Future Offensive Capabilities for Low-Yield Nuclear Deterrence

A Monograph

by

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The return of great power competition and increasing tension with China and Russia is forcing the US to expand its deterrent capabilities. Recent attempts by both states to seize new territory destabilizes their respective regions and US coalition partners are reliant on the US to deter any future attempts. Reduced troop numbers and the extended range from the continental United States combined with improvements in Russian and Chinese anti-access area denial weapons increase the risk to service members and to regional stability should a conflict escalate. Lack of US decisive response capability leaves a gap that adversaries can exploit to achieve rapid and decisive victory in a regional location. There is a capability gap in available US response options. Russia and China both possess low-yield battlefield nuclear weapons that can be utilized to disrupt, defeat, or destroy US forces and enable follow on maneuver. The US needs to expand its available arsenal to include capabilities that increase the cost to each nation should they attempt to escalate. Each nation requires a unique operational approach and combination of forces and technology.

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Abstract

Future Offensive Capabilities for Low-Yield Nuclear Deterrence, by MAJ Justin R. Nash, 47 pages.

The return of great power competition and increasing tension with China and Russia is forcing the Unites States to expand its deterrent capabilities. Recent attempts by both states to seize new territory destabilizes their respective regions and US coalition partners are reliant on the US to deter any future attempts. Reduced troop numbers and the extended range from the continental United States combined with improvements in Russian and Chinese anti-access area denial (A2AD) weapons increase the risk to service members and to regional stability should a conflict escalate. Lack of US decisive response capability leaves a gap that China and Russia can exploit to achieve rapid and decisive victory in a regional location. There is a capability gap in available US response options before escalation to strategic nuclear weapons. Russia and China both possess low-yield battlefield nuclear weapons (LYBNW) that can be utilized to disrupt, defeat, or destroy US forces and enable follow on maneuver. The United States needs to expand its available arsenal to include additional capabilities that increase the cost to each nation should they attempt to escalate. Neither country is the same and each requires a unique operational approach and combination of forces and technology. However, the ability to provide a rapid and decisive response is essential to achieving deterrence and assuring safety among regional partners.

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Abbreviations

A2AD	Anti-Access Area Denial
DoD	Department of Defense
ECS	East China Sea
EMP	Electro-Magnetic Pulse
EMS	Electro-Magnetic Spectrum
HGV	hyper-glide vehicles
INF	Intermediate Range Nuclear Forces
JEDI	Joint Enterprise Defense Initiative
LPI/LPD	Low Probability of Intercept and Low Probability of Detection
LYBNW	Low Yield Battlefield Nuclear Weapons
NATO	North Atlantic Treaty Organization
PrSM	Precision Strike Missile
SPR	Stakeholder Preparedness Review
SRBM	Short Range Ballistic Missile
THIRA	Threat and Hazard Identification and Risk Assessment
TITAN	Tactical Intelligence Targeting Access Node
TLS	Terrestrial Layer System

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Introduction

US hegemony is waning. As nation-states across the globe increase their technological, economic, and military capabilities, American comparative advantage declined. Over the last two decades, both Russia and China increased efforts to expand regional influence through reacquisition of lost territory and, in the case of China, create new territory. Between 2013 and 2016, China expanded the Spratly Islands by over 3,200 acres.[1] Since then, China extended its runways to 8,800 feet and built hangers for up to 24 fighter aircraft using a fleet of massive sand dredgers.[2] China possesses the world's largest fleet of sand dredging vessels, and last year, Taiwan denied over 4,000 sand dredging and sand transportation vessels from its territorial waters.[3] The American focus on the Global War on Terror left this growth unchecked and largely below the Department of Defense (DoD) top priorities. The 2017 *National Security Strategy* acknowledges the return of great-power competition and the importance of maintaining a competitive advantage against adversaries and competitors.[4] This includes DoD modernization efforts across all domains in order to leverage new and existing technologies to counter Chinese and Russian actions across the globe. However, the US is not alone in its quest for modernization; Russia and China increased defense spending, modernized weapon systems, and refined their

[1] Asia Maritime Transparency Initiative, "China Tracker," accessed February 8, 2021, https://amti.csis.org/island-tracker/china/.

[2] Ronald O'Rourke, R42784, *U.S.-China Strategic Competition in South and East China Seas: Background and Issues for Congress* (Washington, DC: Library of Congress, December 29, 2020), 71.

[3] Yimou Lee, "China's Latest Weapon against Taiwan: The Sand Dredger," *Reuters*, February 5, 2021, accessed February 8, 2021, https://www.reuters.com/article/us-taiwan-china-security-idUSKBN2A51EJ.

[4] Donald J. Trump, *2017 National Security Strategy* (Washington, DC: Office of the President of the United States, 2017), 27, accessed December 12, 2020, https://trumpwhitehouse.archives.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905-2.pdf.

doctrine to counter US strengths and exploit weaknesses.[5] While China and Russia have made significant strides in improving their militaries, they are still miniscule in comparison to US capabilities. The DoD budget allocation in 2019 was three times larger than China's and ten times larger than Russia's allocated funds.[6] This gap in capacity and capability is a driving factor in developing new capabilities that the United States is currently unprepared to respond to.

Since President of the People's Republic of China, Xi Jinping's 2013 election, China hardened rhetoric against Taiwan and increased disruptive tactics in the East China Sea (ECS) and South China Sea (SCS). The 2020 Chinese annual work report removed references to "peaceful reunification" from its stance on Taiwan, which existed in the previous six editions of the report.[7] Chinese aircraft incursions across the Taiwanese air defense identification zone in 2020 more than doubled from the previous year's total, and in 2010 China stated its intent to assign a further air defense identification zone, potentially covering the recently developed Subi Reef in the Spratly Islands.[8] Over the last twenty years, China has increased defense spending by seven to eight percent and currently allocates six percent of its annual budget to defense spending, compared to the US three percent.[9]

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[5] Seiman T. Wezemen, "Russia's Military Spending," Stockholm International Peace Research Institute, April 27, 2020, accessed November 11, 2020, https://www.sipri.org/commentary/topical-backgrounder/2020/russias-military-spending-frequently-asked-questions.

[6] Bonnie Glaser, Mathew Funaiole, and Brian Hart, "Breaking Down China's 2020 Defense Budget," Center for Strategic and International Studies, May 22, 2020, accessed September 30, 2020, https://www.csis.org/analysis/breaking-down-chinas-2020-defense-budget.

[7] Kristin Huang, "Chinese Government Drops References to 'Peaceful' Taiwan Reunification," *South China Morning Post*, May 22, 2020, accessed September 30, 2020, https://www.scmp.com /news/china/politics/article/3085700/chinese-government-drops-references-peaceful-reunification.

[8] Al Jazeera, "Taiwan Says 46 Incidents Involving Chinese Planes in Last 9 Days," *Al Jazeera*, September 25, 2020, accessed December 5, 2020, https://www.aljazeera.com/news/2020/9/25/taiwan-says-china-has-made-46-air-incursions-in-past-nine-days.

[9] Glaser, Funaiole, and Hart, "Breaking Down China's 2020 Defense Budget."

The North Atlantic Treaty Organization's (NATO) original mandate when founded in 1949 was to deter aggression from the Soviet Union and secure peace in Europe.[10] Since that time, the Soviet Union and, later Russia, perceived NATO as an existential threat to its own state survival. Russia views the continuously growing alliance as a precursor to a potential invasion or overthrow.[11] In the past 30 years, NATO expansion started in 1999 with the Czech Republic, Hungary, and Poland, followed by Bulgaria, Estonia, Latvia, Lithuania, Romania, Slovakia, and Slovenia in 2004. This expansion continued in 2008 with the NATO Bucharest summit endorsement of Georgia and Ukraine's aspirations to join NATO. Russia's response to the increasing threat led to the invasion of Georgia in 2008 and the invasion and annexation of the Crimea in 2014.[12] The potential accession of Ukraine and Georgia to NATO would place NATO members along the length of Russia's western border, with the exception of Belarus, from the Caspian Sea to the Baltic Sea.

The rise of Chinese and Russian aggression led the US government to re-assess the utility of low-yield tactical nuclear weapons as a viable method of deterrence against continued expansion and aggression from both China and Russia. In 2017, President Donald Trump directed the DoD to conduct a *Nuclear Posture Review* "to ensure a safe, secure, and effective nuclear deterrent that protects the homeland, assures allies and above all, deters adversaries."[13] However, American planning, training, and development of low yield battlefield nuclear weapons

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[10] North Atlantic Treaty Organization (NATO), "Why Was NATO Founded," We are NATO, accessed February 8, 2021, https://www.nato.int/wearenato/index.html.

