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To cite this article: Jon R. Lindsay & Erik Gartzke (2020): Politics by many other means: The comparative strategic advantages of operational domains, Journal of Strategic Studies, DOI: [10.1080/01402390.2020.1768372](https://doi.org/10.1080/01402390.2020.1768372)

To link to this article: <https://doi.org/10.1080/01402390.2020.1768372>



Published online: 01 Jun 2020.



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ARTICLE



## Politics by many other means: The comparative strategic advantages of operational domains

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### ABSTRACT

The land, sea, air, space, and cyber domains have distinct operational characteristics. Specialization in the means of using or threatening force is not just a technical issue because choices to use different kinds of military instruments have political consequences. Conventional and nuclear capabilities in these domains have comparative advantages and disadvantages for three general types of strategy – coercion, warfighting, and deception. More complex strategies that cross or combine domains may achieve force-multiplying synergies or create significant trade-offs that affect military and political performance. This article describes the strategic constraints and opportunities posed by specialized force structures.

**KEYWORDS** Strategy; technology; cross-domain deterrence; military operations; military specialization

### Introduction

Clausewitz famously writes that war is ‘a true political instrument, a continuation of political intercourse, carried on with other means.’<sup>1</sup> Yet there are many kinds of war and many ways to wage it. He notes that ‘wars can have all degrees of importance and intensity, ranging from a war of extermination down to a simple armed observation.’<sup>2</sup> Attack and defense, further, ‘are two distinct forms of action,’<sup>3</sup> and they are best served by different combat arms: ‘the essence of defense is to stand fast, as it were, rooted to the ground; whereas movement is the essence of attack. Cavalry is totally incapable of the former, but preeminent in the latter, so it is suited only to attack. Infantry is best at standing fast, but it does not lack some capacity to move.’<sup>4</sup> Artillery, by contrast, ‘is the most destructive of the arms. Where it is absent, the total

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<sup>1</sup>Carl von Clausewitz, *On War*, trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1976), 87.

<sup>2</sup>Clausewitz, 81.

<sup>3</sup>Clausewitz, 84.

<sup>4</sup>Clausewitz, 285.

power of the army is significantly weakened. On the other hand, it is the least mobile and so makes an army less flexible.<sup>5</sup> One might add that warships can combine the destructiveness of artillery with movement across entire oceans. Clausewitz says little about war at sea, but Corbett picks up his line of argument to highlight different strategic objectives of different services: 'The object of naval warfare is the control of communications, and not, as in land warfare, the conquest of territory. The difference is fundamental.'<sup>6</sup> If war is the continuation of politics by other means, then the diversity of means in modern warfare suggests a diversity of political effects.

In the centuries since Clausewitz wrote, there has been a dramatic increase in the variety of military options available to policymakers and commanders. Cavalry and artillery have become mechanized, and infantry units more versatile and specialized. Evolved versions of traditional formations are joined by new specialists in aviation, air defense, intelligence, special operations, and civil affairs. Naval operations, furthermore, are now conducted on, over, and under the waves at a truly global scale. Entire new services have emerged, from the rise of air forces in the twentieth century to the creation of space forces in the twenty-first. It has become fashionable to describe all these different operating environments as 'domains.' When the United States officially established U.S. Cyber Command (CYBERCOM) in 2010, for instance, the Deputy Secretary of Defense declared that 'cyberspace is a man-made domain ... just as critical to military operations as land, sea, air, and space.'<sup>7</sup> NATO followed suit in 2016 as the 'Allies recognised cyberspace as a domain of operations – just like air, land and sea.'<sup>8</sup> Military writers tend increasingly to refer to strategy and operations as 'cross-domain'<sup>9</sup> or 'multi-domain.'<sup>10</sup> Combined-arms warfare on regional battlefields has thus evolved into multi-domain operations in a global battlespace. As in Clausewitz's day, military commanders still attempt to sequence and combine all these different capabilities to achieve 'a more complete use of them all.'<sup>11</sup>

The venerable tradition of geopolitics is founded on the assumption that land and sea powers have different strategic constraints and opportunities.<sup>12</sup> It would

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<sup>5</sup>Clausewitz, 287.

<sup>6</sup>Julian Stafford Corbett, *Some Principles of Maritime Strategy* (London: Longmans, Green and Co., 1911), 45.

<sup>7</sup>William J. Lynn III, 'Defending a New Domain: The Pentagon's Cyberstrategy,' *Foreign Affairs* 89/5 (2010), 97–108.

<sup>8</sup>North Atlantic Treaty Organization, 'NATO Cyber Defence Factsheet,' February 2018, [https://www.nato.int/nato\\_static\\_fl2014/assets/pdf/pdf\\_2018\\_02/20180213\\_1802-factsheet-cyber-defence-en.pdf](https://www.nato.int/nato_static_fl2014/assets/pdf/pdf_2018_02/20180213_1802-factsheet-cyber-defence-en.pdf).

<sup>9</sup>Jon R. Lindsay and Erik Gartzke, eds., *Cross-Domain Deterrence: Strategy in an Era of Complexity* (New York: Oxford University Press 2019).

<sup>10</sup>U.S. Army, 'The U.S. Army in Multi-Domain Operations 2028,' TRADOC Pamphlet (Fort Eustis, VA: U.S. Army Training and Doctrine Command, 6 December 2018).

<sup>11</sup>Clausewitz, *On War*, 285.

<sup>12</sup>Classic works include Alfred Thayer Mahan, *The Influence of Sea Power Upon History, 1660–1783* (Boston: Little, Brown, and Co. 1890); H. J. Mackinder, 'The Geographical Pivot of History,' *The Geographical Journal* 23/4 (1904), 421–37; Nicholas J. Spykman, 'Geography and Foreign Policy, I,' *The American Political Science Review* 32/1 (1938), 28–50, <https://doi.org/10.2307/1949029>. Modern extensions include Robert J. Art, 'Geopolitics Updated: The Strategy of Selective Engagement,' *International Security* 23/3 (1998), 79–113; Robert S. Ross, 'The Geography of the Peace: East Asia in the Twenty-

be surprising if new arenas of conflict, such as space and cyberspace, did not also have distinct strategic features. The choice to use or mix different types of forces, within or across domains, is not simply an operational military consideration. On the contrary, we argue in this essay, choices about military means matter for political ends. Clausewitz states that war 'is nothing but a duel on a larger scale,' but there are many ways to duel. Rivals who choose pistols must be deadly serious because at least one of them may not survive. Duelists who choose rapiers, by contrast, might simply agree to settle their quarrel at the first shedding of blood. A skillful duelist might persuade his opponent to drop the quarrel altogether, or conversely could cause an adversary to select means that narrow the odds. A dab hand with a foil presumably prefers swords to pistols, while a less practiced fencer may select pistols despite the heightened risk of mortality. A duelist prioritizing safety over honor, alternatively, might spy out flaws in the rival's swordsmanship, sabotage his pistol, or pay a bandit to murder him *en route* to the dueling green. War is politics by other means, to be sure, but different modes of fighting, or threatening to fight, can be used to pursue different political objectives.

The integration of diverse capabilities is and always has been vital in military practice. Students of strategy have also produced rich literatures about warfare by land, sea, and air.<sup>13</sup> Even so, the comparative political utility of different military instruments has not really been systematically analyzed.<sup>14</sup> In this essay we will focus on three very basic and general political objectives – credibility, effectiveness, efficiency – to show how domain-specific features of military capabilities have comparative advantages (and disadvantages) for each. Most national leaders would like their coercive threats to be believed, their military forces to be victorious, and their security policies to be affordable. These goals are all desirable, but they generally cannot be achieved simultaneously, or to the same extent. Military specialization imposes opportunity costs in terms of what a nation does well and where it must compromise its capabilities. Choices about what to buy, and where and how to field the nation's military might, then pose certain constraints on political strategy.

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First Century,' *International Security* 23/4 (1999), 81–118; Barry R. Posen, 'Command of the Commons: The Military Foundation of U.S. Hegemony,' *International Security* 28/1 (2003), 5–46; Jack S. Levy and William R. Thompson, 'Balancing on Land and at Sea: Do States Ally against the Leading Global Power?,' *International Security* 35/1 (1 July 2010), 7–43.

<sup>13</sup>Extended reviews include Beatrice Heuser, *The Evolution of Strategy: Thinking War from Antiquity to the Present* (New York: Cambridge University Press 2010); Lawrence Freedman, *Strategy: A History* (New York: Oxford University Press 2013).

<sup>14</sup>There are exceptions, of course, notably J.C. Wylie, *Military Strategy: A General Theory of Power Control*, ed. John B. Hattendorf (Annapolis, MD: Naval Institute Press 1989). See also the recent special issue in this journal introduced by Todd S. Sechser, Neil Narang, and Caitlin Talmadge, 'Emerging Technologies and Strategic Stability in Peacetime, Crisis, and War,' *Journal of Strategic Studies* 42/6 (19 September 2019), 727–35. Note also that our emphasis is on the strategic utility of different types of military forces rather than the different organizational cultures of military services, i.e., Carl H. Builder, *The Masks of War: American Military Styles in Strategy and Analysis* (Baltimore: Johns Hopkins University Press 1989).

The domains of modern warfare – land, sea, air, space, cyberspace – call for and indeed enable very different types of operations. Nuclear weapons, moreover, have distinctive political features compared to conventional forces in any domain. The unique characteristics of nuclear weapons have long been recognized; indeed, deterrence theorizing (as distinct from the practice of deterrence) emerged in response to the innovation of the atomic bomb. Yet the specific insight that military means matter in shaping political ends has yet to be generalized. While nuclear deterrence may secure civilizations from direct attack, massive retaliation has little salience in more modest disputes, such as ‘gray zone’ subversion or cyber conflict, let alone fixing respective tariff levels in trade negotiations.

