non-nuclear nations to acquire their own nuclear weapons. The global increase of nuclear-weapon states is not conducive to U.S. interests or to global security.

Finally, the United States must build the necessary defenses to contribute to deterrence by denial, which strengthens strategic deterrence and reinforces the credibility of the U.S. promise both to deter strategic attack and to fight to win as quickly as possible with as little damage as possible. The United States must move forward with confidence and end this decades-long chapter in American history during which some of our leaders have deemphasized U.S. nuclear strength and the goal of U.S. nuclear pre-eminence. For the sake of peace and to protect the American people, our way of life, and the U.S.-led order, a renewed and energetic commitment to the keystone of our national defense is imperative.

## Endnotes

1. In his 2006 book *The Audacity of Hope*, then-Senator Barack Obama wrote: “When Truman, Acheson, Kennan, and Marshall sat down to design the architecture of the post–World War II order, their frame of reference was the competition between the great powers that had dominated the nineteenth and early twentieth centuries.... That world no longer exists.” Barack Obama, *The Audacity of Hope: Thoughts on Reclaiming the American Dream* (New York: Crown, 2006), pp. 304–305. In 2014, President Barack Obama declared at the United Nations: “The shadow of World War that existed at the founding of this institution has been lifted; the prospect of war between major powers reduced.” See “Remarks by President Obama in Address to the United Nations General Assembly,” The White House, September 24, 2014, <https://obamawhitehouse.archives.gov/the-press-office/2014/09/24/remarks-president-obama-address-united-nations-general-assembly> (accessed July 16, 2021).
2. Oriana Skylar Mastro, “The Taiwan Temptation, Why Beijing Might Resort to Force,” *Foreign Affairs*, Vol. 100, No. 4 (July/August 2021), <https://www.foreignaffairs.com/articles/china/2021-06-03/china-taiwan-war-temptation> (accessed July 16, 2021).
3. Mary Stokes, Gabriel Alvarado, Emily Weinstein, and Ian Easton, *China’s Space and Counterspace Capabilities and Activities*, U.S.–China Economic and Security Review Commission, March 2020, [https://www.uscc.gov/sites/default/files/2020-05/China\\_Space\\_and\\_Counterspace\\_Activities.pdf](https://www.uscc.gov/sites/default/files/2020-05/China_Space_and_Counterspace_Activities.pdf) (accessed July 16, 2021).
4. Mark Moore, “China Threatens Nuclear War, Expanding Arsenal in Case of ‘Intense Showdown’ with US,” *New York Post*, June 2, 2021, <https://nypost.com/2021/06/02/chinese-media-says-beijing-expanding-its-nuclear-arsenal/> (accessed July 16, 2021), and Tom O’Connor, “China, Creator of ‘Guam Killer’ Missile, Practices Bombing U.S. Territory After North Korea Resumes Threat,” Yahoo Finance, October 31, 2017, <https://finance.yahoo.com/news/china-creator-apos-guam-killer-162708764.html> (accessed July 16, 2021).
5. Rebeccah L. Heinrichs, “Transcript: The Arms Control Landscape ft. DIA Lt. Gen. Robert P. Ashley, Jr.,” Hudson Institute, May 31, 2019, <https://www.hudson.org/research/15063-transcript-the-arms-control-landscape-ft-dia-lt-gen-robert-p-ashley-jr> (accessed July 16, 2021).
6. Admiral Charles A. Richard, U.S. Navy, “Forging 21st-Century Strategic Deterrence,” U.S. Naval Institute *Proceedings*, Vol. 147/2/1,416 (February 2021), <https://www.usni.org/magazines/proceedings/2021/february/forging-21st-century-strategic-deterrence> (accessed July 16, 2021).
7. For an explanation of gray zone tactics, see Elizabeth K. Kiessling, “Gray Zone Tactics and the Principle of Non-Intervention: Can ‘One of the Vaguest Branches of International Law’ Solve the Gray Zone Problem?” *Harvard National Security Journal*, Vol. 12, Issue 1 (February 1, 2021), pp. 116–163, <https://harvardnsj.org/wp-content/uploads/sites/13/2021/02/HNSJ-Vol-12-Kiessling-Gray-Zone-Tactics-and-the-Principle-of-Non-Intervention.pdf> (accessed July 16, 2021). The author defines gray zone tactics as “acts that exceed the threshold of accepted peacetime competition but do not rise to a level likely to trigger a conventional military response.” *Ibid.*, p. 122.
8. For examples, see Reuters, “Taiwan Reports New Incursion by Chinese Jets into Defence Zone,” April 5, 2021, <https://www.reuters.com/article/us-taiwan-china-defence-idUSKBN2BSOU8> (accessed July 16, 2021).
9. Michael Mazza, “‘Rock Solid’: America’s Past and Present Commitment to Taiwan,” *The Journal of Indo-Pacific Affairs, Indo-Pacific Perspectives*, March 2021, p. 6, <https://media.defense.gov/2021/Mar/31/2002611841/-1/-1/1/IPP%20-%20MARCH%202021.PDF?source=GovD> (accessed July 16, 2021).
10. Admiral Philip S. Davidson, U.S. Navy, Commander, U.S. Indo-Pacific Command, statement on “U.S. Indo-Pacific Command Posture” before the Committee on Armed Services, U.S. Senate, March 9, 2021, p. 2, [https://www.armed-services.senate.gov/imo/media/doc/Davidson\\_03-09-21.pdf](https://www.armed-services.senate.gov/imo/media/doc/Davidson_03-09-21.pdf) (accessed July 16, 2021).
11. “Meet the DF-26 Missile: China’s Prized Anti-Carrier Weapon,” *The National Interest*, The Buzz Blog, October 3, 2019, <https://nationalinterest.org/blog/buzz/meet-df-26-missile-chinas-prized-anti-carrier-weapon-85261> (accessed July 16, 2021).
12. Danny Gittings, “General Zhu Goes Ballistic,” *The Wall Street Journal*, July 18, 2005, <https://www.wsj.com/articles/SB112165176626988025> (accessed July 16, 2021).
13. Hans M. Kristensen and Matt Korda, “China’s Nuclear Missile Silo Expansion: From Minimum Deterrence to Medium Deterrence,” *Bulletin of the Atomic Scientists*, September 1, 2021, <https://thebulletin.org/2021/09/chinas-nuclear-missile-silo-expansion-from-minimum-deterrence-to-medium-deterrence/> (accessed September 8, 2021).
14. “China Air Force Video Appears to Show Simulated Attack on US Base on Guam,” *The Telegraph*, September 21, 2020, <https://www.youtube.com/watch?v=OBOho1AOKYY> (accessed July 16, 2021).
15. Lin Bin and He Yun, “Credible Limitations: U.S. Extended Nuclear Deterrence and Stability in Northeast Asia,” in *Disarming Doubt: The Future of Extended Deterrence in East Asia*, ed. Rory Medcalf and Fiona Cunningham, Lowy Institute for International Policy, 2012, p. 47, [https://archive.lowyinstitute.org/sites/default/files/disarmingdoubt\\_web\\_0.pdf](https://archive.lowyinstitute.org/sites/default/files/disarmingdoubt_web_0.pdf) (accessed July 16, 2021).