[11] Reuters, "Putin Criticizes NATO Expansion as Alliance Holds London Summit," *Reuters*, December 3, 2019, accessed May 23, 2021, https://www.reuters.com/article/us-nato-summit-putin/putin-criticizes-nato-expansion-as-alliance-holds-london-summit-idUSKBN1Y71K5.

[12] John J. Mearsheimer, "The Liberal Delusions that Provoked Putin," *Foreign Affairs*, September 2014, accessed May 23, 2021, https://www.foreignaffairs.com/articles/russia-fsu/2014-08-18/why-ukraine-crisis-west-s-fault.

[13] Office of the Secretary of Defense, *Nuclear Posture Review* (Washington, DC: Government Publishing Office, 2018), 1, accessed August 26, 2020, https://fas.org/issues/nuclear-weapons/nuclear-posture-review/.

(LYBNW) has stagnated since the 1987 signing of the Intermediate Range Nuclear Forces (INF) Treaty, in which all weapons with a range between 500 and 5,500 kilometers were removed from forward locations and dismantled.[14] For the purposes of this monograph, LYBNW shall be defined as a nuclear weapon with a yield of less than 15 kilotons and is used, or intended to be used, to create tactical or operational effects against military targets within a specified theater. The inventory of LYBNW was further reduced with the signing of the 1991 Presidential Nuclear Initiatives between President George H.W. Bush and Mikhail Gorbachev and the removal of all nuclear artillery shells and short-range ballistic weapons.[15] While the United States removed all nuclear weapons from forward locations and dismantled them, Soviet efforts stalled in the fall of 1991 with the collapse of the USSR. All weapons were reportedly removed from forward deployed locations, but only one-half were destroyed. Since then, the US Army has not published or updated nuclear doctrine since the 1996 publication of Field Manual (FM) 100-30, *Nuclear Operations.* The Air Force and Navy serve as lead proponents for nuclear doctrine as all three legs of the strategic nuclear triad reside within those services.

In 2014 the US declared Russia to be in violation of the INF treaty citing multiple sources and data identifying the SSC-8 to be in violation of the treaty.[16] Russia's continued denial of the existence of the missile led to the initiation of the 2018 *Nuclear Posture Review*, and also the US withdrawal from the INF treaty in 2019.[17] With the potential return of LYBNWs to the European

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[14] Bureau of Arms Control, Verification and Compliance, "Adherence to and Compliance with Arms Control, Non-proliferation, and Disarmament Agreements and Commitments," US Department of State, July 2014, accessed May 23, 2021, https://2009-2017.state.gov/documents/organization/230108.pdf. 12.

[15] Eli Corin, "Presidential Nuclear Initiatives: An Alternative Paradigm for Arms Control," Nuclear Threat Initiative, March 1, 2004, accessed January 2, 2021, https://www.nti.org/analysis /articles/presidential-nuclear-initiatives/.

[16] Bureau of Arms Control, Verification and Compliance, "Adherence to and Compliance with Arms Control, Non-proliferation, and Disarmarment Agreements and Commitments," 12.

[17] Bureau of Arms Control, Verification and Compliance, "U.S. Response to the Russian Federation's INF Treaty Violation: Integrated Strategy," US Department of State, December 8, 2017, accessed December 12, 2020, https://www.state.gov/u-s-response-to-the-russian-federations-inf-treaty-violation-integrated-strategy/.

theater, President Trump's 2018 *Nuclear Posture Review* intended to develop contingency responses to the spectrum of nuclear possibilities across the globe. This monograph takes the 2018 *Nuclear Posture Review* one step further and identifies definitive response options to provide credible deterrence for the US and coalition partners in the short term.

Problem

While China and Russia continue to increase efforts to expand authority and influence in their respective regions by increasing defense spending and the development of new weapon technologies along with territorial infringement of neighboring sovereign nations. Smaller, less powerful US allies in the region are incapable of denying Chinese and Russian expansion and are reliant on American extended deterrence. Current forward deployed conventional forces are insufficient to deny a Russian or Chinese invasion and increases in air defense capabilities increase risk to an American/coalition counter-attack.

Research Limitations

This research is limited in scope to include unclassified, open-source, material that is readily available to the general public. Further limitations include the restrictive nature of the two primary competitors to the United States: China and Russia. Research and doctrine pertaining to China and Russia is limited to what has been released online or second-hand analysis from US institutions or think tanks. This research is limited to analysis on existing technology for all parties involved. Theoretical concepts are considered to be beyond the scope and scale of this monograph and will not be discussed. However, potential research topics to consider in the future must include space-based weaponry such as lasers or kinetic non-terrestrial weapons, fully autonomous mechanized in-direct fire weapon systems, and quantum entanglement. This research also does not include analysis on a potential chemical, biological, radiological, nuclear, high-yield explosive response to use of LYBNW.

Research Question

If current capabilities are ill prepared to adequately deter Russian and Chinese aggression, what capabilities does the United States require to prevent the use of low-yield battlefield nuclear weapons? Why are the current capabilities no longer an effective deterrent and can they be modified or improved to maintain deterrence? Where should these capabilities be located to best exploit their deterrent nature?

Methodology

The methodology used throughout this monograph is based on the Federal Emergency Management Agency's Threat and Hazard Identification and Risk Assessment (THIRA) and Stakeholder Preparedness Review (SPR). THIRA/SPR is designed to identify and assess potential threats and align capabilities to defeat those risks while identifying gaps to be addressed, how to prioritize them, and what capabilities for mitigation have changed.[18] THIRA uses a three-step process to identify, assess, and mitigate risks: What threats and hazards can affect us? If they occurred, what impacts would those threats and hazards have on us? Based on those impacts, what capabilities should we have? In order to identify potential hazards, scenarios for use of a LYBNW were developed. The scenarios envisioned for both Russia and China were developed utilizing Peter Schwartz' concepts in *Art of the Long View,* to include identification of driving forces, predetermined elements, and critical uncertainties.[19] To accurately measure potential threats from Russia and China, the following variables will be utilized: time, range, severity, and risk. For the purposes of this monograph, time will be measured in amount of time available to effectively deter an adversary from achieving their desired end state from initial notification or

[18] Department of Homeland Security, "National Risk and Capability Assessment," Federal Emergency Management Agency, last updated September 10, 2020, accessed January 13, 2021, https://www.fema.gov/emergency-managers/risk-management/risk-capability-assessment.

[19] Peter Schwartz, *The Art of the Long View* (New York: Crown, 1996), 101.

perceived alert. Range will be measured based on current estimates for potential anti-access area denial (A2AD) systems and prevention of US and coalition air dominance or potential engagement of coalition forces.

Hypothesis

A capability gap currently exists in the ability to provide flexible deterrent options to commanders in the field to defeat or deny large scale enemy forces from offensive operations in a timely manner. Russia and China both possess sufficient air defense artillery, electro-magnetic spectrum (EMS) and fires capabilities to seize initial objectives and begin consolidation of gains prior to US and coalition mobilization to counterattack. The United States must increase and diversify its deterrent options to increase the opportunity costs of any future aggression that may include LYBNWs.

Deterrence Theory and Current Posture

US deterrence policy as stated in the *National Security Strategy* is essential to prevent the use of nuclear weapons or large-scale conventional aggression, while providing security and assurances to our global partners to prevent the spread of nuclear weapons.[20] The *National Security Strategy* also proclaims that American nuclear capability has degraded over time while our adversaries continue to increase their own. The unclassified *National Defense Strategy* summary does not specifically address the action of deterrence, but does state the modernization and development of increased capabilities in the nuclear force as one of the DoD's top priorities. Joint Publication (JP) 3-72, *Joint Nuclear Operations* combined with the *Joint Operating Concept for Deterrence Operations* provides the most relevant definition of deterrence as deterring attacks by affecting an adversary's decision calculus through three primary variables,

[20] Trump, *2017 National Security Strategy,* 30.

the actor's perception of the benefits of a course of action, the actor's perception of the costs of a course of action, and perception of the consequences of restraint or inaction.[21] The potential use of offensive weapon capabilities in response to LYBNW increases the response cost and it is that cost the US aims to increase.