Different domains in turn can be mixed and matched in complementary or less constructive ways. For instance, combining nuclear weapons with forward troop deployments can enhance the credibility of deterrence policies. Air and naval power offer important force multipliers when deterrence fails. Space and cyberspace enhance the scope and efficiency of military operations, and they offer some alternatives to using military force altogether. Now more than ever, war is politics by *many* other means. Force structure and posture, therefore, not just the raw size of armed forces, is politically consequential. Political calculations concerning national defense thus must not only consider the classic tradeoff between ‘guns and butter’ but must also account for complements and tradeoffs between ‘guns and guns.’

We focus here on the preliminary task of clarifying the political utility of different military building blocks, setting aside for now the complex problems of crossing or combining them. We proceed in four parts. First, we disentangle the disparate political objectives inherent in any type of political negotiation. Second, we argue that different domains have varying suitability for the pursuit of these objectives. Third, we discuss nuances and exceptions that arise within and across domains. Finally, we return to the problem of combinations and tradeoffs across domains.

## Disaggregating the politics of war

If war is politics by other means, then politics itself is a choice between at least two very different types of means. Normal politics is full of nominally peaceful pursuits such as governing, speaking, negotiating, trading, allying, colluding, or bribing. Compared to these things, war is extremely costly in blood and treasure, and fraught with risk. Or as Clausewitz puts it, war is a ‘peculiar’ means that combines passion, chance, and reason in a ‘paradoxical trinity.’<sup>15</sup> Given all the danger and misery that war entails, leaders are

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<sup>15</sup>Clausewitz, *On War*, 87, 89. See also Alan Beyerchen, ‘Clausewitz, Nonlinearity, and the Unpredictability of War,’ *International Security* 17/3 (1992), 59–90; Thomas Waldman, *War, Clausewitz and the Trinity* (New York: Routledge 2016).

wise to choose it only if they hope to achieve something thereby that peaceful means cannot.

In modern international relations theory, this idea is encapsulated in the bargaining model of war.<sup>16</sup> All politics concerns the distribution of disputed prerogatives (rights, reputations, etc.) or goods – who gets what, when, and how.<sup>17</sup> Political actors bargain over these distributions, potentially using military forces to do so. War can be likened to the outside option in a negotiation, or the expected utility gained by terminating the negotiation. Actors with better outside options generally have more leverage to get a better deal. For example, an employee with a job offer from another firm might attempt to renegotiate a higher salary. If her present employer values her services, then it might be willing to pay a higher salary to keep her. The employee can enhance the credibility of her threat to leave by providing the employer with a copy of her offer letter and starting to pack up her office. Similarly, politicians may threaten war to intimidate opponents into making concessions, mobilizing the army to show that they are not bluffing. Visible preparations for war, much like the process of fighting itself, can reveal how much actors are willing to pay to get what they want (or keep what they have). But if coercive diplomacy fails to achieve a deal, war can always be used to forcibly redistribute disputed resources.

Actors can thus use military capabilities as political instruments in two very different ways. First, forces can be used to communicate information about interests and resolve by making credible threats. Second, they can be used to shape the distribution of power and benefits more directly, either by taking from those who have or thwarting those who try to take more. The dual informational and distributional modes of military power make it a peculiar instrument indeed, but what if different military instruments themselves vary in their usefulness for each end? Bargaining concepts provide the basis for deterrence theory and inform much of strategic studies. The bargaining model is thus a reasonable place to begin analyzing choices across different domains.

Here we set aside paradigmatic debates about the utility and limitations of the rationalist approach and simply leverage the framework heuristically. Stripped to its essentials, the bargaining model emphasizes just a few simple concepts: the division of a disputed resource, the relative military power of the relevant actors, the costs of fighting or preparing for war, and uncertainty about any of these factors. Because war is profligate (people suffer and resources are destroyed), rational actors ought to be able to agree on a division of resources that leaves each better off without fighting a costly war. However, the same actors have incentives to misrepresent their power

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<sup>16</sup>Overviews include Robert Powell, 'Bargaining Theory and International Conflict,' *Annual Review of Political Science* 5/1 (2002), 1–30; Dan Reiter, 'Exploring the Bargaining Model of War,' *Perspectives on Politics* 1/01 (2003), 27–43; Tami Davis Biddle, 'Coercion Theory: A Basic Introduction for Practitioners,' *Texas National Security Review* 3/2 (20 February 2020).

<sup>17</sup>Harold D. Lasswell, *Politics: Who Gets What, When, How* (New York: Whittlesey House 1936).

and interests to get a better deal in peacetime or crisis.<sup>18</sup> Uncertainty from any source – ignorance, bluffing, secret plans, secret weapons, inherent complexity, stochastic error, Clausewitzian friction – can lead to incompatible expectations about the products of war. Uncertainty is thus increasingly appreciated as a fundamental cause of war.<sup>19</sup> Conversely, anything that improves the common understanding of respective interests and motives, and of the true costs and consequences of war, can be a cause of (negative) peace. Actors can attempt to deliberately cultivate a better mutual understanding of war through signaling or making credible commitments (i.e., via deterrence, compellence, assurance, institutions, etc.).<sup>20</sup>

Yet this implies that there are costs associated with deterring wars as well as fighting them. Some actors may opt for ‘cheap’ aggression where the costs of exploitation or conflict seem low and the price of effective deterrence or coercion seems high. From this perspective, limited forms of conflict can be interpreted as forms of negotiation in the shadow of a larger war. Fighting a small war can marginally alter the distribution of resources and clarify the costs and interests at stake in a potentially bigger war (i.e., a longer duration of fighting or escalation to more pain and destruction).<sup>21</sup> Modest aims or high risks will tend to encourage military restraint. This is entirely consistent with Clausewitz’s observation that the ‘degree of force that must be used against the enemy depends on the scale of political demands on either side. These demands, so far as they are known, would show what efforts each must make; but they seldom are fully known – which may be one reason why both sides do not exert themselves to the same degree.’<sup>22</sup>

Unfortunately, the bargaining model has little to say about how political actors should prioritize its core parameters (demands, power, cost, information). Indeed, the inherent multiplicity of potential preferences in the bargaining model is a source of no little confusion in deterrence theory. While deterrence seems like a simple concept, in fact it is a bundle of different objectives. Actors may place different emphases on enhancing the credibility of threats (influencing the status quo), being able to effectively win a war

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<sup>18</sup>James D. Fearon, ‘Rationalist Explanations for War,’ *International Organization* 49/3 (1995), 379–414.

<sup>19</sup>Geoffrey Blainey, *Causes of War*, 3rd Ed. (New York: Simon and Schuster 1988); Erik Gartzke, ‘War Is in the Error Term,’ *International Organization* 53/03 (1999), 567–87; Adam Meirowitz and Anne E. Sartori, ‘Strategic Uncertainty as a Cause of War,’ *Quarterly Journal of Political Science* 3/4 (31 December 2008), 327–52; Branislav L. Slantchev and Ahmer Tarar, ‘Mutual Optimism as a Rationalist Explanation of War,’ *American Journal of Political Science* 55/1 (1 January 2011), 135–48; Kristopher W. Ramsay, ‘Information, Uncertainty, and War,’ *Annual Review of Political Science* 20/1 (2017).

<sup>20</sup>Thomas C. Schelling, *Arms and Influence: With a New Preface and Afterword* (New Haven, CT: Yale University Press 2008), chap. 2; Robert Jervis, *The Logic of Images in International Relations* (Princeton, NJ: Princeton University Press 1970); James D. Fearon, ‘Signaling Foreign Policy Interests: Tying Hands versus Sinking Costs,’ *The Journal of Conflict Resolution* 41/1 (1 February 1997), 68–90.

<sup>21</sup>R. Harrison Wagner, ‘Bargaining and War,’ *American Journal of Political Science* 44/3 (2000), 469–84; Branislav L. Slantchev, *Military Threats: The Costs of Coercion and the Price of Peace* (New York: Cambridge University Press 2011).

<sup>22</sup>Clausewitz, *On War*, 585.

should deterrence fail (enhancing military power), improving the efficiency of deterrence policy (lowering the costs of protection), and reducing the risk of war (improving peace and stability). All of these goals are desirable, but there are tradeoffs across them. The choice to emphasize one or the other depends on what actors want and how much they are willing to pay or risk to get it. These preferences are all essentially exogenous to the bargaining model; they may arise from leader personalities, bureaucratic and electoral politics, national cultures, or religious ideologies. These unit-level factors are critical in any given case, but they are outside of the scope this essay. The key point here is that different political priorities, whatever their source, tend to give rise to different strategies. Different political strategies, in turn, are best served by different material instruments and military operations.

### Aligning political ends and military means

Clausewitz defines strategy as ‘the use of the engagement for the purpose of the war.’<sup>23</sup> More generally strategy has been considered as a ‘theory’ of how military means advance political ends.<sup>24</sup> There are a great many different possible strategies. In this section we focus on three broad categories of strategy that prioritize different elements of the bargaining model. We then link these strategic objectives to different types of military force. This entails that the choice of *how* to threaten or utilize military violence is as much a political act as the decision of *whether*.

### Different strategic objectives

Political actors may choose to emphasize, according to values and preferences that are external to the bargaining model, to maximize power (effectiveness), maximize influence (credibility), minimize costs (efficiency), or minimize risks (stability). If their priority is to avoid conflict altogether (stability), then they are likely to look to means that minimize the use of military instruments altogether, i.e., de-escalation, demobilization, disarmament, compromise, and appeasement. These may be wise political strategies in many circumstances, but they amount to reliance on ‘regular’ politics rather than politics ‘by other means,’ which is our focus here. The other three goals are best served, respectively, by strategies that use military operations to enforce favorable distributional outcomes (warfighting), prioritize credible communication to achieve influence without war (coercion), or rely on intelligence

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<sup>23</sup>Clausewitz, 177.