16. National Intelligence Council, *Global Trends 2030: Alternative Worlds*, December 2012, p. 69, [https://www.dni.gov/files/documents/GlobalTrends\\_2030.pdf](https://www.dni.gov/files/documents/GlobalTrends_2030.pdf) (accessed July 16, 2021).
17. Harry de Quetteville and Andrew Pierce, "Russia Threatens Nuclear Attack on Poland over US Missile Shield Deal," *The Telegraph*, August 15, 2008, <https://www.telegraph.co.uk/news/worldnews/europe/russia/2566005/Russia-threatens-nuclear-attack-on-Poland-over-US-missile-shield-deal.html> (accessed July 16, 2021).
18. U.S. Department of Defense, Office of the Secretary of Defense, *2019 Missile Defense Review*, p. IV, [https://www.defense.gov/Portals/1/Interactive/2018/11-2019-Missile-Defense-Review/The%202019%20MDR\\_Executive%20Summary.pdf](https://www.defense.gov/Portals/1/Interactive/2018/11-2019-Missile-Defense-Review/The%202019%20MDR_Executive%20Summary.pdf) (accessed July 16, 2021).
19. U.S. Department of Defense, Office of the Secretary of Defense, *2018 Nuclear Posture Review*, February 2018, p. 9, <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF> (accessed July 16, 2021).
20. Mark B. Schneider, "Escalate to De-escalate," U.S. Naval Institute *Proceedings*, Vol. 143/2/1,368 (February 2017), <https://www.usni.org/magazines/proceedings/2017/february/escalate-de-escalate#footnotes> (accessed July 16, 2021).
21. U.S. Department of Defense, Defense Intelligence Agency, *Challenges to Security in Space*, information cutoff date January 2019, pp. 21 (China) and 29 (Russia), [https://www.dia.mil/Portals/27/Documents/News/Military%20Power%20Publications/Space\\_Threat\\_V14\\_020119\\_sm.pdf](https://www.dia.mil/Portals/27/Documents/News/Military%20Power%20Publications/Space_Threat_V14_020119_sm.pdf) (accessed July 16, 2021).
22. Fact sheet, "Chinese and Russian Missile Defense: Strategies and Capabilities," U.S. Department of Defense, [https://media.defense.gov/2020/Jul/28/2002466237/-1/-1/1/CHINESE\\_RUSSIAN\\_MISSILE\\_DEFENSE\\_FACT\\_SHEET.PDF](https://media.defense.gov/2020/Jul/28/2002466237/-1/-1/1/CHINESE_RUSSIAN_MISSILE_DEFENSE_FACT_SHEET.PDF) (accessed July 16, 2021).
23. Rebeccah Heinrichs, "What North Korea's First Missile Test During the Biden Administration Means," *National Review*, March 24, 2021, <https://www.msn.com/en-us/news/world/what-north-korea-s-first-missile-test-during-the-biden-administration-means/ar-BB1eVvXI> (accessed July 16, 2021).
24. Yonah Jeremy Bob, "IAEA Chief: Deeply Concerned Iran Hiding Nuclear Material," *The Jerusalem Post*, June 7, 2021, <https://www.jpost.com/middle-east/iaea-chief-deeply-concerned-iran-hiding-nuclear-material-670325> (accessed July 16, 2021).
25. The Honorable Lisa E. Gordon-Hagerty, Under Secretary for Nuclear Security and Administrator of the National Nuclear Security Administration, U.S. Department of Energy, statement before the Subcommittee on Energy and Water Development, Committee on Appropriations, U.S. House of Representatives, April 2, 2019, p. 3, <https://docs.house.gov/meetings/AP/AP10/20190402/109204/HHRG-116-AP10-Wstate-Gordon-HagertyL-20190402.pdf> (accessed July 16, 2021), and U.S. Department of Defense, *Nuclear Posture Review Report*, April 2010, [https://dod.defense.gov/Portals/1/features/defenseReviews/NPR/2010\\_Nuclear\\_Posture\\_Review\\_Report.pdf](https://dod.defense.gov/Portals/1/features/defenseReviews/NPR/2010_Nuclear_Posture_Review_Report.pdf) (accessed July 16, 2021). The 2010 NPR addresses the Obama Administration's underlying rationale for reducing the U.S. nuclear posture, as well as various related initiatives and objectives; summary statements are found on pages iii and vi.
26. U.S. Department of Defense, "Nuclear Modernization: Ensuring a Safe, Secure, Reliable, and Credible U.S. Nuclear Deterrent," <https://media.defense.gov/2019/Apr/01/2002108024/-1/-1/1/NUCLEAR-MODERNIZATION-FIVE-KEY-TAKEAWAYS.PDF> (accessed July 16, 2021). An increase over 2019 projections is reported in Congressional Budget Office, "Projected Costs of Nuclear Forces, 2021 to 2030," May 2021, <https://www.cbo.gov/system/files/2021-05/57130-Nuclear-Forces.pdf> (accessed July 16, 2021). For a discussion about the changing estimates, see transcript, "Virtual Event | A Conversation on Strategic Forces with Rep. Mike Turner," Hudson Institute, July 7, 2021, p. 9, <https://s3.amazonaws.com/media.hudson.org/Transcript-%20A%20Conversation%20on%20Strategic%20Forces%20with%20Rep%20Mike%20Turner.pdf> (accessed July 16, 2021).
27. Lara Seligman, Bryan Bender, and Connor O'Brien, "Biden Goes 'Full Steam Ahead' on Trump's Nuclear Expansion Despite Campaign Rhetoric," *Politico*, June 2, 2021, <https://www.politico.com/news/2021/06/02/biden-trump-nuclear-weapons-491631> (accessed July 16, 2021).
28. President Joseph R. Biden, Jr., *Interim National Security Strategic Guidance*, The White House, March 2021, p. 13, <https://www.whitehouse.gov/wp-content/uploads/2021/03/NSC-1v2.pdf> (accessed July 16, 2021).
29. U.S. Department of Energy and U.S. Department of Defense, *National Security and Nuclear Weapons in the 21st Century*, September 2008, p. 2, <https://dod.defense.gov/Portals/1/Documents/pubs/nuclearweaponspolicy.pdf> (accessed July 16, 2021).
30. *Ibid.*, p. 19.
31. U.S. Department of Energy, National Nuclear Security Administration, "Plutonium Pit Production," <https://www.energy.gov/nnsa/plutonium-pit-production> (accessed July 1, 2021).
32. The Honorable Lisa E. Gordon-Hagerty, Under Secretary for Nuclear Security and Administrator of the National Nuclear Security Administration, U.S. Department of Energy, statement before the Subcommittee on Energy and Water Development, Committee on Appropriations, U.S. House of Representatives, March 4, 2020, p. 6, <https://docs.house.gov/meetings/AP/AP10/20200304/110623/HHRG-116-AP10-Wstate-Gordon-HagertyL-20200304.pdf> (accessed July 16, 2021).