This definition of deterrence will be used to assess viable alternatives to Chinese and Russian nuclear threats. However, in the discussion of deterrence, one cannot solely rely on the US definition of deterrence. Nuances and varieties in culture also provide different definitions of deterrence and how countries attempt to achieve deterrence. While nations see ICBMs as the primary weapon of strategic nuclear deterrence, there is a disparity in how countries view tactical nuclear weapons. The Chinese view deterrence as a western concept that is inherently offensive in nature. The idea of "deter" in Confucianism is a threat; the "threat" of nuclear deterrence runs counter to the Chinese stated "no first use" policy. China uses a "whole of government" approach and utilizes all elements of national power to provide an all-encompassing defense or self-protection policy.[22] This seemingly non-aggressive stance appears docile; however, it is in direct contradiction to Mao ZeDong's, "only a complete fool or a madman would cherish passive defense as a talisman."[23]

Russians see deterrence as a living, dynamic concept to be adjusted based on the current situation in order to hold back a moving force. That moving force is primarily considered to be NATO and perceived aggression from western nations. Russia uses all instruments of power in

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[21] US Department of Defense, *Global Deterrence Joint Operating Concept* (Washington, DC: Government Printing Office, 2006), 24, accessed February 15, 2021, https://www.jcs.mil/Portals/36/Documents/Doctrine/concepts/joc_deterrence.pdf?ver=2017-12-28-162015-337.

[22] Defense Intelligence Agency, *China Military Power: Modernizing a Force to Fight and Win* (Washington, DC: Defense Intelligence Agency, 2019), 85, accessed January 7, 2021, https://www.dia.mil/Portals/27/Documents/News/Military%20Power%20Publications/China_Military_Power_FINAL_5MB_20190103.pdf.

[23] Mao Zedong, *Selected Military Writings of Mao Tse-Tung* (Beijing: Foreign Languages Press, 1967), 105.

the diplomacy, information, military and economics construct to conduct deterrence. Examples of Russia's intent to utilize LYBNW can be found in the annual Zapad training exercises. The concept of the operation is defense of Belarusian and Russian territory in response to a NATO invasion. Beginning in 1999, the exercise has culminated in the use of non-strategic nuclear cruise missiles targeting a NATO city. Russian Foreign Affairs Minister Mikhail Ulyanov stated in March of 2015 that Russia had the right to place nuclear weapons in Crimea to prevent any attempts to re-take the Crimea after its annexation in 2014.[24] The continued eastern expansion of NATO is a threat to be deterred. In the 2018 *Nuclear Posture Review*, the DoD states "There is no "one size fits all" for deterrence. Consequently, the United States will apply a tailored and flexible approach to effectively deter across a spectrum of adversaries."[25] This implies that deterrence to Russia will not mirror policy and actions towards deterrence to China. While this provides flexibility, it also creates ambiguity and uncertainty to competitors in a complex system; leaving competitors to probe and test state responses to identify where so called "red lines" exist for each of them. The lack of clearly defined limits to prevent nuclear use have left our adversaries to guess and prod at the limits of their foreign interactions with the US and its allies. While the United States maintains the right to utilize a nuclear first strike, current policy states America will not use nuclear weapons against a non-nuclear country that is a signatory to the Nuclear Non-Proliferation Treaty.[26] Russian policy states the potential to utilize tactical nuclear weapons to de-escalate conflict if necessary.[27] China is the only state to declare a direct "no first use" policy.[28] See table 1 for the current postures for the three states.

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[24] Defense24.com, "Russian Nuclear Warheads Deployed In Crimea?" Defense24.com, March 12 2015, accessed January 1, 2021, https://www.defence24.com/russian-nuclear-warheads-deployed-in-crimea.

[25] Office of the Secretary of Defense, *Nuclear Posture Review*, 7.

[26] Ibid., 21.

[27] Ibid., 30.

[28] Defense Intelligence Agency, *China Military Power*, 36.

Concept	US	China	Russia
Deterrence	Flexible Deterrence	Limited or Minimal Deterrence	Escalate to De-escalate
First Use Policy	Right to first use	Stated "No First Use"	Reserves right to defend national sovereignty
Weapons Posture	Alert daily	Launch on Warning	Alert daily

Table 1. Current Deterrence Policy by Nation-State. Created by author.

Why does deterrence succeed? Daniel Kahneman states, humans are more loss averse the higher the stakes. Not solely because of game theory and rational actors, but because of rationality coupled with perceptions and loss aversion.[29] The very risk of escalation towards full on nuclear war or reciprocal nuclear response, deters states from attempting an initial use of nuclear weapons. This monograph acknowledges the changing operational environment due to improvements in technology, economics, and shifting political power dynamic. These changes require a counter action from the United States to retain the initiative and maintain a viable level of deterrence. Prior to developing deterrent options, the threat must be understood.

Evaluating the Threat

While both China and Russia are unique in their capabilities and geography, they maintain similarities in weapon capabilities. The methods to defeat those capabilities vary greatly due to the maritime and land domains and proximity to foreign nations in their respective theaters. Both nations create dilemmas based on distance, but for opposite reasons. The closer distance in Europe requires faster response and smaller ranges due to proximity, while Asia requires greater range due to the breadth of the Pacific Ocean. Identifying potential options for Russia LYBNW use is much easier than the Chinese, based purely on previously published doctrine. Russian doctrine from 1984 utilizes LYBNW to mass on defensive positions and enable armored formations freedom of maneuver to rapidly seize strategic locations in the deep area.

[29] Daniel Kahneman, *Thinking Fast and Slow* (New York: Farrar, Strous, and Giroux, 2011), 269.

Soviet doctrine states low yield air burst munitions to be preferred, still allowing freedom of maneuver for Russian tank formations to conduct penetrations into opposition support areas.[30] Russian use of LYBNW would neutralize the multinational NATO defense brigades in the Baltic states and allow seizure of key cities within hours, long before US and coalition forces could mount an effective counter-attack. China simply maintains its no first use policy, granted with a level of ambiguity on what that means. An official People's Liberation Army Air Force video released in 2020, depicts a first strike attack on Anderson Air Force Base in Guam. Chinese use of LYBNW could decimate global trade or destroy US military installations and naval vessels up to 1,000 km away from their launch point.[31]

Both nations invested heavily in the cyber and information space in attempts to achieve strategic and operational goals below the threshold of large-scale ground conflict. In 2015 China established its Strategic Support Force to consolidate cyber, space, and electronic warfare capabilities under a single command.[32] Russia started its integration in 2008, embedding organic electronic warfare units down to the maneuver brigade level. Both countries are ahead of the US on EMS integration and the US is fighting to catch up.

Russia

Russian fears of further NATO envelopment led to a delay in reduction of LYBNWs that came from the 1991 Presidential Nuclear Initiatives between Presidents George H. W. Bush and Mikhail Gorbachev in which all nuclear missiles with a range of less than 300 miles would be removed from deployed locations and dismantled. This fear is driven by the proximity of nuclear powers surrounding Russia; England, France, China, and North Korea. While Russia has clarified

[30] US Department of the Army, Field Manual (FM) 100-2-2, *The Soviet Army: Specialized Warfare and Rear Area Support* (Washington, DC: Government Printing Office, 1984), 7-4.

[31] Missile Defense Project, "Missiles of China," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, accessed September 17, 2020, https://missilethreat.csis.org /country/china/.

[32] Defense Intelligence Agency, *China Military Power*, 97.

their first use policy as a capability to defend Russian forces or sovereignty, such delineations are vague and can be misunderstood to include further envelopment of the Russian homeland or in support of Russian invasion forces. Russia and China do not see themselves as allies, but more so as strategic partners. The 2001 Treaty of Good Neighborliness and Friendly Cooperation signifies a friendly relationship that allows both nations to secure domestic control through non-democratic means without resistance from the other.[33] Russia's immense natural resources and China's manufacturing capacity form an excellent partnership, and the lack of concern over maintaining regime control allows Russia to focus on the growing threat of NATO from the west.[34] Surrounded on the west by NATO and east by China, Russia has increased its exploration and utilization of the arctic regions. Russian special operations force recently conducted airborne operations in the arctic to test special operations forces and naval capabilities. As Russia attempts to regain prestige lost in the Cold War and prevent encirclement, the possibilities for military action secured by the threat or use of LYBNW increases.

Russian combat power is suffering from the same ailments as US forces but on a larger scale. An aging fleet of weapon systems and technology in the midst of a modernization effort; over the last decade Russia spent over 40 percent of its defense budget on procurement. Russia is in the process of upgrading its main battle tank to the T-14 Armata, although operational forces are yet to receive any. Russian tank brigades primarily consist of 41 T-72 tanks per brigade. The Russian strategic rocket force is also attempting to upgrade their aging missile inventory, with the modernization of the ICBM inventory completed by the end of 2022. Russian military spending increased annually each year since 2010, with an overall 30 percent increase in spending over the

[33] Michael Chase, Evan S. Medeiros, J. Stapleton Roy, Eugene B. Rumer, Robert Sutter, and Richard Weitz, "Russia-China Relations: Assessing Common Ground and Strategic Fault Lines" (Special Report, National Bureau of Asian Research, July 2017), 14, accessed February 13, 2021, https://carnegieendowment.org/files/SR66_Russia-ChinaRelations_July2017.pdf.