<sup>24</sup>Inter alia, Barry Posen, *The Sources of Military Doctrine: France, Britain, and Germany between the World Wars* (Ithaca, NY: Cornell University Press 1984), 13; Richard K. Betts, ‘Is Strategy an Illusion?’, *International Security* 25/2 (2000), 5–50. War colleges often differentiate ‘ways’ and ‘means’ to distinguish policies and instruments, but here we will consider the concept of ‘means’ as generally as possible to encompass force structure, posture, and employment.



or subversion to seek to capture political benefits without incurring the costs of fighting or signaling (deception).

The first two correspond to Thomas Schelling's classic distinction between brute force and coercion, i.e., 'the difference between defense and deterrence, between brute force and intimidation, between conquest and blackmail, between action and threats. ... Brute force succeeds where it is used, whereas the power to hurt is most successful when held in reserve.'<sup>25</sup> In the first case, warfighting strategies attempt to use military capabilities to directly impose or protect preferred policy outcomes. Actors who care most about maximizing their power to ensure that they get what they want, and who are less sensitive to the costs of getting it, should be strongly attracted to warfighting strategies. In the second case, coercive strategies threaten to use force in the future under some specified circumstances, to include deterrent threats to protect the status quo and compellent threats to change it.<sup>26</sup> Whereas military forces used for warfighting act to change the balance of power or shift the distribution of benefits, forces used for coercion communicate information about power or resolve. Coercive diplomacy is attractive because it promises benefits without having to pay the costs of fighting for them, but this also tends to encourage coercers to bluff, and thus leads prospective targets to suspect bluffing. Without some sort of costly signal of ability and resolve, targets are liable to disregard threats as cheap talk.<sup>27</sup>

It is further possible, however, that actors might prize cost-savings over either power or credibility. This could happen because they have few resources available or other important nonmilitary spending priorities (butter over guns). Even well-resourced actors will often prefer to moderate their costs, especially when the stakes are diminutive. Conversely, when a weaker actor seeks to prevail over a more capable one, avoiding direct military confrontation may be tempting. Strategies of deception may become attractive in these circumstances if they promise more bang for the buck, or greater reward for less risk. We use the concept of deception broadly here to refer to espionage, disguise, subversion, disinformation, active measures, covert action, sabotage, and counterintelligence. These all work by tricking the target into harming itself (misinformation and seduction) or foregoing opportunities (camouflage and concealment). The victim of deception voluntarily, but unwittingly, provides benefits to the deceiver through his own action. Deception is logically distinct from warfighting or coercion, even as all three strategies often operate together. Deception may be used in war, as in a feinting maneuver or concealment of an ambush. Limited war, similarly, can

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<sup>25</sup>Schelling, *Arms and Influence*, 3.

<sup>26</sup>Schelling, *Arms and Influence*. On the variety of coercive strategies see Robert J. Art and Kelly M. Greenhill, 'Coercion: An Analytical Overview,' in Kelly M. Greenhill and Peter J. P. Krause (ed.), *Coercion: The Power to Hurt in International Politics* (New York: Oxford University Press 2018), 3–32.

<sup>27</sup>Fearon, 'Signaling Foreign Policy Interests.'

be used in support of deterrence policies. Yet these strategies work by a different logic. Whereas defense explicitly resists, and deterrence explicitly warns, deception slyly manipulates. Deception is not just a tactic but rather a distinct strategy for gaining political benefits without the cost and risk of direct confrontation.<sup>28</sup> Intelligence, for example, uses deceptive tradecraft to enable a weaker defender to employ scarce resources more efficiently to offset a stronger aggressor's intentions and capabilities rather than attempt to defend everywhere.<sup>29</sup> Importantly, the efficiency advantage of intelligence must be protected by secrecy. When clandestine sources and methods are revealed, the enemy can adopt countermeasures that compromise policy effectiveness altogether. Capabilities that rely on secrecy and deception are generally ill-suited for clear and credible communication.<sup>30</sup>

### *Different military domains*

Military forces have long been used for all three strategies. Armies have conquered, princes have coerced, and spies have conspired for millennia. Yet the advent of different kinds of technology in history sometimes makes different strategies more relevant. During the Cold War, most obviously, nuclear weapons encouraged hard thinking about deterrence strategy, precisely because nuclear warfighting seemed impractical in the extreme. Deterrence was practiced for millennia before nuclear weapons encouraged careful theorizing about it. Today, similarly, cyber espionage and covert influence are drawing more attention to classic strategies of deception. Espionage and subversion are ancient practices, but the scale of cyber conflict encourages new theorizing about them.

The main thrust of our argument is that capabilities in different operational domains are differentially suited for these three strategies. We use the term 'domain' here in a loose sense to describe categories of military technologies that have interestingly different operational characteristics, often as a result of the environment in which they operate. The physical domains (land, sea, air, and space) are each interestingly different from one another because platforms operating in them face specific geospatial constraints on power-

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<sup>28</sup>For further discussion of the distinct strategy of deception see Erik Gartzke and Jon R. Lindsay, 'Weaving Tangled Webs: Offense, Defense, and Deception in Cyberspace,' *Security Studies* 24/2 (2015), 316–48.

<sup>29</sup>David Kahn, 'An Historical Theory of Intelligence,' *Intelligence and National Security* 16/3 (1 September 2001), 79–92.

<sup>30</sup>Under certain restrictive conditions clandestine capabilities can be revealed for strategic communication; see Austin Carson and Keren Yarhi-Milo, 'Covert Communication: The Intelligibility and Credibility of Signaling in Secret,' *Security Studies* 26/1 (2017), 124–56; Michael Poznansky and Evan Perkoski, 'Rethinking Secrecy in Cyberspace: The Politics of Voluntary Attribution,' *Journal of Global Security Studies* 3/4 (1 October 2018), 402–16; Brendan Rittenhouse Green and Austin Long, 'Conceal or Reveal? Managing Clandestine Military Capabilities in Peacetime Competition,' *International Security* 44/3 (1 January 2020), 48–83.

projection, movement, and coordination. Technology sometimes alters geographical constraints, as when railroads increased the scope and scale of terrestrial mobilization, but the effects of geography are not eliminated altogether. Often the opening of a new domain enables constraints in other domains to be transcended (e.g., aircraft overfly coastlines and mountain ranges, and electronic communications move at the speed of light). The virtual realm of cyberspace is interestingly different from the physical domains because it relies on logical programming to protect and exploit the command and control of anything that drives, sails, flies, or orbits.<sup>31</sup> Geography and technology do not directly determine politics, of course, because actors make purposeful choices about how to deploy, employ, and counter material capabilities.<sup>32</sup> However, technology and geography both enable and constrain the options available to politico-military actors, broadening or restricting the outcomes that are possible in any given case.<sup>33</sup>

We are most interested here in the analytic question of how operational differences matter politically, not the ontological question of what is 'really' a domain. From this perspective it is reasonable to distinguish the 'nuclear domain' from conventional warfare, even as nuclear weapons are deployed on land and at sea, delivered through air and space, and controlled via cyber networks. As a simple heuristic, a state's decision to divide different classes of capability into different services or major functional commands is a *prima facie* indicator of coherent functional specialization. Indeed, the description of coherent capabilities as a 'warfighting domain' has proved useful for consolidating bureaucratic control over military resources, most notably in the cyber community's quest for recognition and resources in the early 2000s. Consideration of a distinct 'missile domain' becomes especially apt in other national contexts (e.g., China's PLA Rocket Force). One might further subdivide the 'big five' domains to consider, for instance, an 'undersea domain,' or variation across different service branches, weapon platforms, or labor

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<sup>31</sup>We do not consider the cyber 'domain' to be a separate 'virtual' geographical space but rather the information infrastructure that enables command and control in any physical environment. Territorial metaphors about 'cyberspace' are extremely problematic, as discussed by Jordan Branch, 'What's in a Name? Metaphors and Cybersecurity' (Typescript, 2019).

<sup>32</sup>The interdisciplinary field of Science, Technology, and Society has marshalled sustained criticism on technological determinism, e.g., Wiebe E Bijker et al., eds., *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge, MA: MIT press 1987); Merritt Roe Smith and Leo Marx, eds., *Does Technology Drive History? The Dilemma of Technological Determinism* (Cambridge, MA: MIT Press 1994); Geoffrey L. Herrera, *Technology and International Transformation: The Railroad, the Atom Bomb, and the Politics of Technological Change* (Albany, NY: State University of New York Press 2006).

<sup>33</sup>While technology and geography do not determine, they do shape and channel. See, inter alia, Lewis Mumford, *Technics and Civilization* (Chicago: University of Chicago Press 2010); Langdon Winner, *Autonomous Technology: Technics-out-of-Control as a Theme in Political Thought* (Cambridge, MA: MIT Press 1977); William H. McNeill, *The Pursuit of Power: Technology, Armed Force, and Society since A.D. 1000* (Chicago: University of Chicago Press 1982); Allan Dafoe, 'On Technological Determinism: A Typology, Scope Conditions, and a Mechanism,' *Science, Technology, & Human Values* 40/6 (1 November 2015), 1047–76.

**Table 1.** Comparative advantages and disadvantages of military domains for different political objectives.

Strategic Objective	Land	Sea	Air	Nuclear (missile)	Space	Cyber
Improve credibility by maximizing influence over status quo	✓	?	x	✓	?	x
Improve effectiveness by maximizing power to fight a war	?	✓	✓	?	✓	?
Improve efficiency by minimizing the costs and risks of military operations	x	?	?	x	✓	✓

✓ comparative advantage

? potential advantage or disadvantage depending on operational context

x comparative disadvantage

specialties. One could also embrace non-military ‘domains’ such as economic statecraft or coercive engineered migration that are sometimes used in lieu of, or in response to, military force.<sup>34</sup> To keep the analysis tractable, we focus here only on six different categories of military capability – nuclear, land, sea, air, space, and cyber. There is already enough diversity across these to enable us to make the first order point that different means have different political utility.