33. Statement of Lisa E. Gordon-Hagerty, former Administrator, National Nuclear Security Administration, in stenographic transcript, *Hearing to Receive Testimony on United States Nuclear Deterrence Policy and Strategy*, Subcommittee on Strategic Forces, Committee on Armed Services, U.S. Senate, June 16, 2021, p. 26, [https://www.armed-services.senate.gov/imo/media/doc/21-53\\_06-16-2021.pdf](https://www.armed-services.senate.gov/imo/media/doc/21-53_06-16-2021.pdf) (accessed July 16, 2021).
34. Patty-Jane Geller and Rebecca L. Heinrichs, "Extending New START Makes U.S. Nuclear Modernization Imperative," Heritage Foundation *Backgrounder* No. 3595, March 16, 2021, p. 7, <https://www.heritage.org/arms-control/report/extending-new-start-makes-us-nuclear-modernization-imperative>.
35. U.S. Department of Defense, Office of the Secretary of Defense, *2018 Nuclear Posture Review*, p. 2.
36. General Timothy M. Ray, Commander, Air Force Global Strike Command, statement on "FY22 Posture for Department of Defense Nuclear Forces" before the Subcommittee on Strategic Forces, Committee on Armed Services, U.S. Senate, May 12, 2021, p. 9, <https://www.armed-services.senate.gov/imo/media/doc/5-12-21%20Gen%20Ray%20Written%20Statement%20Final.pdf> (accessed July 18, 2021).
37. *Ibid.*, p. 15.
38. Mark Gunzinger, "Don't Delay GBSB ICBMs; It's Too Risky," *Breaking Defense*, July 2, 2019, <https://breakingdefense.com/2019/07/dont-delay-gbsd-icbms-its-too-risky/> (accessed July 16, 2021).
39. Matthew Kroenig, "The Case for the US ICBM Force," *Strategic Studies Quarterly*, Vol. 12, Issue 3 (Fall 2018), p. 58, [https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-12\\_Issue-3/Kroenig.pdf](https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-12_Issue-3/Kroenig.pdf) (accessed July 16, 2021).
40. U.S. Department of Defense, Office of the Secretary of Defense, *2018 Nuclear Posture Review*, p. 46.
41. Dennis Evans and Jonathan Schwalbe, "The Long-Range Standoff (LRSO) Cruise Missile and Its Role in Future Nuclear Forces," Johns Hopkins University, Applied Physics Laboratory, *National Security Perspective*, 2017, pp. 4–5, <https://www.jhuapl.edu/Content/documents/LRSO.pdf#:~:text=Summary%20of%20need%20for%20LRSO%20in%20the%20nuclear,the%20B-21%20is%20fully%20operational%20in%20the%20nuclear%20mission> (accessed July 16, 2021).
42. U.S. Department of Defense, Office of the Secretary of Defense, *2019 Missile Defense Review*, pp. XII and 54.
43. Rebecca Kheel, "US Deploys Submarine-Launched Low-Yield Nuke," *The Hill*, February 4, 2020, <https://thehill.com/policy/defense/481345-us-deploys-submarine-launched-low-yield-nuke> (accessed July 16, 2021).
44. Council for a Livable World, "Presidential Candidates: Joe Biden," <https://livableworld.org/presidential-candidates-joe-biden/> (accessed July 16, 2021).
45. "Columbia-Class Ballistic Missile Submarines," *Naval Technology*, <https://www.naval-technology.com/projects/columbia-class-ballistic-missile-submarines/#:~:text=The%20new%20submarines%20will%20support%20the%20US%20strategic,nation%E2%80%99s%20operational%20nuclear%20weapons.%20Columbia-class%20submarine%20programme%20details> (accessed July 1, 2021).
46. Brent Sadler, "U.S. Navy," in *2021 Index of U.S. Military Strength*, ed. Dakota L. Wood (Washington: The Heritage Foundation, 2021), p. 399, [https://www.heritage.org/sites/default/files/2020-11/2021\\_IndexOfUSMilitaryStrength\\_ASSESSMENT\\_POWER\\_NAVY.pdf](https://www.heritage.org/sites/default/files/2020-11/2021_IndexOfUSMilitaryStrength_ASSESSMENT_POWER_NAVY.pdf).
47. Global Zero, *Global Zero U.S. Nuclear Policy Commission Report: Modernizing U.S. Nuclear Strategy, Force Structure and Posture*, May 2012, p. 7, [https://www.globalzero.org/wp-content/uploads/2018/09/gz\\_us\\_nuclear\\_policy\\_commission\\_report.pdf](https://www.globalzero.org/wp-content/uploads/2018/09/gz_us_nuclear_policy_commission_report.pdf) (accessed July 16, 2021).
48. News release, "Secretary of Defense Speech: Remarks on 'Sustaining Nuclear Deterrence,'" U.S. Department of Defense, September 26, 2016, <https://www.defense.gov/Newsroom/Speeches/Speech/Article/956630/remarks-on-sustaining-nuclear-deterrence/> (accessed July 16, 2021).
49. U.S. Department of Defense, Office of the Secretary of Defense, *2019 Missile Defense Review*, 2019, p. III.
50. Hearing, Security Update on the Korean Peninsula, Committee on Armed Services, U.S. House of Representatives, 116th Cong., 2nd Sess., January 28, 2020, p. 13, <https://www.congress.gov/116/chrg/CHRG-116hrg40664/CHRG-116hrg40664.pdf> (accessed July 16, 2021).
51. *Ibid.*



# How Prioritizing Climate Change Could Weaken America’s Military

Rebecca Grant, PhD

At approximately 12:30 pm on October 10, 2018, Hurricane Michael struck Northwest Florida as a Category 5 storm with sustained winds of 160 miles per hour. Hurricane Michael had burgeoned into a massive storm in just two days. Trapped in a hangar at Tyndall Air Force Base were 17 U.S. Air Force F-22 stealth fighters. While 38 of the advanced-performance stealth jets had been flown out to safety at other bases, these 17 F-22 Raptors were undergoing repairs and could not be moved on short notice. Official reports found that Hurricane Michael was the third most intense storm to make landfall in the U.S. since 1900. A wind gust of over 130 mph was recorded at Tyndall before the sensor failed.<sup>1</sup>

When Hurricane Michael passed, the pictures of smashed buildings and F-22s covered in roof debris seemed to deliver a final warning: Climate change could impact the Department of Defense (DOD). Rising global temperatures could fuel storms and floods and perhaps even spark international conflict. If so, shouldn’t the U.S. military move climate change to the heart of its planning priorities?

Fast forward three years, and the Department of Defense has taken on the most ambitious climate change policy agenda in its history. On January 27, 2021, President Joe Biden declared by executive order “that climate considerations shall be an essential element of United States foreign policy and national security” and directed that:

The Secretary of Defense and the Chairman of the Joint Chiefs of Staff shall consider the security implications of climate change, including any relevant information from the Climate Risk Analysis described in subsection (c) of this section, in developing the National Defense Strategy, Defense Planning Guidance, Chairman’s Risk Assessment, and other relevant strategy, planning, and programming documents and processes.<sup>2</sup>

“We know first-hand the risk that climate change poses to national security because it affects the work we do every day,” said Secretary of Defense Lloyd Austin in an official Pentagon statement that same day.<sup>3</sup> “Climate change is a threat,” Chairman of the Joint Chiefs of Staff General Mark Milley similarly testified to Congress in June 2021. “Climate change has a significant impact on military operations, and we have to take that into consideration.”<sup>4</sup>

For activists, skeptics, and everyone in between, the climate change discussion had arrived—and with significant risks.