[34] Ibid., 29.

past decade.[35] Russian military spending remained stable over the last 3 years, averaging 3.9 percent of its gross domestic products.[36] Improvements in technology and increased costs for equipment modernization shifted Russian strategy to focus more on shaping and disrupting adversaries in the cyber and information domains. Russian advancements in electronic warfare and integrated EMS capability at the brigade level enable the Russians to field jamming capability at up to a 50km range.[37] This includes the GPS jamming that 155mm Excalibur and missile rounds are reliant on for mensurated grids. The 50km jamming range of the Russian R-330b and R-378b in the electronic warfare companies exceed the firing range of the 155mm canon. Russian use of information operations in cyberspace and media have enabled non-kinetic shaping operations that support a non-aggressive response. Russia utilizes the concept of reflexive control to coerce opponents into decisions preferable to Russian strategic aims while maintaining plausible deniability.[38] This drives the Russian narrative of a well-meaning nation state oppressed by western aggressors. The Russian standing army currently sits at 325,000 troops; however, their state of readiness and capability are also limited due to funding constraints, the Russian annual gross domestic product is less than the state of Texas.[39] Russian cognizance of limited ground forces and modern weapon systems conveys a reluctance to engage in large-scale combat operations without a clearly defined end state or the desire for total war.

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[35] Defense Intelligence Agency, *Russia Military Power: Building a Military to Support Great Power Aspirations* (Washington, DC: Defense Intelligence Agency, 2017), 19, accessed October 7, 2020, https://www.dia.mil/Portals/27/Documents/News/Military%20Power%20Publications/Russia%20Military%20Power%20Report%202017.pdf.

[36] Wezemen, "Russia's Military Spending."

[37] Roger N. McDermott, *Russia's Electronic Warfare Capabilities to 2025* (Estonia: International Center for Defense and Security, September 2017), 5, accessed September 16, 2020, https://icds.ee/wp-content/uploads/2018/ICDS_Report_Russias_Electronic_Warfare_to_2025.pdf.

[38] Keir Giles, James Sherr, and Anthony Seaboyer, *Russian Reflexive Control* (Kingston, On, Canada: Canadian Defence Research and Development, October 2018), 5, accessed Nobember 30, 2020, https://www.researchgate.net/profile/Keir_Giles/publication/328562833_Russian_Reflexive_Control/links/5bd4b1714585150b2b8b2a21/Russian-Reflexive-Control.pdf.

[39] Defense Intelligence Agency, *Russia Military Power*, 50

Such a concept of limited war is currently imagined as three scenarios, all occurring in the west. The three likely Russian courses of action that involve kinetic action are all designed with the stated goal of disruption and dissolution of NATO. While all three scenarios have the same end state, the dissolution of NATO. They have varying degrees of probability. However, without planning for them, the possibility of a successful response is decreased. The scenarios envisioned were developed utilizing Schwartz' concepts from *Art of the Long View* to include identification of driving forces, predetermined elements, and critical uncertainties.[40] The three scenarios are: closing the Suwalki Gap in an attempt to reunite Kaliningrad, expanding the buffer between Russia and Poland, and a potential replay of the Crimean scenario in an attempt to annex portions of the Baltic States where the majority of the population is of Russian ethnic descent.

Either operation would have to be rapid and complete before NATO forces could mobilize and mass forces. If Russian forces engaged in seizing territory under the auspices of ethnic protection or stability operations in Eastern Europe, it would inevitably be against a NATO nation, and set the stage for an invocation of Article 5 of the NATO treaty and force intervention. The massing of NATO forces could potentially be provocation to utilize Russia's "escalate to de-escalate" policy and utilize LYBNW to prevent and destroy coalition forces. The last potential scenario involves a seizure of territory, either in the high north, Scandinavian countries or in the near eastern former Soviet states that have a high Russian ethnic population similar to Crimea. Russia has shown an increased propensity to utilize non-kinetic efforts for shaping operations to disrupt NATO such as cyber, EMS jamming, and information operation to affect a wide range of operations from banking to misinformation. CyberBerkut, the Russian hacking group is credited with cyber shaping operations prior to the Ukrainian invasion.[41] The ability to utilize non-lethal

[40] It is these critical uncertainties that drive the need for multiple levels of deterrence. Our inability to identify just how far nation states are willing to escalate that requires flexible options. Schwartz, *The Art of the Long View*, 101.

[41] Defense Intelligence Agency, *Russia Military Power*, 39.

effects can disrupt command and control and delay coalition response to Russian aggression. Beginning in 2008, electronic warfare capabilities have been embedded organically down to the brigade level and are used to both mask detection of artillery and detect enemy artillery.[42]

As the Baltic states are already members of NATO, the probability of Russia attempting to seize one of the Baltic states is assessed as low with the understanding that NATO would invoke Article 5 of the NATO charter. However, President Putin has stated "I would like to make it clear to all: our country will continue to actively defend the rights of Russians, our compatriots abroad, using the entire range of available means–from political and economic to operations under international humanitarian law and the right of self-defense."[43] In Estonia, 38.5 percent of the population are ethnic Russians, while in Latvia 25 percent of the population is ethnic Russian and one-half the population of the capital Riga, identify as ethnic Russian.[44] Much like in Ukraine, the potential for a humanitarian crisis of "stateless" peoples exists due to strict immigration laws in Latvia and Estonia that continue to segregate the Soviet era population among its borders. These laws were put in place shortly after the fall of the Soviet Union in response to years of Soviet oppression throughout the Baltics.[45] Lithuania has a much smaller stateless population due to a liberal immigration policy of acceptance and integration. Should this manufactured humanitarian crisis take place, Russian intervention and occupation of a large population center could prevent NATO response to target Russian forces within the city. Knowing the value western civilizations place on preservation of human life, the most plausible

[42] McDermott, *Russia's Electronic Warfare Capabilities to 2025*, 6.

[43] Vladimir Putin, "Conference of Russian Ambassadors and Permanent Representatives," July 1, 2014, accessed January 7, 2021, http://en.kremlin.ru/events/president/news/46131.

[44] Central Intelligence Agency, "Explore All Countries-Estonia," The World Factbook, accessed January 7, 2021, https://www.cia.gov/the-world-factbook/countries/estonia/#people-and-society.

[45] Marina Best, "The Ethnic Russian Minority: A Problematic Issue in the Baltic States," *Verges: Germanic and Slavic Studies in Review* 2, no. 1 (2013): 33-41, accessed February 13, 2021, https://journals.uvic.ca/index.php/verges/article/view/11634.

option to prevent massive retaliation from NATO would be to seize a large population center as quickly as possible before Russian A2AD capabilities are defeated. Vilnius is the capital of Lithuania and less than 30km from the Russian border while Riga is the farthest capital from the border, roughly 240km from the Russian border. A 2016 RAND wargaming analysis concluded, the longest it would take for Russian forces to reach Riga is 60 hours.[46] Russian forces in Kaliningrad provide opportunities to range the vast majority of the Baltic Sea with not only anti-air capability but also electronic warfare capabilities and nuclear weapons. The Russian security umbrella can deny deployment of naval forces in the region and also destroy air forces in the event of attempted seizure of Baltic states or closing of the Suwalki Gap. Russia has also deployed the S-400 anti-air missile system to multiple locations along its border, creating an A2AD ring from the Baltic to the Caspian Sea. Russia has also deployed the S-400 in Tartus, Syria, which can range Incirlik airbase, a known location of US LYBNW storage for B61 gravity bombs. Recent history of Russian actions in Georgia and Crimea has shown Russian forces will utilize information and cyber warfare to disrupt adversaries and create opportunities for follow on maneuver forces to seize objectives. Coupled with previously published Russian doctrine on the use of LYBNW, Russia may use LYBNWs to mass on defensive positions and enable armored formations freedom of maneuver to rapidly seize strategic locations in the deep area. Soviet doctrine states low yield airburst munitions are preferred, still allowing freedom of maneuver for Russian tank formations.[47] Such actions would necessitate a rapid response capable of disrupting Russian tanks from reaching cities prior to their arrival. Potential actions would be in an attempt to dissolve NATO. Putin sees NATO as a fragile system and that the only event that occurred to stress the system was the US call for article 5 after 9/11. However, the perceived risk to force

[46] David A. Shlapak and Michael Johnson, *Reinforcing Deterrence on NATO's Eastern Flank: Wargaming the Defense of the Baltics* (Santa Monica, CA: RAND Corporation, 2016), accessed December 30, 2020, https://www.rand.org/pubs/research_reports/RR1253.html.