Table 1 summarizes the comparative political advantages and disadvantages of military domains. In some cases, the advantages are ambiguous, either because of the diversity of platforms and units within a domain or of effects achieved across domains. Some of these nuances will be unpacked in the following sections. Table 1 lists domains roughly in the historical order of their emergence, from land to cyberspace. We also break out nuclear weapons (missiles) between air and space due to their peculiar saliency. There is a suggestive historical pattern across domains. As forces become more specialized, mobile, and dependent on information, their political utility shifts from credibility (land), to warfighting (sea and air), to intelligence and deception (space and cyber). Nuclear weapons represent a sharp break in this pattern, in that they more resemble the comparative advantages of land rather than air or space. The extreme, and extremely obvious, destruction of nuclear weapons, when combined with prompt global delivery platforms, enables the air (and space) domain to recover some of the deterrence utility, otherwise concentrated in the land domain, that was sacrificed in the quest for effectiveness and efficiency. The nuclear exception illustrates the importance of context and combination, insofar as specialization for mass destruction of nuclear weapons (which enhances the credibility of punishment strategies) offsets the mobility and stealth of delivery

<sup>34</sup>Daniel W Drezner, ‘Economic Sanctions in Theory and Practice: How Smart Are They?’ in Kelly M. Greenhill and Peter Krause (ed.), *Coercion: The Power to Hurt in International Politics* (New York: Oxford University Press 2018), 251–70; Kelly M. Greenhill, ‘Asymmetric Advantage: Weaponizing People as Nonmilitary Instruments of Cross-Domain Coercion,’ in Jon R. Lindsay and Erik Gartzke (ed.), *Cross-Domain Deterrence: Strategy in an Era of Complexity* (New York: Oxford University Press 2019), 259–89.

platforms moving through air and space (which undermines credibility). We expand on these arguments and highlight numerous similar exceptions below.

## Analysis of comparative advantages

In this section we explain how the geographic and technological features of different operational domains create comparative advantages for the three basic political objectives. We will paint in broad brushstrokes, drawing on stylized insights from scholarship on each domain. We do so at the risk of eliding important distinctions and debates in specialized literatures, but to do them all justice is impossible in the space available. We hope to make up for the lack of technical nuance by providing synthetic insight into the political implications of specialized capabilities.<sup>35</sup>

### Land

Land is the oldest domain of warfare. Armies that can be used to invade, occupy, or defend territory have also long been useful for making credible threats.<sup>36</sup> Large ground deployments are hard to hide, so a target knows that a capability is present. Their logistic entourage moves slowly, so the target knows that a capability will remain present. Mobilized forces are expensive to maintain in the field, so a target knows that the threat is serious. By paying the financial and political costs to deploy and sustain troops in harm's way, political leaders can more credibly communicate their willingness to conquer or defend an interest. Even ground forces that cannot defeat an attack on their own still signal a defender's interest in a particular place or issue. Further, they can also act as a tripwire, committing a defender to deploy additional forces in a crisis or war. So much the better for deterrence (or compellence) if ground forces are large and strong enough to also mount a successful defense (or invasion).

During the Cold War, as today, the United States extended nuclear guarantees to some of its allies. Concerns about the credibility of the nuclear umbrella were pithily summed up by the question of whether the United States would trade Washington for Paris or Bonn. American officials addressed the problem with a cross-domain solution. U.S. troops were deployed to Europe to commit the United States to a larger, and most likely nuclear, war if the Soviet Union attacked Central Europe. Tripwire forces in the

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<sup>35</sup>In our own terms, we have traded efficiency for effectiveness in this article, but we hope to preserve some credibility!

<sup>36</sup>Slantchev, *Military Threats*; Michael Allen Hunzeker and Alexander Lanoszka, 'Landpower and American Credibility,' *Parameters* 45/4 (2015), 17–26; Erik Gartzke and Koji Kagotani, 'Being There: U.S. Troop Deployments, Force Posture and Alliance Reliability' (Working Paper, 2017); Bryan Frederick et al., *Understanding the Deterrent Impact of U.S. Overseas Forces* (Santa Monica, CA: RAND Corporation 2020).

Cold War, as in the Baltic region today, may not have been able to defeat an enemy attack, but their failure to do so would have helped to generate the will to respond with even more force. Schelling describes their mission with characteristic flair: 'Bluntly, they can die. They can die heroically, dramatically, and in a manner that guarantees that the action cannot stop there.'<sup>37</sup> Indeed, NATO adopted a concentrated forward deployment in Western Germany that was politically efficacious, even though a defense in depth across Western Europe would probably have improved defensive fighting power. Innovations in technology and doctrine eventually helped to relieve the painful tradeoff policymakers faced between defense and deterrence. The adoption of AirLand Battle doctrine by the U.S. military (and Follow-on-Forces Attack by NATO) substituted the possibility of forward air interdiction in Eastern Europe for the politically less attractive option of defense in depth in Western Europe. Once again, this was a cross-domain solution, leveraging the warfighting potency of air forces to complement the deterrent credibility of ground forces. The improvement in NATO's conventional power during the late Cold War greatly enhanced deterrence by denial (the threat of successful defense) and thereby relieved the exclusive reliance in the early Cold War on nuclear deterrence (the threat of costly punishment).

John Mearsheimer points out that attrition, as contrasted with maneuver warfare, is the foundation of coercive strategy with conventional land forces.<sup>38</sup> Attrition relies on massed forces – large numbers of troops and heavy firepower – to both absorb and inflict damage, which raises the costs of conflict for the enemy state (coercive punishment) and wears down the enemy military's ability to keep fighting (warfighting denial). While a willingness to engage in contests of attrition can be useful for deterrence, they are also a liability for warfighting effectiveness. Attrition also wears down friendly forces and political will. Maneuver strategies, by contrast, attempt to flank or penetrate enemy formations to throw them into disarray. Throughout history, commanders have struggled to restore maneuver to attritional battlefields.<sup>39</sup> Maneuver warfare can potentially force a battlefield decision, shorten a conflict, and conserve friendly forces. Modern ground forces rely on combinations of different capabilities within the land domain itself to survive the lethality of the modern battlefield, and to restore mobility.<sup>40</sup> In combined-arms warfare, the strengths of each branch – infantry, armor, artillery, aviation, etc. –

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<sup>37</sup>Schelling, *Arms and Influence*, 47.

<sup>38</sup>John J. Mearsheimer, *Conventional Deterrence* (Ithaca, NY: Cornell University Press 1985). See also Cathal Nolan, *The Allure of Battle: A History of How Wars Have Been Won and Lost* (New York: Oxford University Press 2017). We are grateful to a reviewer for pointing out that we are talking about the American distinction between attrition and maneuver here rather than the Prussian distinction between attrition and annihilation, which do not necessarily overlap.

<sup>39</sup>Russell F. Weigley, *The American Way of War: A History of United States Military Strategy and Policy* (Bloomington, IN: Indiana University Press 1973); Alex Roland, 'Technology, Ground Warfare, and Strategy: The Paradox of the American Experience,' *Journal of Military History* 55/4 (1994), 447–67.

<sup>40</sup>Stephen D. Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Princeton, NJ: Princeton University Press 2004).

cover the weaknesses of the others, creating synergies that enhance the fighting power of the overall force. Joint doctrines like AirLand Battle leverage forces from other domains to shift the emphasis from mass to maneuver in warfighting. Yet even in the best of circumstances, maneuver warfare is still highly constrained by terrain features, weather, material infrastructure, and local politics. Schemes of maneuver often fail to go according to plan because, as Clausewitz stressed long ago, machines break down, troops panic and make mistakes, intelligence proves unreliable, or the enemy behaves surprisingly.<sup>41</sup> When speed and coordinated maneuver falter, armies must fall back on mass to take the hits and keep on fighting.<sup>42</sup> Napoleon may have been a genius of maneuver warfare, but even he is reputed to have believed that God favors bigger battalions.

Special forces are an exception that proves the rule. Commando units rely on stealth and speed to achieve an advantage.<sup>43</sup> More often than not, however, they do so by leveraging air, naval, space, and communications platforms from other domains that have comparative advantages other than mass. Special operators who find themselves outgunned in land encounters usually fare badly.<sup>44</sup> Moreover, some forms of irregular warfare recapitulate the classic ground force emphasis on mass; for instance, counterinsurgency doctrine calls for troops to 'surge' in order to 'clear, hold, and build.'<sup>45</sup> In general, the land domain incentivizes ground forces to rely more on mass than maneuver. Mass, in turn, facilitates costly signaling that disproportionately enable credibility in coercive (deterrence) strategies.

## Sea

Navies, by contrast, enable maneuver on a grand scale. Vessels can move heavy cargo around the world at relatively low cost. Naval fleets can project supporting fires, land expeditionary troops, and deliver logistical supplies to any region with a coastline. The ocean becomes a highway for nations that can afford capital-intensive maritime capabilities and a barrier for those that cannot. Naval mastery enabled Great Britain in its heyday to minimize expenditure on standing armies yet still shape continental, and eventually global, politics.<sup>46</sup> The mobility and flexibility of sea power provides strategic advantages for projecting force, imposing blockades, resupplying troops, and keeping sea lanes open for trade.

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<sup>41</sup>Clausewitz, *On War*, 113–21.

<sup>42</sup>Stephen Biddle, 'Speed Kills? Reassessing the Role of Speed, Precision, and Situation Awareness in the Fall of Saddam,' *Journal of Strategic Studies* 30/1 (2007), 3–46.