America’s military is facing China and Russia across multiple domains. Yet while the Defense Department strives to modernize nuclear deterrence forces, replace old aircraft and ships, guard access to space, and fend off cyberattacks, new directives mandate that the military must also focus on the effects of climate change. “Every dollar that we spend addressing the effects of climate change is a dollar that we are not

putting toward other priorities, like meeting the challenge posed by China and modernizing our forces,” as Deputy Secretary of Defense Kathleen Hicks pointed out in May 2021.<sup>5</sup>

Asking the military to split its attention between great-power competition and the wide-ranging impacts of climate change is a tough assignment. The potential consequences of the effects of climate change for the military include everything from seawalls to B-2 bomber flights over the Arctic. Imagine if the military were told to prepare for “risks from Russia” but did not differentiate between cyberattacks and harassment of U.S. Navy destroyers in the Black Sea.

On top of that, the risks are poorly understood, and that is not standard practice at the Pentagon. If natural hazards do not emerge as predicted, the U.S. military may find that building forces, bases, and plans for climate change was a waste of effort. At a minimum, the dollars for climate crisis programs will have to compete with dollars for the development and acquisition of technologies needed for the U.S. to dominate in all-domain operations.

Nevertheless, there are surprises in this discussion. For example, the Department of Defense is by no means neglecting climate change. To the contrary: It has decades of experience with environmental impact studies, improving base resilience, and investing in sustainability and green energy research. That said, however, prioritizing climate change risks weakening the Pentagon’s preparations to face near-term threats. Policymakers face a difficult task in trying to develop policies that address climate change concerns while also maintaining U.S. military dominance.

No definitive answers will be provided here. Rather, this essay sets out several areas to consider for a better grasp of how the quest for climate change policies may impact U.S. military capabilities.

### **Climate Change and Defense Planning Guidance**

The rise of climate as a new policy direction for the Pentagon did not happen overnight.

Discussion and assessments of climate date back over 15 years. Most recent defense reviews from the Administrations of Presidents Donald Trump and Barack Obama added a section on climate concerns.

However, the Biden–Harris Administration’s 2021 executive order went much further than previous policy guidance. As noted, the DOD was directed to perform a Climate Risk Analysis and then to include climate risk findings in “the National Defense Strategy, Defense Planning Guidance, Chairman’s Risk Assessment, and other relevant strategy, planning, and programming documents and processes.” Every January, starting in 2022, the Secretary of Defense and Chairman of the Joint Chiefs of Staff must report to the National Security Council on how they have included climate matters in key planning processes.<sup>6</sup>

This was not just a heads up; it was a mandate to inject responses to climate change into the most crucial defense planning processes. “This means that climate considerations must become an integral element in resource allocation and our operational decision-making process,” confirmed Deputy Secretary Hicks.<sup>7</sup>

Bringing a rigorous discussion of climate change into defense planning will not be easy because the threat analysis that is so central to military planning is at an elementary stage in this area. Typically, the military has years of analysis of threats to back its decisions. Analysis centers on weapons systems capabilities and adversary tactics. Convene a discussion of missile defense or China’s Taiwan strategy and you will get tactical and technological detail along with informed analysis and contrasting opinion on the best options. The climate change discussion has not yet met the rigorous standards demanded for national security dialogue.

Contrast that with the state of play seen in the 2019 unclassified Worldwide Threat Assessment released by the Director of National Intelligence. It noted threats to low-lying military installations and remarked on the general risks in language not so different from that of past Administrations: “Climate hazards such

as extreme weather, higher temperatures, droughts, floods, wildfires, storms, sea level rise, soil degradation, and acidifying oceans are intensifying, threatening infrastructure, health, and water and food security.”<sup>8</sup>

Such an estimate, while startling, does not provide clear direction for defense programs. Nor does it help decision-makers balance climate initiatives with meeting challenges from nation-state adversaries, terrorism, and so forth. In short, the DOD has a tremendous analytic task ahead if leaders want to take on climate change and make their budget and policy recommendations stick after scrutiny by Congress.

### **Climate Change and Military Disaster Relief Missions**

One of the easiest areas to evaluate should be requirements for disaster relief. U.S. military forces engage regularly in relief missions both small and large. Current climate change policy anticipates increased deployment of U.S. forces for international disaster relief and for support to civil authorities at home. However, it is not always the climate—atmospheric and temperature conditions—that drives disaster relief missions. Earthquakes are a big factor.

Consider recent experience. On January 12, 2010, a 7.0 magnitude earthquake in Haiti left 220,000 dead.<sup>9</sup> The capital city of Port Au Prince was devastated. U.S. special forces set up air traffic control at the airport’s one working runway. Roads from the neighboring Dominican Republic were few because of problematic political relationships. Aid from the international community poured in, but 10 years later, Haiti was still rebuilding.

A 9.0 magnitude earthquake hit Japan on March 11, 2011, causing a tsunami with a wave height measured at 133 feet. The tsunami swamped the power supply to Japan’s Fukushima nuclear reactor and killed 20,000 Japanese.<sup>10</sup> “At the peak,” according to the Congressional Research Service, “approximately 24,000 personnel, 189 aircraft, and 24 Navy vessels were involved in the humanitarian assistance and relief efforts. Major assets in

the region were redirected to the quake zone, including the USS *Ronald Reagan* Carrier Strike group.”<sup>11</sup>

The U.S. military brings specialized assets including command and control, airlift, air traffic control, and others to international disaster relief. The services already have both doctrine on disaster relief and prudent planning to keep joint task force resources at the ready.

Put in context, climate change projections may not be the right framework for estimating military contributions to disaster relief missions. Even a cursory look at historic disasters from the Great Chinese Famine of 1958–1962 or the 1815 eruption of the volcano at Mount Tambora, Indonesia, shows that factors other than climate can drive disaster relief. By projecting climate change, especially on a global scale, the U.S. military could oversize its relief forces at the expense of combat capability. Natural and man-made disasters will occur, and the U.S. military may well respond, but the climate change set of disasters is not a good sizing tool.

Ultimately, the decision to deploy military forces for worldwide disaster relief comes down to politics. Key ally Japan merited and welcomed assistance after the 2011 tsunami. The situation might be very different in flood-prone China or if the victim country did not want much help from U.S. forces. The bottom line is that climate change alone is not the driver of intervention; in the end, the choice is a political one. Focusing on climate change may not improve the forecasting and related preparation for disaster relief missions.