[47] US Army, FM 100-2-2, *The Soviet Army: Specialized Warfare and Rear Area Support,* 7-4.

over a potential risk to defeat against a Russian force that has hinted at a use of LYBNW to defeat a counter-attacking coalition could fracture NATO. While the potential chance of a Russian invasion of a Baltic NATO member or Non-NATO Scandinavian partner is very low, Schwartz advises not to ignore the possibility, or the US will have no solution should it happen.[48] The development of viable deterrent options to deter or defeat the use of LYBNW creates an opportunity space to validate Taleb's concept of antifragility of the NATO alliance should Russia invade.[49]

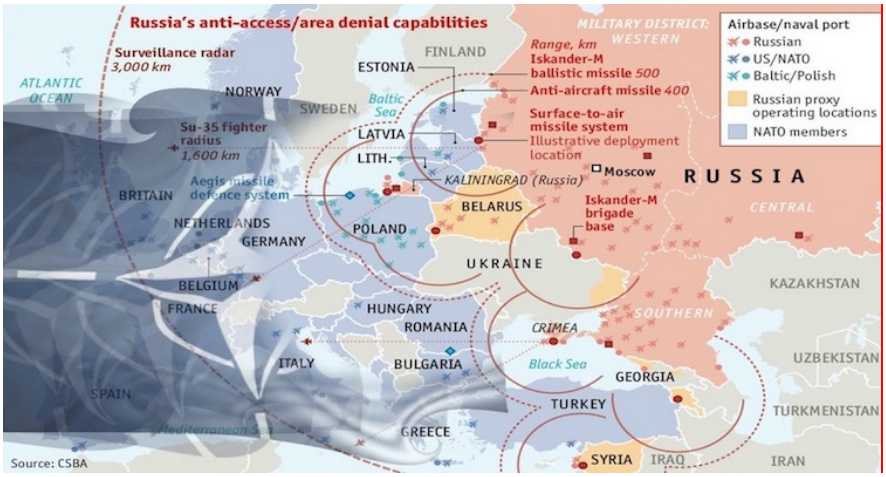

Figure 1. Current Russia A2AD capabilities. Aziz Erdogan, "Russian A2AD Strategy and Implications for NATO, Beyond the Horizon," December 6, 2018, accessed December 28, 2020, https://behorizon.org/russian-a2ad-strategy-and-its-implications-for-nato/.

China

While, China continues to state that the US is the "principal instigator" of global instability, its attempts to seize or expand islands in the ECS and SCS are in direct violation of

[48] Schwartz calls these "memories of the future" imaginative scenarios created in order to prepare you for a possible future. Schwartz, *The Art of the Long View,* 33.

[49] Taleb states that antifragile systems get stronger with shock to it. An overwhelming response from NATO would reaffirm the coalitions support to Article 5 and reduce fear from other partner states. Nassim Nicholas Taleb, *Antifragile* (New York: Random House, 2012), 3.

the United Nations Convention on the Law of the Seas.[50] Illegal island building combined with rhetoric on the reclamation of Taiwan creates instability in the region. China has always maintained that Taiwan is nothing but a breakaway province that will one day return to communist rule. The foundation of deterrence against Chinese territorial expansion continues to be grounded in defense and support agreements with other Asian nations. America maintains bi-lateral mutual defense treaties with the Philippines and Japan along with multi-lateral agreements with Thailand, Australia, and New Zealand.[51] The US also provides continued defensive support through economic agreements and foreign arms sales to Taiwan as approved in the 1979 Taiwan Relations Act.[52] The US and its allies continue to conduct freedom of navigation patrols throughout the SCS and ECS to ensure the safety of global commerce and allied territorial integrity. China possesses land based anti-ship and anti-air capabilities that can deny American air and naval access out to the second island chain. Any attempt to retake Taiwan or deny freedom of maneuver in the SCS and ECS would require long range fires to disrupt an invasion force of Taiwan. Since China never signed the INF treaty, China established a large stockpile of surface launched missiles and currently possesses between 750 to 1,500 short range ballistic missiles (SRBM) capable of attacking surface vessels out to 1,000km away.[53] China also maintains a smaller contingent of long-range missiles capable of threatening Guam. The smaller number, and longer flight times, make them much easier to defend against with THAAD and Patriot air defense batteries. The potential for China to employ LYBNW is lower than Russia's due to current strategic aims and geographic make-up of the region, however, the threat does exist. China maintains that Taiwan is still part of greater China and a nuclear attack on Taiwan

[50] Permanent Court of Arbitration, "UNCLOS South China Sea Arbitration Award," accessed February 12, 2021, https://pcacases.com/web/sendAttach/2086.

[51] Missile Defense Project, "Missiles of China."

[52] Taiwan Relations Act, Public Law 96-8, 96th Cong. (April 10, 1979).

[53] Missile Defense Project, "Missiles of China."

would constitute a nuclear attack on its own people, which has the potential to cause increased recognition of Taiwan as a sovereign state by the United Nations and have a gross negative effect on Chinese goals. However, foreign invasion or troop presence in Taiwan may be construed as an invasion of China proper. China has long maintained that an attack on Chinese territory would also be justification to launch a full-scale nuclear strike with strategic nuclear weapons which is beyond the scope of this monograph. With 40 percent of Chinese exports and global trade moving through the ECS and SCS, a nuclear attack as an area denial weapon in the region would be just as detrimental, if not more, to China than it would be to the rest of the world economy.[54] However, China's policy on Taiwan would consider outside troop enforcement of Taiwan to be provocation for war and justify a massive military response. Should a Chinese invasion or assault on Taiwan be successful, any counter-attack or support to Taiwan may initiate a nuclear response to disrupt amphibious forces.

A direct invasion of the island of Taiwan is not the only option available to China; as China seeks to expand its sovereign territory, the potential to seize Taiping Island looms large. Either a seizure of a Taiwanese controlled island or expansion and occupation of coral reefs in the Spratly Islands creates a military airfield centrally located in the SCS. China could lay claim to major shipping lanes vital to the Philippines, Vietnam, and Indonesia. An indirect attack away from the main island of Taiwan provides for reduced risk to China through coalition response and a large payoff through greater control on global shipping.

Recent US arms sales to Taiwan of anti-ship missiles, shore defense batteries and F-16 fighters have increased the security posture of Taiwan towards a potential Chinese attempt at reclamation. Continued foreign military sales and reinforced infrastructure have the potential to accelerate a Chinese attempt at re-unification before risk to the People's Liberation Army exceeds

[54] Center for Strategic and International Studies, "How Much Trade Transits the South China Sea?," China Power Project, Center for Strategic and International Studies, August 2, 2017, accessed January 2, 2021, http://chinapower.csis.org/much-trade-transits-south-china-sea/.

benefit to the nation. Should escalation to a full-on conflict occur, China maintains a complex A2AD perimeter consisting of hundreds of short and medium range ballistic and anti-ship missiles with nuclear capability (see figure 2). China sees Taiwan as a breakaway province and would attempt to treat re-unification as an internal matter, the threat of its A2AD defenses would be used to prevent external influence or support to Taiwan. The use of nuclear weapons would then be justified internally as a protective measure for Chinese sovereign soil.

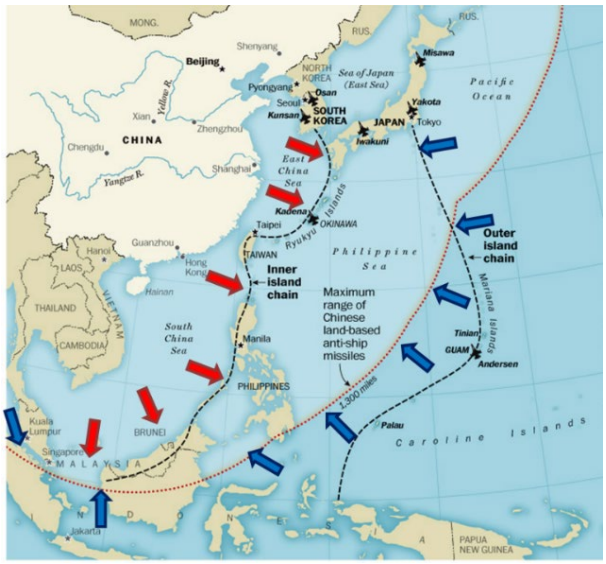

Figure 2. Chinese A2AD Missile Ranges. Center for International Maritime Strategy, "Strategic Architectures," February 12, 2014, accessed December 28, 2020, http://cimsec.org/strategic-architectures/9941.