<sup>43</sup>William H. McRaven, *Spec Ops: Case Studies in Special Operations Warfare: Theory and Practice* (New York: Presidio Press 1995).

<sup>44</sup>See for example, Sean Naylor, *Not a Good Day to Die: The Untold Story of Operation Anaconda* (New York: Penguin 2005).

<sup>45</sup>U. S. Army, *FM 3–24: Counterinsurgency* (Washington, D.C.: Government Printing Office 2006); David H. Ucko, *The New Counterinsurgency Era: Transforming the U.S. Military for Modern Wars* (Washington, DC: Georgetown University Press 2009).

<sup>46</sup>Paul M. Kennedy, *The Rise And Fall of British Naval Mastery*, Revised (London: Penguin Random House 2017).

These features are politically consequential. As Francis Bacon observed, 'he that commands the sea is at great liberty, and may take as much and as little of the war as he will. Whereas those that be strongest by land are many times nevertheless in great straits.'<sup>47</sup> The vastness of the sea enables navies to withdraw from danger and opt into engagements in favorable conditions. Land armies are more likely to find themselves caught in desperate situations. Yet the discretion that enhances defense is not good for deterrence: navies can renege on commitments by simply sailing away, while more cumbersome ground forces remain committed to fight (or surrender). Navies provide a state with expanded options for power projection relative to ground forces, but the availability of options also undermines the credibility of promises. The same mobility that creates warfighting options also enables commanders to protect these advantages by avoiding risky encounters. Athenians sacrificed their city, after all, but not the fleet. Fleet battle is rare historically because the loss of capital ships, and the resulting compromise of supply lines and power projection, threaten catastrophic consequences for a maritime nation. Churchill thus characterized Admiral Jellicoe as 'the only man on either side who could lose the war in an afternoon.'<sup>48</sup>

This does not mean that naval deterrence is impossible. On the contrary, the sea is a natural barrier for invasion forces.<sup>49</sup> For the same reason, naval powers might credibly signal defensive intentions and thereby discourage the formation of balancing coalitions against them.<sup>50</sup> While naval forces operating in peripheral theaters might reasonably suggest that a state is pursuing limited aims, states that cross an enemy border with land forces might find it harder to commit not to march on the enemy capital.<sup>51</sup> Naval missions to 'show the flag' through port visits and 'freedom of navigation operations' can demonstrate the ability to move firepower into an area, which can enhance coercion and assurance to allies; moreover, navies must assume some risk by sailing into a potential adversary's engagement envelope to do so. The credibility of 'presence' missions is weakened, however, by the degree to which mobile platforms like naval vessels can simply sail away at the moment of crisis. Alternatively, navies may be too far away to arrive in time and in sufficient quantity to be of much help. Mobility and vulnerability are twin liabilities for deterrence.<sup>52</sup>

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<sup>47</sup>Francis Bacon, *Essays, Civil and Moral: And The New Atlantis* (New York: P.F. Collier & Son 1909), 89.

<sup>48</sup>Hugh White, 'Losing the War in an Afternoon: Jutland 1916,' *The Strategist* (Australian Strategic Policy Institute, 13 May 2016).

<sup>49</sup>John J Mearsheimer, *The Tragedy of Great Power Politics* (New York: Norton 2001), 114–28.

<sup>50</sup>Levy and Thompson, 'Balancing on Land and at Sea.'

<sup>51</sup>Corbett, *Some Principles of Maritime Strategy*, 52–59.

<sup>52</sup>This argument is developed further with supporting empirical data in Erik Gartzke and Jon R. Lindsay, 'The Influence of Seapower on Politics: Domain- and Platform-Specific Attributes of Material Capabilities,' *Security Studies* (Forthcoming).



The sea-based leg of the nuclear triad offers another rule-proving exception. Much as special forces rely on other domains to exploit maneuver rather than rely on mass, ballistic missile submarines (SSBNs) rely on the air and space domains to impose horrific punishment. SSBNs can disappear for months at a time to evade counterforce targeting, which improves the survivability of forces available for nuclear retaliation. Military uncertainty about the location of mortal threats improves political certainty that they will be available when called upon, in much the same way as the infeasibility of missile defense enhances the credibility of deterrent threats. Thus, nuclear states tend to converge on SSBN forces once they get over the significant investment and learning curve involved in mastering SSBN operations.<sup>53</sup> Submarines can also use their advantages in maneuver and stealth for intelligence collection, but this may have a negative effect on the mutual information required for stable deterrence. Indeed, one objective of clandestine operations is to convey no information at all. Yet this very tension creates questions for allies about whether extended deterrence through SSBNs is as credible as nuclear capabilities based on the client's own soil.<sup>54</sup>

As a general rule, the mobility and stealth of navies weakens the credibility of deterrence strategies relative to armies, even as the ability to transport expeditionary forces and project firepower in substantial quantities affords some additional bargaining leverage. The formidable costs involved in building – and risking – a navy can also provide a marginal advantage in making credible threats relative to other capabilities that are even more maneuverable and vulnerable, such as air forces.

## Air

The comparative advantage of modern air power is the rapid delivery of firepower (and other effects) over great distances. Aircraft can project precision fires to targets far inland that naval fires simply cannot reach. Aircraft can also serve as reconnaissance platforms to target fires from, or into, other domains. This in turn enhances the efficiency of combined arms warfare (as well as variants like Joint force maneuver or multi-domain operations) and thus decreases reliance on mass. By reducing the number of personnel in harm's way, moreover, modern air power can increase military power while decreasing political risk, which is especially attractive for casualty-sensitive democracies.

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<sup>53</sup>Erik Gartzke, Jeffrey M. Kaplow, and Rupal N. Mehta, 'The Determinants of Nuclear Force Structure,' *Journal of Conflict Resolution* 58/3 (2014), 481–508.

<sup>54</sup>Rupal N. Mehta, 'Extended Deterrence and Assurance in Multiple Domains,' in Jon R. Lindsay and Erik Gartzke (ed.), *Cross-Domain Deterrence: Strategy in an Era of Complexity* (New York: Oxford University Press 2019).

Yet while air power exceeds naval power in speed, maneuverability, and global reach, aircraft are far more fragile than ships. Warships with modern close-in weapon systems and damage control systems might remain afloat and fighting under missile attack, but gravity usually dooms a damaged aircraft. Air superiority is thus a critical precondition for effective use of the air domain to project power into the land and sea domains. Air forces are also needed to oppose enemy air forces that threaten them.<sup>55</sup> To an even greater extent than naval forces, air forces rely on stealth and maneuver to compensate for their disadvantages in mass and protection. The political tradeoff between power and credibility is thus even greater as well. Even though the rise of air power is closely associated with the articulation of coercive punishment strategies, the historical record casts doubt on the political efficacy of strategic bombing.<sup>56</sup> Air power can be very effective at generating deterrence at the operational rather than strategic level, however, precisely by using its mobility and firepower to deny the ability of ground forces to concentrate mass, even as doing so requires some degree of air superiority.<sup>57</sup> Aircraft can also draw away enemy fighters that might attempt to do the same to friendly ground forces. The military features of air power make it a highly desirable instrument for fighting and winning a war. The same features make air power alone somewhat less useful for credibly signaling political interests and consequences.

Recent U.S. drone campaigns highlight some of the advantages of air forces for warfighting, at least in permissive airspace, together with their disadvantages for strategic coercion. The remote location of aircrew protects them from lethal exposure to enemy fires. The range and endurance advantages of drones have improved intelligence coverage in politically sensitive areas that are off limits to U.S. troops, which has improved the precision and accountability of aerial targeting.<sup>58</sup> Empirical studies of drone campaigns find a significant effect in suppressing insurgent violence in areas around drone strikes, while arguments about blowback from civilian casualties appear to be

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<sup>55</sup>In this regard, surface-to-air missiles may be considered disposable unmanned aircraft tailored for the mission of aerial denial. SAMs are a cross-domain response to the threat posed by the air domain to the land domain.

<sup>56</sup>Robert Anthony Pape, *Bombing to Win: Air Power and Coercion in War* (Ithaca, NY: Cornell University Press 1996); Tami Davis Biddle, *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas about Strategic Bombing, 1914–1945* (Princeton, NJ: Princeton University Press 2002); Phil M. Haun, *Coercion, Survival, and War: Why Weak States Resist the United States* (Stanford, CA: Stanford University Press 2015); Abigail Post, 'Flying to Fail: Costly Signals and Air Power in Crisis Bargaining,' *Journal of Conflict Resolution* 63/4 (2019), 869–95.

<sup>57</sup>Phil Haun and Colin Jackson, 'Breaker of Armies: Air Power in the Easter Offensive and the Myth of Linebacker I and II in the Vietnam War,' *International Security* 40/3 (1 January 2016), 139–78; Phil Haun, 'Air Power Versus Ground Forces – Deterrence at the Operational Level of War,' in Jon R. Lindsay and Erik Gartzke (ed.), *Cross-Domain Deterrence: Strategy in an Era of Complexity* (New York: Oxford University Press 2019).