### **Connecting Climate Change and Causes of Wars**

Another very difficult area to evaluate is the connection between climate change and the causes of wars. It has become almost an article of faith that climate change stokes conflict, in the words of Deputy Secretary Hicks, by “actually increasing risks of conflict from terrorism and civil wars.”<sup>12</sup> “Already, significant conflicts are being fueled by high temperatures

contributing to water shortages and crop failures in Africa, the Middle East, and South Asia,” commented retired Admiral and former NATO Supreme Allied Commander James Stavridis. “Wars in Syria, Iraq, Mali and Afghanistan are all examples of that.”<sup>13</sup>

Climate change as an accelerant of conflict is not a new idea. The 2010 Quadrennial Defense Review stated that “[w]hile climate change alone does not cause conflict, it may act as an accelerant of instability or conflict” and increase the “burden...on civilian institutions and militaries around the world.”<sup>14</sup> President Obama’s 2015 National Security Strategy sharpened the point and called climate change “an urgent and growing threat to our national security, contributing to increased natural disasters, refugee flows, and conflicts over basic resources like food and water.”<sup>15</sup>

But the evidence is much more complicated. One clear connection is the Arctic. Thawing ice has led to open sea-lanes and increased competition among Arctic powers. The B-2 flights of 2020 were part of a coordinated show-of-presence mission to deter Russian activity in the Arctic.<sup>16</sup>

Some have attempted to link worsening climate conditions with the outbreak of wars, but scholarly debate is still raging. Take Syria’s civil war, which began in 2011. In 2015, Secretary of State John Kerry told an audience in Norfolk, Virginia, that “it’s not a coincidence that immediately prior to the civil war in Syria, the country experienced its worst drought on record.”<sup>17</sup> President Obama also suggested that “the droughts that happened in Syria contributed to the Syrian civil war.”<sup>18</sup>

The claims did not hold up. Scholars differed with respect to the impact of the drought and the complex causes of the civil war such as the actions of Bashar al-Assad’s regime. A paper published by the National Academy of Sciences linked a rise in global sea temperature in the Mediterranean to a period of drought from 2007–2010.<sup>19</sup>

However, a contrasting study showed that rainfall in Syria was at the drought level of 80 percent of average rainfall only for 2008.

Drought alone was not sustained and did not cause the civil war; bad agricultural policies, which induced more migration to cities, were found to be more likely contributors.<sup>20</sup> Another academic study was even more direct:

We find that there is no clear and reliable evidence that anthropogenic climate change was a factor in northeast Syria’s 2006/07–2008/09 drought; we find that, while the 2006/07–2008/09 drought in northeast Syria will have contributed to migration, this migration was not on the scale claimed in the existing literature, and was, in all probability, more caused by economic liberalisation than drought; and we find that there is no clear and reliable evidence that drought-related migration was a contributory factor in civil war onset.<sup>21</sup>

While the DOD seeks to improve its modelling of climate threats, presuming that a climate crisis will drive certain types of conflicts is a risky proposition. Part of the problem comes from scaling up data on smaller, isolated conflicts. For example, a 2016 U.S. intelligence community report found specific cases of small riots over water access in Mexico, Nigeria, and Mauritania.<sup>22</sup> This suggests that there may be a direct relationship between climate change and small-scale internal conflict, but there are few, if any, data to suggest that the same relationship exists in much larger country or regional-level events. On the contrary, another study predicted increasing demands for water to 2040 but noted that “historically, water tensions have led to more water-sharing agreements than violent conflicts.”<sup>23</sup>

It would therefore be prudent for future modelling to appreciate the limits of data relevance.

### **Policy Clashes with Military Allies**

Putting so much emphasis on climate change could also strain military alliances if allies disagree on decarbonization goals. Take the case of Australia. At the April 2021 Climate

Summit,<sup>24</sup> Australia opted to stick with its goals of reducing carbon emissions by about 26 percent.<sup>25</sup> Its goals are in line with the Paris Climate Accords, and Australia leads the world in solar panel capacity at 591 watts per person—eight times the world average.<sup>26</sup> This would seem to be a good thing worthy of praise.

Australia was also the world's second-largest exporter of coal at 395 metric tons in 2019 compared to Indonesia at 455 metric tons. Interestingly, China and India were the biggest coal buyers that year. Trade coal accounts for only about one-fifth of global coal consumption, implying that coal-produced energy occurs mostly with domestically produced coal and further implying that China and India produce huge quantities of coal. Despite a ban from China that was implemented in late 2020, Australia's coal exports recovered by feeding the markets of India and other countries. China produces, purchases, and consumes more coal than any other nation per year.<sup>27</sup>

However, senior Biden Administration officials chose to criticize Australia, saying that it was “insufficient for Australia to follow the existing trajectory and hope that they will be on a course to deep decarbonization and getting to net zero emissions by mid-century.” The U.S. made no reference to China and its prodigious consumption of coal and production of greenhouse gases. This prompted a rebuttal from Angus Taylor, Australia's Energy and Emissions Reduction Minister, who said that “emissions reductions across the globe are what's necessary here to achieve outcomes.”<sup>28</sup>

Consider, however, that Australia is one of America's most crucial military allies in the Pacific and, indeed, the world. Australia hosts U.S. forces for training; maintains hypersonic missile test ranges; joined U.S.-led operations in Afghanistan, Iraq, and Syria; opposes China's 5G intrusions; and figures in every scenario for keeping peace in the Pacific. In short, the U.S.–Australia relationship is of paramount importance. Clouding defense cooperation with criticism because of climate change goals could put larger U.S. defense strategy goals at risk.

## Vulnerable Bases

One slam-dunk area for analysis should be U.S. base vulnerability. In 2021, the DOD adopted an Army climate risk tool and put it to work evaluating the more than 5,000 U.S. military installations at home and abroad.

The fiscal impacts of climate change can be seen clearly in the recent repair bills. Together, Hurricane Michael and Hurricane Florence, which hit the Carolinas in September 2018, created a bill of almost \$9 billion, primarily for the Air Force (costs of approximately \$5 billion) and the Marine Corps (\$3.3 billion from damage to Camp Lejeune and other facilities).<sup>29</sup> While many military construction projects are chronically underfunded, the mechanism to identify and characterize them does provide transparent funding for base repair.

The problem arises when one tries to project how hurricanes may increase funding needs in the future. Hurricanes are very costly but notoriously difficult to predict, especially years into the future.

For one thing, the historical baseline for big storms is spotty. According to data from the National Oceanic and Atmospheric Administration (NOAA), just four Category 5 hurricanes have made landfall in the United States since 1851: the 1935 Labor Day storm, Hurricane Camille in 1969, Hurricane Andrew in 1992, and Hurricane Michael in 2018. The number of hurricanes making landfall in the continental United States did not increase in either frequency or intensity from 1900 through 2017. What did increase were the populations along U.S. coastlines and the overall damage costs.<sup>30</sup>

Looking at the data another way, one study determined that warming temperatures affected the global spatial distribution of hurricanes from 1988 to 2018 but did not affect their frequency. Intriguingly, this same study projected that increasing greenhouse gas emissions would lead to fewer hurricanes in coming years.<sup>31</sup>

What defense official would want to explain a hurricane disaster budget line to Congress with data this disparate? Storm repair

even in a bad year remains a tiny percentage of the overall defense budget. The DOD has a workable method for major disaster repair appropriations and completes them in a single fiscal year.

Keep in mind that money to rebuild military bases is just one part of the federal response to weather disasters. In contrast, other government departments fall behind on their storm mitigation. The National Flood Insurance Program, for example, “was about \$21 billion in debt to the Department of the Treasury as of April 2019,” and “the Congressional Budget Office estimated in May 2019 that federal crop insurance would cost the federal government an average of about \$8 billion annually from 2019 through 2029.”<sup>32</sup> By wider federal standards, the DOD has a more efficient mechanism for coping with damage from climate change. Why, then, this imperative for the DOD to start accounting for the potential consequences of severe weather as if it has been negligent or unaware?