A potential Chinese nuclear response could utilize waves of nuclear missiles in an attempt to defeat air defense systems and destroy potential US counter-attack forces. This enhanced area denial concept has the potential to destroy all US naval forces in the SCS and ECS and force a retreat out to the second island chain. The Chinese DF-12 SRBM has a range up to 1,000km and is road mobile with nuclear capable warheads.[55] China has invested heavily in mobile launch capabilities using transport erector launchers combined with solid fuel propulsion

[55] Missile Defense Project, "DF-12 (M20 / CSS-X-15)," *Missile Threat,* Center for Strategic and International Studies, Last updated June 23, 2020, accessed September 19, 2020, https://missilethreat.csis.org/missile/df-12/.

systems that reduce launch preparation time to less than 15 minutes for some of its shorter range missiles.[56] While the distances involved with strategy in the Pacific are immense and hinder American options in the close fight, the inverse can be applied to China in the event a blue water engagement happens beyond the first island chain. China's lack of blue water naval capacity indicates greater emphasis on operations in the littorals. China also completed a complex tunnel system, the "Great Wall Project," that created a system of underground tunnels allowing storage of nuclear weapons underground for protection against a pre-emptive strike prior to movement to a launch site.[57] The response time to identify and target a potential launch is reliant on rapid sensor to shooter transition and approval from appropriate authorities.

Current Capabilities

Current American deterrence is reliant on the threat of retaliation. The current American and coalition forward deployed troop numbers and equipment are not adequate to engage and destroy an attacking force of Russian or Chinese. A 2016 RAND wargaming analysis concluded, the longest it would take for Russian forces to reach Riga is 60 hours.[58] The US currently maintains zero permanently stationed maneuver forces in Germany and Poland. With overall NATO support consisting of four multinational battle groups and 4,700 total troops. American rotational units provide an additional 60 Abrams tanks. However, a 2017 RAND report estimates an almost six to one ratio of Russian to NATO main battle tanks and over two to one troop ratio of forces in the Baltic region.[59] The current force posture in Eastern Europe is deterrent only in

[56] Ibid.

[57] Gregory Giles, Christine Cleary, and Michele Ledgerwood, *Minimum Nuclear Deterrence Research* (Washington, DC: Defense Threat Reduction Agency, 2003), II-97, accessed January 2, 2021, https://fas.org/irp/agency/dod/dtra/minimum.pdf.

[58] Shlapak and Johnson, *Reinforcing Deterrence on NATO's Eastern Flank*, 1.

[59] Scott Boston, Michael Johnson, Nathan Beauchamp-Mustafaga, and Yvonne Crane, "Assessing the Conventional Force Imbalance in Europe: Implications for Countering Russian Local Superiority" (Research Report, RAND Corporation, Santa Monica CA, 2018), 7, accessed November 20, 2020, https://doi.org/10.7249/RR2402.

the belief that Russia fears an overwhelming US and NATO counter-attack. Potential Russian aggression against a non-NATO member provides a bleaker picture as a response would be delayed while a coalition of the willing is developed to restore sovereignty leaving time for Russia to consolidate gains and prepare defenses. Ground based deterrent capabilities to prevent Chinese aggression in the ECS and SCS are even thinner. The distance and time required to deploy forces to defeat or deny a conventional Chinese force benefit the Chinese, and they know this. Rotational units in South Korea are aligned towards defense of the North Korean border, making the Marine Corps units stationed in Okinawa the only viable unit capable of response. However, Chinese missile threats are capable of denying naval and aerial transport units leaving the island and marine bases are located outside of Army tactical missile system (ATACM) and precision strike missile (PrSM) ranges to the Taiwan straits and SCS.

Identifying the Gaps

The following gaps were developed based on an assessment of Russian, Chinese, and American military capabilities that provide relative advantage to Russian and Chinese forces. Key factors for assessment are based on time to implement, cost, and risk to mission and force.

Maneuver

Limited numbers of troops on ground to serve as the blunt force. Currently the US maintains a single rotational armored brigade combat team and one airborne brigade combat team (173rd IBCT(A)) in the blunt layer. A 2017 RAND report estimates an almost six to one ratio of Russian to NATO main battle tanks and over two to one troop ratio of forces in the Baltic region, with zero permanently stationed American main battle tanks.[60] The relatively small land masses in the Pacific prevent staging of any significant maneuver forces in the SCS and all of them would be within range of Chinese surface-to-surface fires capabilities. With the strait of Taiwan

[60] Boston et al., "Assessing the Conventional Force Imbalance in Europe," 4.

being 100 miles wide, Chinese amphibious assault ships can remain within their own territorial waters and initiate an invasion in a matter of hours.

Fires

US forces currently lack the ability to provide all weather, long-range precision fires greater than 100 miles. The Army Tactical Missile System is also limited to one missile per pod and there is only a single artillery battalion in theater. The joint force does maintain several options for LBYNW both forward deployed and in CONUS based stockpiles that can be used to block a rapid advance. However, the US Army has not had a viable LYBNW option in its arsenal since 1991, with the signing of the Presidential Nuclear Initiatives between Russia and the US. Leaving the US reliant on the B-61 bomb. Aerial delivery systems have provided a flexible deterrent option in the past but are now becoming less reliable due to improvements in adversary anti-air capabilities and constraints in response time. The latest B-61-12 nuclear gravity bomb has variable yield capability from 0.3-50 kilotons.[61] The US maintains approximately 180 B-61s forward deployed at air bases in the European theater.[62] As the B-61 is a bomb, it is reliant on fixed wing aircraft for delivery. Not only can inclement weather and maintenance issues keep it on the ground, but with Russian and Chinese improvements in A2AD weapon systems such as the Russian S-400, and Chinese air superiority or even air parity over a potential target is no longer a given. This is a critical vulnerability in its use as a viable deterrent. Aircraft and their armaments are stored in fixed locations at airfields, making them easy to target and identify. Mobile ground launchers increase survivability by their decreased targeting signature; it is also

[61] Hans Kristensen, and Matt Korda, "Tactical Nuclear Weapons, 2019," *Bulletin of the Atomic Scientists* 75, no. 5, (August 2019): 258, accessed August 24, 2020, https://www.tandfonline.com/doi/full/10.1080/00963402.2019.1654273.

[62] Brendan Thomas-Noone, "Tactical Nuclear Weapons in the Modern Nuclear Era," Lowy Institute, September 2016, accessed September 17, 2020, https://www.lowyinstitute.org/publications /tactical-nuclear-weapons-modern-nuclear-era.

significantly cheaper to purchase a high mobility artillery rocket system or multiple launch rocket system than it is an F15 or B2 as a means of delivery.

Command and Control

While US communications integration and equipment is superior to all adversaries, it is also a significant liability. The majority of American communications equipment is not hardened to withstand an electromagnetic pulse from a nuclear weapon. Warfighter information network-tac and integrated tactical network systems also create large EMS signatures, battalion and above footprints can be easily identified and targeted through electronic jamming or cyber-attack. Destruction or degradation of American communications architecture would delay any potential US response and enable Russia and China to seize objectives with decreased opposition. While the hardening of communications equipment is a defensive measure, the use of the tactical network to conduct command and control are necessary to employ offensive capabilities and therefore included in this discussion. Warfighter information network-tac systems are reliant on 1.2m satellite dishes for higher throughput and are easily targeted through their electronic signature. Integrated tactical network helps to distribute the electronic signature through employment of multiple transport pathways across multiple form factors. This provides a much wider distribution of transport nodes throughout theater and helps to mitigate the effects of a single electro-magnetic pulse (EMP) or directional jamming device. A high-altitude electromagnetic pulse has the potential to damage minimally shielded electronic equipment over a 300-mile area.[63] See Figure 3 for possible EMP effects for a 30 kt nuclear blast.

[63] National Cybersecurity and Communications Integration Center, *Electromagnetic Pulse (EMP) Protection and Resilience Guidelines for Critical Infrastructure and Equipment* (Arlington, VA: National Cybersecurity and Communications Integration Center, February 2019), 14, accessed January 3, 2021, https://www.cisa.gov/sites/default/files/publications/19_0307_CISA_EMP-Protection-Resilience-Guidelines.pdf.https://www.cisa.gov/sites/default/files/publications/19_0307_CISA_EMP-Protection-Resilience-Guidelines.pdf.