<sup>58</sup>Gregory S. McNeal, 'Targeted Killing and Accountability,' *Georgetown Law Journal* 102 (March 2014), 681–794; Jason Lyall, 'Bombing to Lose? Airpower and the Dynamics of Violence in Counterinsurgency Wars,' Working Paper (Social Science Research Network 3 September 2017), <http://dx.doi.org/10.2139/ssrn.2422170>.

exaggerated.<sup>59</sup> Yet as effective as drones may be for denial, drone strikes provide little information to targets on the receiving end about the resolve of the nation that relies on drones. The chronic attrition of limited war has the useful political function of separating weaker but more resolved actors from stronger but less resolved types. If, however, the stronger actor only imposes rather than pays costs, then the weaker actor receives no information about the political resolve of the stronger actor. The targets of drone strikes thus have incentives to target more vulnerable civilian populations in an effort to test the resolve of the stronger power.<sup>60</sup>

### **Nuclear weapons**

Nuclear weapons, typically delivered through air and space, create a major exception to our generalization about the coercive limits of air power. Certainty about the extreme costs of nuclear punishment compensates somewhat for the uncertainties associated with stealthy, long-range, maneuverable platforms. Nuclear weapons are uniquely devastating and, when delivered by volleys of long-range missiles, extremely difficult to intercept. In theory, a state with a secure second strike capability – an arsenal that can survive an attempted preemptive strike – can openly advertise to others that it has the ability to punish nuclear attacks on its vital interests.<sup>61</sup> The political certainty of retaliation, interestingly, depends on tactical uncertainty about the location of delivery platforms and the inability to intercept all of their warheads. It is difficult to target mobile or hidden platforms and to intercept warheads speeding in from outer space. A single missed warhead, moreover, can incinerate an entire city. As a result, the importance of aggregate military power is somewhat muted in the nuclear domain. Above a certain threshold, the marginal damage inflicted by additional mass destruction adds little to the horrendous damage already inflicted. The orthodox theory of the nuclear revolution – stability through mutually assured

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<sup>59</sup>James Igoe Walsh, 'The Effectiveness of Drone Strikes in Counterinsurgency and Counterterrorism Campaigns' (Carlisle Barracks, PA: Strategic Studies Institute 26 September 2013), <http://www.strategicstudiesinstitute.army.mil/pubs/display.cfm?pubID=1167>; Patrick B. Johnston and Anoop K. Sarbahi, 'The Impact of US Drone Strikes on Terrorism in Pakistan,' *International Studies Quarterly* 60/2 (2016), 203–19; Aqil Shah, 'Do U.S. Drone Strikes Cause Blowback? Evidence from Pakistan and Beyond,' *International Security* 42/04 (1 May 2018), 47–84.

<sup>60</sup>Erik Gartzke and James Igoe Walsh, 'The Drawbacks of Drones: The Effects of UAVs on Militant Violence in Pakistan,' *Journal of Peace Research*, Forthcoming; Erik Gartzke, 'Blood and Robots: How Remotely Piloted Vehicles and Related Technologies Affect the Politics of Violence,' *Journal of Strategic Studies* 0/0 (3 October 2019), 1–31. For an alternative view that overweights the power to impose costs and underweights the willingness to absorb them, cf. Amy Zegart, 'Cheap Fights, Credible Threats: The Future of Armed Drones and Coercion,' *Journal of Strategic Studies* 43/1 (28 February 2018), 6–46.

<sup>61</sup>Classic statements of nuclear deterrence theory include Bernard Brodie et al., *The Absolute Weapon: Atomic Power and World Order* (New York: Harcourt, Brace and Co. 1946); Herman Kahn, *On Thermonuclear War* (Princeton University Press 1960); Schelling, *Arms and Influence*. For a review of this vast literature see Lawrence Freedman, *Deterrence* (Cambridge: Polity Press, 2004).

destruction (MAD) – holds that small arsenals and conservative force postures are sufficient for effective deterrence.<sup>62</sup>

The central problem in nuclear deterrence theory is credibility. Executing a nuclear threat entails significant risks of enemy nuclear retaliation, collateral consequences from friendly nuclear strikes, and the potential opprobrium of breaking the ‘nuclear taboo.’<sup>63</sup> An actor must be perceived as having an extremely high value for the stakes in a contest before it can credibly make such a threat. Deterrent threats to protect vital interests, such as regime survival, are widely believed to be more credible than compelling threats to advance revisionist goals, which are more likely to be perceived as a bluff.<sup>64</sup> Loss-aversion heuristics tend to reinforce the asymmetry of stakes.<sup>65</sup> One implication is that actors who rely mainly on nuclear deterrence will tend to compromise on disputes over less-than-vital interests. Nuclear threats may credibly deter major war, but it is not credible to threaten Armageddon in response to minor acts in peripheral theaters (which gives rise to the so-called stability-instability paradox).<sup>66</sup> The Kennedy administration’s pursuit of ‘Flexible Response’ as an alternative to Eisenhower’s ‘Massive Retaliation’ reflected, in part, a desire to fashion additional tools for deterrence and influence below the threshold of nuclear credibility.<sup>67</sup> Nuclear weapons discourage attacks on vital interests, even as credibility suffers, and even encourages challenges, in less-than-vital arenas.

Nuclear deterrence in practice has involved a dizzying variety of capabilities for nuclear warfighting; defense and deception are often mixed with deterrence. MAD skeptics point out that modern reconnaissance and precision strike capabilities make nuclear warfighting more feasible than generally appreciated.<sup>68</sup>

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<sup>62</sup>Inter alia, Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca: Cornell University Press 1989); Charles L. Glaser, *Analyzing Strategic Nuclear Policy* (Princeton, NJ: Princeton University Press 1990); Charles L. Glaser and Steve Fetter, ‘Should the United States Reject MAD? Damage Limitation and U.S. Nuclear Strategy toward China,’ *International Security* 41/ 1 (1 July 2016), 49–98, [https://doi.org/10.1162/ISEC\\_a\\_00248](https://doi.org/10.1162/ISEC_a_00248).

<sup>63</sup>The precedent of nuclear non-use appears to have a weak but nonzero effect on public preferences, which may not reflect policymaker preferences: Daryl G. Press, Scott D. Sagan, and Benjamin A. Valentino, ‘Atomic Aversion: Experimental Evidence on Taboos, Traditions, and the Non-Use of Nuclear Weapons,’ *American Political Science Review* 107/1 (February 2013), 188–206.

<sup>64</sup>Todd S. Sechser and Matthew Fuhrmann, *Nuclear Weapons and Coercive Diplomacy* (New York: Cambridge University Press 2017). Cf. Matthew Kroenig, *The Logic of American Nuclear Strategy: Why Strategic Superiority Matters* (New York: Oxford University Press 2018).

<sup>65</sup>Robert Jervis, Richard Ned Lebow, and Janice Gross Stein, *Psychology and Deterrence* (Baltimore, MD: Johns Hopkins University Press 1985).

<sup>66</sup>Glenn H. Snyder, ‘The Balance of Power and the Balance of Terror,’ in Paul Seabury (ed.), *The Balance of Power* (San Francisco, CA: Chandler 1965).

<sup>67</sup>‘Flexible Response’ was never actually implemented as an operational nuclear doctrine during the Kennedy and Johnson administrations according to Francis J. Gavin, *Nuclear Statecraft: History and Strategy in America’s Atomic Age* (Ithaca: Cornell University Press 2012), chap. 2.

<sup>68</sup>Inter alia, Keir A. Lieber and Daryl G. Press, ‘The End of MAD? The Nuclear Dimension of U.S. Primacy,’ *International Security* 30/4 (1 April 2006), 7–44; Austin Long and Brendan Rittenhouse Green, ‘Stalking the Secure Second Strike: Intelligence, Counterforce, and Nuclear Strategy,’ *Journal of Strategic Studies* 38/1–2 (2014), 38–73; Keir A. Lieber and Daryl G. Press, ‘The New Era of Counterforce: Technological Change and the Future of Nuclear Deterrence,’ *International Security* 41/4 (1 April 2017), 9–49; Kroenig, *The Logic of American Nuclear Strategy*.

Counterforce strategies tend to require larger and more varied arsenals, with more aggressive postures, to deal with a wider range of scenarios. The ability to track and target enemy nuclear forces would enable a state to limit the damage an enemy could inflict in a nuclear war, even as the same ability creates temptations for nations possessing these capabilities to engage in a preemptive counterattack. Yet even the most vocal advocates of counterforce still consider nuclear warfighting to be a last-resort option to be exercised only in the event that deterrence fails. Because even a small nuclear war entails considerable risk for all sides, nuclear weapons are ill-suited as an instrument of conquest. Despite all the debate about counterforce and strategic stability, a rough consensus endures that the primary utility of nuclear weapons is for deterring major war and ensuring state survival.

## Space

Many of the reconnaissance functions first performed by aircraft can now be performed more effectively by satellites. Yet there are important differences between the air and space domains. Outer space is more difficult to access. Despite being physically vast, maneuver in space is highly constrained by orbital physics, extremely high velocities of spacecraft, and hazardous environmental conditions including radiation and debris. Debris created by asteroids, derelict satellites, rocket bodies, or kinetic strikes might create orbiting hazards that imperil any satellite in the same orbit, including those operated by the attacker.<sup>69</sup> Unfortunately, spacecraft have limited fuel stores for defensive maneuver, and remote control from ground stations might not be timely in tactical situations. The replacement of damaged or derelict satellites is expensive and time-consuming, particularly for highly specialized platforms like U.S. Space-Based Infrared System (SBIRS) satellites. All of these factors put a premium on centralized command and control. Russia and China already have dedicated military space agencies, and the United States is in the process of consolidating operational capabilities into a new Space Force.<sup>70</sup> Given the steep barriers to entry to a functional space program, only major powers tend to be space powers, even as the commercial space industry continues to grow.<sup>71</sup>

Space is strategically salient because of what it means for operations on Earth, not because of what happens in space per se.<sup>72</sup> Space is primarily, but

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<sup>69</sup>A single weapon test by China in 2007 and an accidental satellite collision in 2009 increased the amount of trackable space debris by 40%; see Nicholas L. Johnson, 'Orbital Debris: The Growing Threat to Space Operations' (33rd Annual Guidance and Control Conference, Breckenridge, CO, 2010), <https://ntrs.nasa.gov/search.jsp?R=20100004498>.