### Impact on Research and Development

Of course, the DOD does more than spend money on base repair. Laced throughout the defense budget are many programs that take on climate problems. For example, the Defense Advanced Research Projects Agency (DARPA) has a project called the Reefense program, “which aims to develop novel hybrid biological and engineered reef-mimicking structures to mitigate wave and storm damage and reduce the ecological impact of current coastal protection measures.”<sup>33</sup>

Energy programs have often taken the lead. In 2015, the U.S. Navy used 78 million gallons of biofuel to help power the USS *John C. Stennis* Carrier Strike Group.<sup>34</sup> Ten years earlier, the U.S. Air Force flew a B-52H bomber using biofuels in all eight engines.<sup>35</sup>

The Department of Defense operates about 170,000 non-tactical vehicles, a number second only to the number operated by the U.S. Postal Service. As a result, Deputy Secretary of Defense Kathleen Hicks has called for smart investment in electrification for that fleet.<sup>36</sup>

Combat vehicles are another matter, but research is underway. The Army has been investing in research into electric vehicles for years. In early 2021, a defense contractor developed an electric vehicle prototype for Army officials in just 12 weeks. The Army will spend \$50 million in fiscal year 2022 on electric and mobility vehicle development, although with caution. “If you took the amount of batteries with current technology that you would need to move an Abrams tank purely electrically,” according to Brigadier General Glenn Dean, Program Executive Officer for Ground Combat Systems, “it’s bigger than the tank, so we have a packaging and storage problem when it comes to pure electric.”<sup>37</sup>

There is no reason why the DOD should not leverage commercial development of electric vehicles as part of climate response, but taken as a whole, programs like these run the risk of depleting investment needed to face higher priorities such as great-power competition. Surely, the men and women of America’s military should not be asked to fight with equipment for which green energy and sustainability were dominant design factors. Carbon footprint reduction should not become a key performance parameter for major military systems. Such a course would inevitably put combat performance at risk.

### Climate, War Games, and Modelling Uncertainty

Injecting climate concerns into formal modelling of conflict is a tall order. The DOD counts on highly refined analysis to back up its internal budget choices and justify them to Congress. For nearly a century, American military planning has employed scenarios as tools for the assessment of tactics and systems for future combat. The 1930s “color plans” like War Plan Orange set out detailed plot lines for war with Japan and even Great Britain.<sup>38</sup> The Army and Navy used these scenarios to game out moves in battle and learn from the results. Scenario-based planning dominated during the Cold War and has created the basis for analyzing China as a pacing threat.

The current state of climate analysis is nowhere near the level needed, as the DOD has recognized. “We will need to incorporate climate change into our threat assessments,” Deputy Secretary Hicks has noted. “We must update our modeling and simulations to reflect climate change. Warfighting concepts, regional and country engagement plans, and logistics planning also need to be updated.”<sup>39</sup>

What would a climate scenario for the military look like? Recently, the Office of the Director of National Intelligence produced a set of five scenarios set in 2040, including one titled “Tragedy and Mobilization” that captured climate issues.<sup>40</sup> In the scenario, a global food catastrophe caused by climate change led to formation of a global coalition led by Europe and China working with non-governmental organizations. Stronger “green” parties won elections and the scenario culminated with the rise of a Human Security Council that distributed food and technology.

Granted, this future scenario was the product of the intelligence community and is designed to stimulate thought. However, it contains little insightful future forecasting for military operations. With climate change not a principal factor in great-power competition, asking the military to put in time on scenarios like this could soon add up to a net loss of analytic capability.

As the DOD proceeds, it is important to note that climate modelling is known for wide swings in uncertainty. A World Bank/United Nations report estimated that a rare, major hurricane might strike the U.S. every 38 to 480 years under 2010 weather conditions but that the probability would shift to every 18 to 89 years with warmer average temperatures.<sup>41</sup> Clearly, such a wild analytic range is not helpful for the refined analysis that the DOD needs to justify more than \$700 billion in annual spending.

It is possible that models can be developed to bring greater fidelity to climate analysis for the DOD, but the process is tricky. Leading insurance firm Lloyds found windstorms easier to model than hurricanes.

Insurers have money on the line and invest heavily in models to control risk, but the models they use are a case study of the numerous difficulties involved in modeling for climate change. One analysis found that climate change could imply a 3 percent–5 percent decrease in the total number of potentially damaging storms but a 10 percent–20 percent increase in the number of larger storms in addition to a shift in storm tracks toward France and Germany.<sup>42</sup> Insurers point out that even these sophisticated models cannot cover every peril in every region.

### **Conclusion: The DOD’s Long History with Climate Consequences**

The new guidance for the Department of Defense sets out extremely ambitious targets for including climate change as a national security priority, but the evidence indicates clearly that building up a proper analytic foundation will not be easy. For too long, casual discussion of climate and conflict has led proponents to skim the surface but neglect the tough choices.

What is needed is spadework to bring the climate “threat analysis” up to the high standards necessary for decisions on national defense—if possible. Likewise, the DOD must acknowledge that every bit of attention given to climate change comes with a risk of distracting it from the pressing problems of China and Russia (among many others).

Yet the Department of Defense also deserves credit for its solid, quiet work on environmental protection, energy efficiency, and base resilience, all of which enhance its overall mission.

Sometimes the DOD does not get enough credit for activities already underway such as providing a “climate-ready force.”<sup>43</sup> The DOD defines this as a force that is ready to train and operate in extreme temperatures. In this case, the department is well ahead of climate policy prescriptions.

Not surprisingly, weather has figured in equipment development for a very long time. For example, the Air Force operates the world’s largest indoor weather facility at Eglin Air

Force Base.<sup>44</sup> The McKinley Climatic Laboratory creates sandstorms, blizzards, and any conditions needed to test aircraft and equipment—and has been doing so since 1947. The analytic rigor needed for analyzing a climate-ready force should start with getting to know what that force already has to offer.

The United States military has been measuring sea levels, tracking erosion, improving energy efficiency, rebuilding bases after hurricanes, and trying to anticipate conflict trends from the Arctic to the sub-Saharan region for years. For example, the work of the Army Corps of Engineers stretches back decades and even centuries. In 1892, officers of the Corps took a grand jury on a boat tour of Pittsburgh harbor and obtained indictments against 50 firms that were dumping debris into the rivers.<sup>45</sup> The

Corps, of course, got its start building coastal forts like the one underneath the Statue of Liberty and has measured sea-level rise as a matter of routine from the late 1790s.

As for the 17 F-22s trapped in the hangar at Tyndall, none were destroyed. All were back in the air within a month. Despite being caught by surprise, the Air Force had taken proper precautions to protect the irreplaceable jets. The F-22s rode out the storm. Four had damage to multiple areas including coatings, doors, canopies, leading edge, and engine inlet, but their stealth features were fully restored by the summer of 2019.<sup>46</sup>

That was a tribute to something far beyond climate discussion: the resilience and ingenuity of the men and women who serve in America's military.