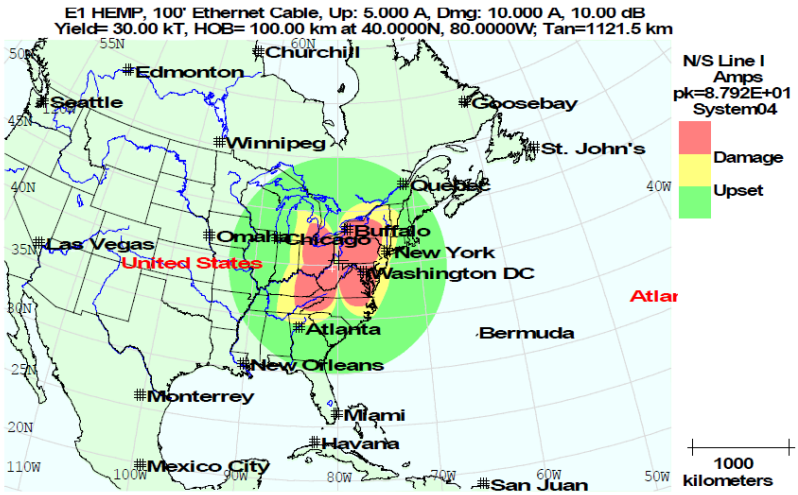

Figure 10. Potential disruption for 100' Ethernet-connected equipment from 30 kT HEMP

Figure 3. Potential EMP Damage from 30kt nuclear blast. National Cybersecurity and Communications Integration Center, *Electromagnetic Pulse (EMP) Protection and Resilience Guidelines for Critical Infrastructure and Equipment* (Arlington, VA: National Cybersecurity and Communications Integration Center, February 2019), 13, accessed January 3, 2020, https://www.cisa.gov/sites/default/files/publications/19_0307_CISA_EMP-Protection-Resilience-Guidelines.pdf.

Electro-Magnetic Spectrum

The US Department of Defense released its first *Electromagnetic Spectrum Superiority Strategy* in October of 2020. In it, the DoD acknowledges EMS as being intertwined with all domains and not a separate domain itself.[64] While joint all domain command and control is a step in the right direction, there are still many hurdles to overcome in true EMS deconfliction. Increased commercial demand for new technology such as 5th generation millimeter wave spectrum and future 6th generation technology continue to congest a finite spectrum. Combined with the inherent nature of the expeditionary US force. The DoD is constrained by foreign

[64] US Department of Defense, *Electromagnetic Spectrum Superiority Strategy* (Washington, DC: Government Publishing Office, 2020), 9, accessed January 8, 2021, https://media.defense.gov/2020/Oct/29/2002525927/-1/-1/0/ELECTROMAGNETIC_SPECTRUM_SUPERIORITY_STRATEGY.PDF.

governments and what has already been allocated to its own citizens within their own borders. Beginning in 2008, Russia integrated EMS jamming capabilities at the brigade level that have the ability to jam or disrupt communications on multiple wavelengths up to 50km away.[65] In comparison, American forces have yet to integrate electronic jamming capabilities at the tactical level, other than small remote control improvised explosive devices. Future capabilities such as the terrestrial layer system for electronic warfare are due to be integrated in the coming year, however, it is still unproven in the field.[66]

Recommendations

If the US Army is shifting to multi-domain operations, it must continue to expand the availability of options to provide multiple dilemmas to its adversaries and competitors and increase risk and cost to its adversaries. This includes supporting operations through sister services based on time, space, and capability requirements. The following options are materiel and manning solutions that inevitably drive changes across the entire doctrine, organization, training, materiel, leadership and education, personnel, facilities and policy (DOTMLPF-P) spectrum. It is also important to mention that offensive operations can be conducted in the information space to sway global opinion as to the validity of potential Russian/Chinese aggression at relatively low cost. The recommendations are broken down by war fighting function to delineate separate capability recommendations.

The future capabilities being researched or fielded by the Army are assessed below using metrics based on their current cost and availability versus their ability to deny adversary objectives, incur severe costs, and inflict a worse outcome by encouraging adversary restraint.

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[65] McDermott, *Russia's Electronic Warfare Capabilities to 2025*, 5.

[66] US Department of the Army, PEO IEW&S, "PEO IEW&S Army Industry Day Slides," AFCEA, accessed January 8, 2020, https://www.afcea.org/event/sites/default/files/files/PEO%20IEW%26S%20Army%20Industry%20Day%20Slides.pdf.

Capability	$$ Cost	Availability	Risk to Force
Conventional Armor BDE's	2.7 Billion/Annually	???? Requires Army Manning Increase Minimum 5 years	>25K Soldiers
PrSM	5.75mil/round FY 21= 30 Rounds	2021	~229 Soldiers
W80-1 LYNW	8.4 Million/Round	Now	N/A
Hyper Sonics	1.17 Billion	2023 (1 Battery)	~71 Soldiers
TITAN Ground Station	$30 Million/Annually	2023	~261
JADC2	$435 million FY21	Now	N/A
JEDI	$10 Billion	UNK	N/A
TLS	$489 Million for FYDP	2022	N/A

Table 2. Capability Cost/Availability Analysis. Created by author.

Maneuver

An increase in maneuver forces would undoubtedly increase the material and personnel cost to Russia and China to accomplish their desired goals. However, if the decision is made to utilize a nuclear weapon, the death of one American soldier is no different than the death of thousands to the American public and would only serve to reduce operational capability of counter-attack forces in the surge layer and therefore no large-scale troop increases are recommended. One RAND study concludes a Russian invasion of the Baltics can be stopped with the forces of 7 total brigades including 3 heavy armor brigades at a cost of $2.7 billion annually.[67] While the US would not be burdened with the entirety of the cost, the limitations of the Baltic Armed forces and NATO imply the US would inherent the majority of it. The overall recurring annual cost of employing a sufficient amount of forces is prohibitive and also the

[67] Shlapak and Johnson, *Reinforcing Deterrence on NATO's Eastern Flank*, 11.

required troop numbers would require either a drastic force increase or a reallocation of forces from other mission sets. The increase of at least 25,000 soldiers in the region would not only raise tensions with Russia at the risk of invasion, but also decrease options globally. An increase in Army personnel in the Pacific is inconsequential to China as there is no adjacent land border or base to stage soldiers. China would see US forces in Taiwan as a violation of Chinese sovereignty and the existing Chinese A2AD bubble increases the risk of embarked Marine forces inside the first island chain to infeasible numbers.

Fires

The Army has invested heavily in progression of long-range precision fires to serve as a stand-off capability to increase deterrence and provide flexible response options, but more can be done to expand those options. Nuclear capability modifications to both the PrSM and future hypersonic glide vehicles can expand options for both theaters. Modification of the W80-1 warhead to be launched using the PrSM delivery system allows for greater standoff range than canon artillery outside of electronic jamming range. Maintaining a nuclear equipped multiple launch rocket system presence on alert in Poland to respond to potential Russian incursion denies avenues of approach to Russian tank forces that cannot be covered by a single multi-national security brigade. While the range of the PrSM is 500km and would not entirely cover the Estonian border, it would also not reach Saint Petersburg or Moscow. A rapid response high mobility artillery rocket system platoon can be alerted to conduct a raid aboard a C-130 anywhere in theatre with minimal risk to force as well. The DoD has authorized Army procurement of 30 PrSMs for FY20 at a current cost of $172.6 million.[68] These missiles can be fielded with rotational units in Poland. However, the limits of lethality in a single warhead still prohibits rapid

[68] US Department of Defense, Office of the Under Secretary of Defense (Comptroller), *FY2021 Program Acquisition Costs by Weapons System* (Washington, DC: Government Publishing Office, 2020), 5-14, accessed December 30, 2020, https://comptroller.defense.gov/Portals/45/Documents /defbudget/fy2021/fy2021_Weapons.pdf.

response to a brigade or larger invasion force of Russian tanks. Previous procurement cost of the W80-1 LYBN warhead was $8.4 million each. Combined, each round would cost roughly $13.9 million. A 15 kiloton LYBNW has an effective ground burst blast radius of over 1.6 km, and second degree burns for exposed troops out to 2.6 km.[69] The ability to disrupt a Russian advance through indirect fires reduces the risk to coalition troops and raises the cost of Russian aggression furthering deterrence.

The speed and maneuverability of hypersonic weapons offer a unique capability that further increases the risk of nuclear use through their ability to rapidly target operational and strategic nodes. The Army has currently allocated $1.17 billion over the current Future Year Defense Program (average $235 million annually) to the development and fielding of hypersonics and intends to field a single hypersonic battery by 2023.[70] Hypersonic cruise vehicles are considered to be missiles capable of cruising at Mach 5 or higher, current technology exists for hyper-glide vehicles (HGV) to reach speeds of up to Mach 20 or 15,000 miles-per-hour.[71] A hypersonic weapon launched from Warsaw traveling at Mach 10 would have an average time of flight of 5.5 minutes before reaching Moscow. A hypersonic launched from Camp Humphries would have an even shorter flight time to Beijing. The added benefit of maneuverability of weapons changes the ability to predict its impact location, due to variable trajectory and degraded missile defense capability due to an opposition's inability to form complete anti-missile defense rings around every high-profile target. Placing these systems within range of maneuver forces can

[69] Jean M. Bele, "Thermal Radiation Calculator," Nuclear Weapons Education Project, accessed January 4, 2021, https://nuclearweaponsedproj.mit.edu/Node/108.