<sup>70</sup>Benjamin Bahney and Jonathan Pearl, 'Why Creating a Space Force Changes Nothing,' *Foreign Affairs*, 26 March 2019.

<sup>71</sup>James Clay Moltz, *Crowded Orbits: Conflict and Cooperation in Space* (New York: Columbia University Press 2014).

<sup>72</sup>The metaphor of space as a global littoral area is developed by Bleddyn E. Bowen, *War in Space: Strategy, Spacepower, Geopolitics* (Edinburgh: Edinburgh University Press 2020).

not exclusively, an informational domain that enables intelligence collection, communications relay, and precision navigation on Earth. Low-earth, mid-earth, geostationary, and elliptical orbits each offer unique vantage points for locating and interconnecting assets in the land, sea, and air domains. Yet a parabolic path through space is also the quickest way to move between two widely separated points on Earth. Satellite-based targeting and early warning capabilities *in* space offer critical support for ballistic missile operations that transit *through* space. The space age and the missile age are one and the same, making nuclear deterrence a planetary-scale problem.<sup>73</sup> The informational and kinetic applications of space have an important but underappreciated strategic similarity in this respect: it is difficult to defend against them. Warheads reenter the atmosphere at many times the speed of sound, which makes missile defense a difficult technical challenge. Decoy warheads and volley fire add to the difficulties, while even a single missed interception might mean the incineration of an entire city. Reconnaissance satellites, meanwhile, provide continuous or near-continuous coverage of the entire globe across the entire electromagnetic spectrum. While it is possible to conceal activity and shield signals, it is difficult to concentrate large land formations or to move big metal platforms at sea while remaining undetected from space.<sup>74</sup> Satellite vehicles may be easy to track from Earth against the blackness of space, but their intelligence payloads remain closely guarded secrets. This in turn creates many opportunities for non-intrusive intelligence, early warning, and arms control verification. Put simply, the space domain is fundamentally cross-domain.

The strategic stability of space is a complicated matter, in large part because of changing relationships, and greater dependencies, across domains. Stability appears to be eroding since the end of the Cold War due to improvements in ASAT technology and the increased reliance on space for conventional operations.<sup>75</sup> ASAT technology was immature in the Cold War, and the superpowers were deterred from using it given the close coupling between early warning satellites and nuclear forces.<sup>76</sup> The informational

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<sup>73</sup>Daniel Deudney, *Whole Earth Security: A Geopolitics of Peace*, Worldwatch Paper 55 (Washington, DC: Worldwatch Institute 1983).

<sup>74</sup>This is especially true of the operational (theater) level of war, but tactical detection of individual platforms from space became increasingly feasible throughout the Cold War. See Norman Friedman, *Seapower and Space: From the Dawn of the Missile Age to Net-Centric Warfare* (Naval Institute Press 2000).

<sup>75</sup>Benjamin Bahney, Jonathan Pearl, and Michael Markey, 'Anti-Satellite Weapons and the Instability of Deterrence,' in Jon R. Lindsay and Erik Gartzke (ed.), *Cross-Domain Deterrence: Strategy in an Era of Complexity* (New York: Oxford University Press 2019).

<sup>76</sup>An excellent primer on ASAT operations, still relevant despite considerable technological change and thus reflecting the important physical constraints on the space domain, is Ashton B. Carter, 'Satellites and Anti-Satellites: The Limits of the Possible,' *International Security* 10/4 (1986), 46–98. On Cold War stability see Paul B. Stares, *The Militarization of Space: U.S. Policy, 1945–1984* (Ithaca, NY: Cornell University Press 1985); James Clay Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests* (Stanford, Calif: Stanford Security Studies 2008).

advantages of space, together with the difficulty of defending against missiles and reconnaissance from space, helped to make deterrence a feasible grand strategy during the Cold War. Indeed, states with reconnaissance satellites have been less likely to be targeted with military aggression.<sup>77</sup> Today, however, there are growing incentives to preempt in space during a conventional military crisis. Ironically, this may improve the credibility of Russian and Chinese deterrence against the United States given the heavy reliance of the latter on space for power projection. Increasing dependence on space by new space powers for all kinds of peacetime and wartime missions could also result in some degree of mutual vulnerability and restraint similar to that experienced during the Cold War.<sup>78</sup> At the same time, however, war in space might injure only spacecraft rather than people, creating credibility problems similar to those discussed above regarding drone campaigns.

### Cyberspace

Space and cyberspace are both informational domains. Indeed, part of cyberspace is literally in outer space. For example, the Global Positioning System (GPS) supports the synchronization of global financial transactions and enables mobile phone users to find themselves on digital maps. Space also relies on cyberspace insofar as satellite operations depend on electronic data links to ground stations, computer hardware, and software control systems. Global information infrastructure is physically located in all four environmental domains, improving intelligence, communications, and control for them all. Even more than space, the cyber domain is inherently cross-domain.

Yet there are also significant operational differences. Outer space is a mostly empty physical environment constrained by unforgiving physical laws. Cyberspace, by contrast, is a flexible, human-built, institutionally-governed, sociotechnical infrastructure.<sup>79</sup> There are few spacefaring nations, but billions of people interact online. Low barriers to entry enable many weaker states and non-state actors to cause problems in cyberspace; space infrastructure is a major national investment ASAT, and threats are almost exclusively military in nature, while the civilian technology in the global economy is the source of most cyber vulnerability. Satellites collect intelligence from above a target, but cyber operations get inside the target's networks.

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<sup>77</sup>Bryan R. Early and Erik Gartzke, 'Spying from Space: Reconnaissance Satellites and Interstate Disputes' (Typescript, 20 August 2017).

<sup>78</sup>David C. Gompert and Phillip C. Saunders, *The Paradox of Power: Sino-American Strategic Restraint in an Age of Vulnerability* (Washington DC: National Defense University Press 2011).

<sup>79</sup>Laura DeNardis, *The Global War for Internet Governance* (New Haven: Yale University Press, 2014); Nazli Choucri and David D. Clark, *International Relations in the Cyber Age: The Co-Evolution Dilemma* (Cambridge, MA: MIT Press 2018).



Any domain (or capability in a domain) that useful for information and communication functions will be particularly relevant for intelligence and deception. Because cyberspace is built out of information and communication technology, the possibilities for deception are limitless. The economic viability of cyberspace depends on the willingness of millions of users to entrust valuable data to remote servers. Increased trust and lowered transaction costs, in turn, make it possible for malicious actors to abuse trust at low cost.<sup>80</sup> Pervasive digital networks offer unprecedented opportunities for secrecy, deception, obfuscation, manipulation, and subversion. Cyber operations exploit technical vulnerabilities and manipulate human gullibility for intelligence collection (surveillance and espionage), network disruption (sabotage and covert action), or indirect influence (subversion and disinformation). Military forces that depend on digital networks for their combat power must be especially concerned about electronic attack, cyber exploitation, and other forms of disruption and disinformation, let alone the self-inflicted friction created by complex information systems.<sup>81</sup> Defense is difficult in cyberspace because offense has many opportunities for deception, but network defenders can employ deception as well to monitor and entrap attackers. Cybersecurity can be usefully understood as an intelligence-counterintelligence contest, conducted with new means at a historically unprecedented scale.<sup>82</sup>

Deception, by its very nature, undermines credibility. Extreme secrecy and tactical flexibility tend to make cyber deterrence quite difficult.<sup>83</sup> Ransomware (e.g., the WannaCry attacks of 2017) provides another rule-proving exception here. This method employs a surprise attack to embargo a user's data and then demands a ransom to unlock it (or to avoid releasing embarrassing documents). This threat only works if the ransom is less than the cost of replacement or response. More generally, a cyber threat that is specific enough to be believable is also specific enough to enable a target to patch or reconfigure its networks. For the same reason, offensive cyber

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<sup>80</sup>Sean Bodmer et al., *Reverse Deception: Organized Cyber Threat Counter-Exploitation* (New York: McGraw-Hill 2012); Richard Bejtlich, *The Practice of Network Security Monitoring: Understanding Incident Detection and Monitoring* (San Francisco: No Starch Press 2013).

<sup>81</sup>Tim Benbow, *The Magic Bullet? Understanding the Revolution in Military Affairs* (London: Brassey's 2004); Jacquelyn Schneider, 'The Capability/Vulnerability Paradox and Military Revolutions: Implications for Computing, Cyber, and the Onset of War,' *Journal of Strategic Studies* 42/6 (19 September 2019), 841–63; Jon R. Lindsay, *Information Technology and Military Power* (Ithaca, NY: Cornell University Press 2020).

<sup>82</sup>Thomas Rid, *Cyber War Will Not Take Place* (London: Hurst 2013); Joshua Rovner, 'Cyber War as an Intelligence Contest,' *War on the Rocks* (blog), 16 September 2019, <https://warontherocks.com/2019/09/cyber-war-as-an-intelligence-contest/>.

<sup>83</sup>Martin C. Libicki, *Cyberdeterrence and Cyberwar* (Santa Monica, CA: RAND 2009); Tim Stevens, 'A Cyberwar of Ideas? Deterrence and Norms in Cyberspace,' *Contemporary Security Policy* 33/1 (1 April 2012), 148–70; Joseph S. Nye, 'Deterrence and Dissuasion in Cyberspace,' *International Security* 41/3 (1 January 2017), 44–71; Erica D. Borghard and Shawn W. Loneragan, 'The Logic of Coercion in Cyberspace,' *Security Studies* 26/3 (3 July 2017), 452–81.



operations are often at pains to avoid losing access to target networks. Exploitation that is too aggressive, and thus prompts a target to disconnect from common networks, undermines the possibility for further exploitation, or invites retaliation in other domains.