## Endnotes

1. Data on Hurricane Michael from U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Hurricane Center and Central Pacific Hurricane Center, "Hurricane Michael: Bulletin: Hurricane Michael Intermediate Advisory Number 16A...Corrected, NWS National Hurricane Center Miami FL AL142018, 100 PM CDT Wed Oct 10 2018," [https://www.nhc.noaa.gov/archive/2018/all4/all42018.public\\_a.016.shtml](https://www.nhc.noaa.gov/archive/2018/all4/all42018.public_a.016.shtml) (accessed July 31, 2021), and news release, "Hurricane Michael Upgraded to Category 5 at Time of U.S. Landfall," U.S. Department of Commerce, National Oceanic and Atmospheric Administration, last updated April 19, 2019, <https://www.noaa.gov/media-release/hurricane-michael-upgraded-to-category-5-at-time-of-us-landfall> (accessed July 31, 2021).
2. Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad," January 27, 2021, *Federal Register*, Vol. 86, No. 19 (February 1, 2021), pp. 7619 and 7621, <https://www.govinfo.gov/content/pkg/FR-2021-02-01/pdf/2021-02177.pdf> (accessed August 1, 2021).
3. News release, "Statement by Secretary of Defense Lloyd J. Austin III on Tackling the Climate Crisis at Home and Abroad," U.S. Department of Defense, January 27, 2021, <https://www.defense.gov/Newsroom/Releases/Release/Article/2484504/statement-by-secretary-of-defense-loyd-j-austin-iii-on-tackling-the-climate-cr/> (accessed July 31, 2021).
4. Joseph Guzman, "Changing America: Trump Lashes out After Biden Says Joint Chiefs Told Him Greatest Threat to US Is Global Warming," *The Hill*, June 10, 2021, <https://thehill.com/changing-america/sustainability/climate-change/557867-trump-lashes-out-after-biden-says-joint-chiefs> (accessed July 31, 2021).
5. David Vergun, "Climate Change Resiliency a High DOD Priority, Deputy Defense Secretary Says," U.S. Department of Defense, May 24, 2021, <https://www.defense.gov/Explore/News/Article/Article/2630037/climate-change-resiliency-a-high-dod-priority-deputy-defense-secretary-says/> (accessed July 31, 2021).
6. Executive Order 14008, *Federal Register*, Vol. 86, No. 19 (February 1, 2021), p. 7621.
7. Kathleen Hicks, Deputy Secretary of Defense, Keynote Remarks at Department of Energy ARPA-E Energy Innovation Summit, May 24, 2021, <https://www.defense.gov/Newsroom/Speeches/Speech/Article/2630071/deputy-secretary-of-defense-dr-kathleen-hicks-delivers-keynote-remarks-at-the-d/> (accessed August 3, 2021).
8. Daniel E. Coats, Director of National Intelligence, "Worldwide Threat Assessment of the US Intelligence Community," statement before the Select Committee on Intelligence, U.S. Senate, January 29, 2019, p. 23, <https://www.dni.gov/files/ODNI/documents/2019-ATA-SFR---SSCI.pdf> (accessed July 31, 2021).
9. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Centers for Environmental Information, Significant Earthquake Database, "January 12, 2010 DART [Deep-Ocean Assessment and Reporting of Tsunami] Data," [https://www.ngdc.noaa.gov/hazard/dart/2010haiti\\_dart.html](https://www.ngdc.noaa.gov/hazard/dart/2010haiti_dart.html) (accessed July 31, 2021).
10. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Centers for Environmental Information, "On This Day: 2011 Tohoku Earthquake and Tsunami," March 11, 2021, <https://www.ncei.noaa.gov/news/day-2011-japan-earthquake-and-tsunami> (accessed July 30, 2021).
11. Andrew Feickert and Emma Chanlett-Avery, "Japan 2011 Earthquake: Department of Defense (DOD) Response," Congressional Research Service *Report for Congress* No. R41690, June 2, 2011, p. 1, <https://fas.org/sgp/crs/row/R41690.pdf> (accessed July 31, 2021).
12. Hicks, Keynote Remarks at Department of Energy ARPA-E Energy Innovation Summit.
13. Adm. James Stavridis, "The Climate and U.S. National Security: A Conversation Series," *The Cipher Brief*, January 21, 2021, <https://www.thecipherbrief.com/the-climate-and-u-s-national-security-a-conversation-series> (accessed July 31, 2021).
14. Pew Project on National Security, Energy and Climate, "Defense Department Says Climate Change Is a Significant Threat to National Security," March 31, 2010, <https://www.pewtrusts.org/-/media/assets/2010/03/31/pewqdfactsheet.pdf> (accessed July 31, 2021).
15. President Barack Obama, *National Security Strategy*, The White House, February 2015, p. 12, [https://obamawhitehouse.archives.gov/sites/default/files/docs/2015\\_national\\_security\\_strategy\\_2.pdf](https://obamawhitehouse.archives.gov/sites/default/files/docs/2015_national_security_strategy_2.pdf) (accessed August 2, 2021).
16. Press release, "B-2s Fly North of Arctic Circle, Integrate with Norwegian F-35s," U.S. Air Forces in Europe & Air Forces Africa, June 18, 2020, <https://www.usafe.af.mil/News/Press-Releases/Article/2224362/b-2s-fly-north-of-arctic-circle-integrate-with-norwegian-f-35s/> (accessed July 31, 2021).
17. John Kerry, Secretary of State, "Remarks on Climate Change and National Security," Old Dominion University, Norfolk, Virginia, November 10, 2015, <https://2009-2017.state.gov/secretary/remarks/2015/11/249393.htm> (accessed August 2, 2021).
18. Zane Razaq, "Framing the Syrian War in Terms of Climate Change Oversimplifies a Complex Tragedy, Warn Experts," *New England Climate Change Review*, November 21, 2016, <https://www.northeastern.edu/climatereview/?p=210v> (accessed July 31, 2021).
19. Colin P. Kelley, Shahrzad Mohtadi, Mark A. Cane, Richard Seager, and Yochanan Kushnir, "Climate Change in the Fertile Crescent and the Implications of the Syrian Drought," *Proceedings of the National Academy of Sciences*, Vol. 112, No. 11 (March 17, 2015), pp. 3241–3246, <https://www.pnas.org/content/pnas/112/11/3241.full.pdf> (accessed July 31, 2021).