Incentives for restraint in cyberspace create a new twist on the Cold War stability-instability paradox. The risks of cross-domain retaliation, the benefits of continued intelligence exploitation, and reliance on interdependence for future exchange, all tend to discourage major aggressions, while at the same time encouraging minor harms.<sup>84</sup> The cyber domain becomes useful for the marginal revision of the balance of power through espionage and influence rather than dramatic coercion, costly punishment, or large-scale surprise attack.

### Conclusion: The complexity of modern strategy

With more ways and means available, strategists must cope with additional complexity and uncertainty. As the 2017 U.S. National Security Strategy asserts, 'State and non-state actors place the safety of the American people and the Nation's economic vitality at risk by exploiting vulnerabilities across the land, air, maritime, space, and cyberspace domains.'<sup>85</sup> Beijing's 2015 defense white paper also highlights the importance of new domains: 'The world revolution in military affairs (RMA) is proceeding to a new stage. Long-range, precise, smart, stealthy and unmanned weapons and equipment are becoming increasingly sophisticated. Outer space and cyber space have become new commanding heights in strategic competition among all parties.'<sup>86</sup>

Military power continues to diversify, and yet many analysts continue to treat power as an undifferentiated good. The details of implementation are relegated to military professionals or considered mere technicalities of policy. Policymakers and commanders, by contrast, have long appreciated, if only intuitively, that the ways in which political actors decide to generate and employ force is politically salient. Choices about force structure and posture have consequences for grand strategy and, given their pecuniary expense,

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<sup>84</sup>Jon R. Lindsay, 'Restrained by Design: The Political Economy of Cybersecurity,' *Digital Policy, Regulation and Governance* 19/ 6 (2017), 493–514; Jon R. Lindsay and Erik Gartzke, 'Coercion through Cyberspace: The Stability-Instability Paradox Revisited,' in Kelly M. Greenhill and Peter Krause (ed.), *Coercion: The Power to Hurt in International Politics* (New York: Oxford University Press 2018), 179–203; Brandon Valeriano, Benjamin M. Jensen, and Ryan C. Maness, *Cyber Strategy: The Evolving Character of Power and Coercion* (Oxford University Press 2018).

<sup>85</sup>United States, 'National Security Strategy of the United States of America' (White House Office December 2017), 7, <https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf>.

<sup>86</sup>State Council Information Office, 'China's Military Strategy' (Beijing: The State Council Information Office of the People's Republic of China May 2015), [http://www.chinadaily.com.cn/china/2015-05/26/content\\_20820628.htm](http://www.chinadaily.com.cn/china/2015-05/26/content_20820628.htm).

alternative domestic priorities. A more differentiated portfolio of military options makes these considerations more difficult, and arguably more important.

Any type of cross-domain or multi-domain strategy is inherently complex. Our basic argument is that the complexities are as much political as military. The technological and geographical characteristics of different operational domains make them more or less useful for different political strategies. Military capabilities that offer advantages in mass – masses of troops or mass destruction – enhance the credibility of coercive strategies (including deterrence). For the same reason, however, they are liabilities for efficiency since they require the actor to absorb considerable cost or risk of punishment. Capabilities that offer advantages in speed and maneuver, by contrast, such as air and naval fleets that can deliver long-range precision fires, enhance the effectiveness of warfighting strategies. The same mobility that enhances warfighting has the potential to improve the coverage of coercion (i.e., increase efficiency), but this benefit comes at the price of reduced credibility (by making it easier to abandon commitments). Domains that offer advantages for information – intelligence and communication infrastructure in space and cyberspace – enhance the efficiency of strategies that seek political-military benefits at vastly reduced cost and risk. Yet secrecy and deception are usually incompatible with credible communication and strategic signaling.

Our analysis is extremely coarse, we readily admit, but we believe that it captures important underlying features that differentiate broad categories of military capabilities. Each of the general operational domains has a distinctly recognizable political flavor. At the same time, we have attempted to highlight important variation and subtlety within each domain, which offer more nuanced strategic choices. Different platforms and types of units in each domain can, in certain circumstances, offer countervailing (or amplifying) advantages with respect to the general trend in the domain. Furthermore, it is only for the sake of analytical clarity that we have analyzed these domains and strategies separately. Even so, we have already encountered interdependence and synergy across domains, as well as tradeoffs and interference. Indeed, many of the most useful capabilities in practice involve combinations of organizational branches and operational domains. We expect that much of the nuance observed in real circumstances will often be the product of combinations of comparative advantages in mass, maneuver, and information at a more fine-grained level.

Our aim in this essay has been to articulate the political characteristics of the operational building blocks of military strategy. Much work remains to be done analyzing whether and how political actors combine and sequence these building blocks. The logic of complementarity across domains is intuitive and undergirds classic doctrines of combined-arms warfare as well as

contemporary emphasis on Joint, combined, and multi-domain operations. Close air support (tactical airpower) and airborne operations each leverage the air domain to enhance the range or combat power of land forces. Similarly, aircraft carriers leverage the air domain to improve the power projection of warships. Military specialization in pursuit of efficiency and effectiveness tends to put an imperative on integration. The integration of complementary weapon systems and domains is especially attractive in a warfighting context where power maximization is a primary consideration: all forces can be concentrated in a unified effort. Efficiency – cost minimization – is also desirable insofar as every military must operate within a budget of blood and treasure (especially for democratic states seeking to minimize exposure to casualties). Information-leveraging via space and cyberspace is attractive as a ‘force-multiplier,’ i.e., a way to do more with less. These informational domains can enhance the efficiency and scope of maneuver in all domains by providing ISR and reliable command and control. At the same time, nuclear weapons underscore the enduring relevance of ‘mass’ underwriting the credibility of deterrence. Indeed, nuclear deterrence puts an upper bound on the dynamics of any cross-domain strategy. Politics continues in the shadow of nuclear threats because actors still look for other ways to improve or undermine political-military advantages and strategic credibility.

Historical doctrines such as ‘AirLand Battle’ and ‘AirSea Battle’ seek power-improving synergies, but their critics have also highlighted liabilities, such as crisis instability and inadvertent escalation.<sup>87</sup> Cross-domain combinations can sometimes interfere with, rather than enhance, strategic objectives. Increasing reliance on the sea and air domains comes at the price of reduced credibility for coercion, precisely because mobile forces might choose to move away from their commitments. Strategies of offshore balancing that aim to deter a would-be challenger may end up sacrificing the credibility of the very deterrence that they aim to create while attempting to minimize cost and risk. Capabilities create vulnerabilities.<sup>88</sup> The informational capabilities in space and cyberspace that integrate military and economic power at an unprecedented scale, improving efficiency, are also vulnerable to remote exploitation and disruption, imperiling effectiveness. Space and cyberspace can, in different circumstances, amplify or interfere with advantages of other domains for war fighting or coercion. Space-based ISR makes surprise attack less likely to succeed, which

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<sup>87</sup>Barry R. Posen, *Inadvertent Escalation: Conventional War and Nuclear Risks* (Ithaca, N.Y.: Cornell University Press 1991); Avery Goldstein, ‘First Things First: The Pressing Danger of Crisis Instability in U.S.-China Relations,’ *International Security* 37/ 4 (2013), 49–89; Caitlin Talmadge, ‘Would China Go Nuclear? Assessing the Risk of Chinese Nuclear Escalation in a Conventional War with the United States,’ *International Security* 41/ 4 (1 April 2017), 50–92; James M. Acton, ‘Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War,’ *International Security* 43/ 1 (1 August 2018), 56–99.

<sup>88</sup>Schneider, ‘The Capability/Vulnerability Paradox and Military Revolutions.’

is stabilizing. Cyber exploitation of enemy nuclear command and control, by contrast, could be profoundly destabilizing. The cyber and nuclear domains have notably opposite informational characteristics. Offensive cyber operations depend on stealth and deception to disable control systems, which has the potential to enhance the effectiveness of nuclear counterforce or damage limitation strategies. Yet this also can undermine the stability of nuclear deterrence, which depends on credible mutual information about the balance of power. Efforts to win the counterforce contest in the cyber domain thus make it more likely that deterrence will fail in the nuclear domain.<sup>89</sup> The pursuit of synergies and avoidance of interferences is by necessity an ongoing and dynamic process. Because this balancing act is politically consequential, moreover, it cannot be relegated to technical functionaries.

Clausewitzian insights about war remain relevant, indeed vital, in the modern world. War remains a 'paradoxical trinity' of popular passions, unpredictable events, and *raison d'état*, as it was in Clausewitz's day. Yet this chaotic interaction now moves through even more complicated geometries of coercion, warfighting, and deception in the highly interdependent context of economic and technological globalization. While Clausewitz discussed the comparative tactical advantages of different combat arms at the beginning of the nineteenth century, today entirely new military domains host novel comparative strategic advantages. The proliferation of domains and complex interactions across them are both increasing the practical difficulty of strategy and creating new demand for theoretical concepts to guide it. Our attempt at disaggregating ends and means is not the final word, to be sure. Yet even a modest improvement in conceptualizing the coercive strengths and weaknesses of different technologies may prove useful for both theory and practice.

## Acknowledgements

Jon R. Lindsay is Assistant Professor at the Munk School of Global Affairs and Public Policy at the University of Toronto. Erik Gartzke is Professor of Political Science at the University of California, San Diego and Director of the Center for Peace and Security Studies (cPASS). This research was supported by the Department of Defense Minerva Initiative (Office of Naval Research Grant N00014-14-1-0071). The authors have benefited immensely from conversations with contributors to their volume, *Cross-Domain Deterrence: Strategy in an Era of Complexity* (Oxford University Press, 2019).

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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<sup>89</sup>Erik Gartzke and Jon R. Lindsay, 'Thermonuclear Cyberwar,' *Journal of Cybersecurity* 3/1 (February 2017), 37–48.

## Funding

This work was supported by the Department of Defense Minerva Initiative and the Office of Naval Research [N00014-14-1-0071].

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