20. Lina Eklund and Darcy Thompson, "Is Syria Really a 'Climate War'? We Examined the Links Between Drought, Migration and Conflict," *The Conversation*, July 21, 2017, <https://theconversation.com/is-syria-really-a-climate-war-we-examined-the-links-between-drought-migration-and-conflict-80110> (accessed July 31, 2021).
21. Jan Selby, Omar S. Dahi, Christiane Frölich, and Mike Hulme, "Climate Change and the Syrian Civil War Revisited," *Political Geography*, Vol. 60 (September 2017), p. 241, <http://sro.sussex.ac.uk/id/eprint/69311/4/Selby%20et%20al%202017%20Climate%20change%20and%20Syria.%20Published%20version.pdf> (accessed August 2, 2021).
22. National Intelligence Council, *Implications for US National Security of Anticipated Climate Change*, NIC WP 2016-01, September 21, 2016, p. 7, [https://www.dni.gov/files/documents/Newsroom/Reports%20and%20Pubs/Implications\\_for\\_US\\_National\\_Security\\_of\\_Anticipated\\_Climate\\_Change.pdf](https://www.dni.gov/files/documents/Newsroom/Reports%20and%20Pubs/Implications_for_US_National_Security_of_Anticipated_Climate_Change.pdf) (accessed July 31, 2021).
23. Office of the Director of National Intelligence, *Global Water Security*, Intelligence Community Assessment ICA 2012-08, February 2, 2012, <https://fas.org/irp/nic/water.pdf> (accessed August 1, 2021).
24. U.S. Department of State, "Leaders Summit on Climate," <https://www.state.gov/leaders-summit-on-climate/> (accessed August 1, 2021).
25. BBC News, "Australia Resists Calls for Tougher Climate Targets," April 23, 2021, <https://www.bbc.com/news/world-australia-56854558> (accessed August 1, 2021).
26. Clare Watson, "Australia Just Broke a Major Record for New Solar Panel Roof Installations," *ScienceAlert*, May 14, 2021, <https://www.sciencealert.com/australia-a-world-leader-in-rooftop-solar-breaks-new-record-for-installations> (accessed August 1, 2021).
27. Worldometer, "Coal Reserves by Country," 2016, <https://www.worldometers.info/coal/coal-reserves-by-country/> (accessed August 1, 2021).
28. Matthew Knott, "'Insufficient': Biden Administration Criticises Australia on Climate," *The Sydney Morning Herald*, April 22, 2021, <https://www.smh.com.au/world/north-america/insufficient-biden-administration-criticises-australia-on-climate-20210422-p571b9.html> (accessed August 1, 2021).
29. The Air Force had another \$350 million in expenses from flooding at Offut Air Force Base, located in Nebraska, that same year.
30. Phillip J. Klotzbach, Steven G. Bowen, Roger Pielke Jr., and Michael Bell, "Continental U.S. Hurricane Landfall Frequency and Associated Damage: Observations and Future Risks," *Bulletin of the American Meteorological Society*, Vol. 99, Issue 7 (July 2018), pp. 1359-1377, [https://journals.ametsoc.org/view/journals/bams/99/7/bams-d-17-01841.xml?tab\\_body=pdf](https://journals.ametsoc.org/view/journals/bams/99/7/bams-d-17-01841.xml?tab_body=pdf) (accessed August 1, 2021).
31. Hiroyuki Murakami, Thomas L. Delworth, William F. Cooke, Ming Zhao, Baoqiang Xiang, and Pang-Chi Hsu, "Detected Climatic Change in Global Distribution of Tropical Cyclones," *Proceedings of the National Academy of Sciences*, Vol. 117, No. 20 (May 19, 2020), pp. 10706-10714, <https://www.pnas.org/content/pnas/117/20/10706.full.pdf> (accessed August 1, 2021).
32. U.S. Government Accountability Office, *Climate Change: Potential Economic Costs and Opportunities to Reduce Federal Fiscal Exposure*, GAO-20-338T, December 19, 2019, p. 8 <https://www.gao.gov/assets/gao-20-338t.pdf> (accessed August 2, 2021).
33. U.S. Department of Defense, Defense Advanced Research Projects Agency, "DARPA Launches Program to Mitigate Coastal Flooding, Erosion and Storm Damage," December 17, 2020, <https://www.darpa.mil/news-events/2020-12-17#> (accessed August 1, 2021).
34. Wyatt Olsen, "Navy Launching First Great Green Fleet," *Stars and Stripes*, January 15, 2016, [https://www.stripes.com/theaters/asia\\_pacific/navy-launching-first-great-green-fleet-next-week-1.388769](https://www.stripes.com/theaters/asia_pacific/navy-launching-first-great-green-fleet-next-week-1.388769) (accessed August 1, 2021).
35. U.S. Air Force, "B-52 Flight Uses Synthetic Fuel in All Eight Engines," December 15, 2006, <https://www.af.mil/News/Article-Display/Article/128702/b-52-flight-uses-synthetic-fuel-in-all-eight-engines/> (accessed August 1, 2021).
36. Hicks, Keynote Remarks at Department of Energy ARPA-E Energy Innovation Summit.
37. Jen Judson, "Is the Army Warming up to Electric Vehicles in Its Fleet?" *Defense News*, July 12, 2021, <https://www.defensenews.com/land/2021/07/12/is-the-army-warming-up-to-electric-vehicles-in-its-fleet/> (accessed August 2, 2021).
38. Henry G. Cole, *The Road to Rainbow: Army Planning for Global War, 1934-1940* (Annapolis, MD: Naval Institute Press, 2003), pp. xviii and 22-23.
39. Hicks, Keynote Remarks at Department of Energy ARPA-E Energy Innovation Summit.
40. Office of the Director of National Intelligence, *Global Trends 2040: A More Contested World*, National Intelligence Council Publication NIC 2021-02339, March 2021, pp. 118-119, [https://www.dni.gov/files/ODNI/documents/assessments/GlobalTrends\\_2040.pdf](https://www.dni.gov/files/ODNI/documents/assessments/GlobalTrends_2040.pdf) (accessed July 31, 2021).
41. World Bank and United Nations, *Natural Hazards, UnNatural Disasters: The Economics of Effective Prevention*, *The World Bank*, 2010, pp. 20-21, <https://documents1.worldbank.org/curated/en/620631468181478543/pdf/578600PUB0epi2101public10BOX353782B.pdf> (accessed July 31, 2021).

42. Ralf Toumi and Lauren Rostell, "Catastrophe Modeling and Climate Change," Lloyd's, 2014, p. 14, <https://www.lloyds.com/-/media/lloyds/reports/emerging-risk-reports/cc-and-modelling-template-v6.pdf> (accessed July 31, 2021).
43. David Vergun, "Climate Change Resiliency a High DOD Priority, Deputy Defense Secretary Says," U.S. Department of Defense, May 24, 2021, <https://www.defense.gov/Explore/News/Article/Article/2630037/climate-change-resiliency-a-high-dod-priority-deputy-defense-secretary-says/> (accessed July 31, 2021).
44. Kirk Velasco, "McKinley Climatic Laboratory Home to World's Largest Climatic Chamber," Arnold Air Force Base, September 8, 2020, <https://www.arnold.af.mil/News/Commentaries/Display/Article/2338681/mckinley-climatic-laboratory-home-to-worlds-largest-climatic-chamber/> (accessed July 31, 2021).
45. U.S. Army Corps of Engineers, *The U.S. Army Corps of Engineers: A Brief History*, <https://www.usace.army.mil/About/History/Brief-History-of-the-Corps/> (accessed July 31, 2021).
46. Lockheed Martin, "F-22s After the Storm: Tyndall's Raptors Ride Out Hurricane Michael," 2019, <https://www.lockheedmartin.com/en-us/news/features/2019-features/f-22-after-the-storm--tyndalls-raptors-ride-out-hurricane-michael.html> (accessed July 31, 2021).