[70] US Department of the Army, *Department of Defense, Fiscal Year (FY) 2020 Budget Estimates* (Washington, DC: Government Publishing Office, March 2019), 673, accessed 30 December 2020, https://www.asafm.army.mil/Portals/72/Documents/BudgetMaterial/2020/Base%20Budget/rdte/04%20RDTE%20-%20Vol%202%20-%20Budget%20Activity%204.pdf.

[71] Missile Defense Advocacy Alliance, "Hypersonic Weapon Basics," Last updated May 30, 2018, accessed October 21, 2020, https://missiledefenseadvocacy.org/missile-threat-and-proliferation/missile-basics/hypersonic-missiles/.

provide a responsive deterrent to potential invasion. Also, technological improvements can further reduce the risk of their defeat by adversary missile defense systems and improve success rates. A US Air Force funded study on the use of magnetized plasma, released in 1994, provides an option for decreased detection of aircraft or vehicles in flight.[72] The application of magnetized plasma layers on HGV's absorbs radar waves through embedded alternately charged electrode strips and prevents return signals to enemy radar tracking equipment. The combination of magnetized plasma and the inherent speed of an HGV can provide the US with an undetectable rapid delivery system capable of ranging theater targets from Okinawa or Germany. The current lack of availability or proven record of success, limits hypersonic's ability to provide a current and responsive deterrent to Chinese or Russian LYBNW use.

The Baltic states and Poland are all current basing options for exceeding the current indirect fires range, using PrSM munitions. The Chinese A2AD bubble increases risk of use of aircraft and surface naval ships. Heavy traffic and shallow depths in the littorals of the SCS also create dilemmas for submarine launched weapons. The distances from Guam and South Korea to the SCS and ECS are too far to stage fires assets, leaving the only viable option as a hypersonic battery in Okinawa or the Philippines. With the current projected range of hypersonics at 1,400 miles, this range extends beyond Taiwan into the Taiwan strait as well as into the SCS and the Spratly Islands, but does not range Beijing to threaten potential first strike of government decapitation. Due to the inherent size of amphibious assault ships and troop transports, an invasion force could be directly engaged by a battery of hypersonic missiles within range of the Taiwan strait.

[72] J. Reese Roth, "Interaction of Electromagnetic Fields with Magnetized Plasmas" (Scientific Report, UTK Plasma Science Laboratory, Knoxville, April 1989–March 1994), 28, accessed December 20, 2020, https://apps.dtic.mil/sti/pdfs/ADA285496.pdf.

Command and Control

The US Army is currently developing the tactical intelligence targeting access node (TITAN) ground station capable of integrating global joint and interagency intelligence surveillance and reconnaissance and rapidly directing fires through enhanced routing aided by artificial intelligence with an initial prototype to be fielded in FY23.[73] Regionally aligned, TITAN ground stations can be located outside of SRBM range and still effectively provide fire direction for joint forces in theater. The capability to rapidly deconflict airspace and fires will enable efficient targeting of road mobile launchers, artillery, electronic warfare, and headquarters prior to nuclear weapon launch.

TITAN ground stations, coupled with combined joint all domain command and control through the Army's Project Convergence rapidly decreases threat detection and target acquisition timelines and will enable joint targeting throughout the theater of operations. With the establishment of common networking and coding standards across the joint force, validation and data sharing can be streamlined and increase risk to adversaries. The DoD's Joint Enterprise Defense Initiative (JEDI) will also assist in reducing decision making time. The JEDI program is mired in legal objections from Amazon Web Services and is currently three years behind schedule.[74]

While the DoD is working to streamline its targeting and fire mission processing it can create redundance in its current equipment through communications hardening and protection from EMP attack. Implementation of National Cybersecurity and Communications Integration Center guidelines for EMP hardening, from properly categorizing and shielding appropriate levels

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[73] Nishawn S. Smagh, *Intelligence, Surveillance, and Reconnaissance Design for Great Power Competition* (Washington, DC: Congressional Research Service, 2020), 23, accessed January 3, 2021, https://fas.org/sgp/crs/intel/R46389.pdf.

[74] US Department of Defense, "DOD Reaffirms Original JEDI Cloud Award to Microsoft," Department of Defense, September 4, 2020, accessed January 11, 2021, https://www.defense.gov /Newsroom/Releases/Release/Article/2337557/dod-reaffirms-original-jedi-cloud-award-to-microsoft/.

equipment to inclusion of maintaining redundant communications devices with similar configurations stored in a properly shielded faraday cage.[75] Rapid integration of low probability of intercept and low probability of detection (LPI/LPD) modems with EMP shielding can hide below the noise floor to prevent directional jamming by Russian and Chinese forces. LPI/LPD modems are available now and are interoperable with current DoD transmission nodes. LPI/LPD modems also decrease the probability of detection and targeting of command-and-control nodes by both conventional and nuclear means.

Electro-Magnetic Spectrum

Rapid acquisition and deployment of the terrestrial layer system (TLS) will make significant gains in providing direction finding, electronic attack and even offensive cyber capabilities to commanders in the field.[76] While development is ongoing with an estimated $498 million allocated across the current Future Year Development Program for further research, development, test and evaluation, the Army intends to field a single brigade combat team by 2022.[77] Until such an offensive capability can be fielded, diversity of communications is essential for mitigating and deterring jamming or electronic interference. One option is to transition communications up the electronic spectrum to the visible light range. Li-Fi provides a faster internet connection speed and increased security in enclosed spaces. Li-Fi transmission is 10 times faster than traditional Wi-Fi connections.[78] Li-Fi intranet communications can be coupled

[75] National Cybersecurity and Communications Integration Center, *Electromagnetic Pulse (EMP) Protection and Resilience Guidelines for Critical Infrastructure and Equipment*, 40.

[76] Sydney J. Freedberg Jr., "Army Wants New Mega-Jammer In 2023: TLS-EAB," *Breaking Defense*, September 29, 2020, accessed September 30, 2020, https://breakingdefense.com/2020/09/army-wants-new-mega-jammer-in-2023-tls-eab/.

[77] US Department of the Army, *Department of Defense, Fiscal Year (FY) 2021 Budget Estimates* (Washington, DC: Government Publishing Office, February 2020), 264, accessed January 11, 2021, https://www.asafm.army.mil/Portals/72/Documents/BudgetMaterial/2021/Base%20Budget/Procurement/OPA_BA_2_FY2021_PB_Other_Procurement_BA2_Communications_and_Electronics.pdf.

[78] Defense Information Systems Agency, "Li-Fi Technology Offers Benefits in Mobility, Speed, Cost, Security," accessed January 10, 2021, http://www.disa.mil/NewsandEvents/2017/Li-Fi.

with laser-based internet communication for large network connectivity that is increasingly difficult to target or jam. Laser based communications links also provide large throughput, secure point-to-point communications over long distance or from geosynchronous satellite orbit. The concentration of the beam makes jamming extremely difficult and allows for faster and larger throughput than traditional radio frequency communications. NASA, in coordination with the DoD has begun experimenting with laser communications earlier this year and reports 10 to 100 times the overall throughput of traditional radio frequency communications..[79]

Conclusion

In conclusion, disparities in geography and adversary strategic goals require tailored deterrent packages for each actor. The range and responsive nature of a non-nuclear hypersonic weapon enables the US to engage high payoff targets and decrease the benefit cost of use of LYBNW from China and Russia without escalation to nuclear release. However, the unavailability of hypersonics for at least the next two years requires deployment of shorter range PrSM systems in Poland and the Philippines. Long-range precision fires themselves are not sufficient in providing a viable deterrent option for all scenarios involving Russia and China. Advancements and modernization in all domains are necessary to create multiple dilemmas for US adversaries to contemplate and weigh their perceived imposed costs to overcome. Regardless of future technology or personnel improvements, transparency, diversity, and responsiveness are the keys in all future kinetic options in order to prevent a security dilemma for any competitors and prevent the use of LYBNW. Without this trio of requirements, adversaries are incapable of mitigating the risk to themselves and their forces. These requirements are not solely reliant on military capabilities, they are reliant on all elements of national power. Transparency is

[79] Lee Mohon, "What is the Laser Communications Relay Demonstration?," National Aeronautics and Space Administration, Last updated December 9, 2020, accessed January 10, 2021, http://www.nasa.gov/mission_pages/tdm/lcrd/overview.html.

necessary, not only from a strategic messaging standpoint, but also from a capability standpoint. When dealing with a potential nuclear weapons release, it is vital that nuclear powers do not commit unnecessary errors of uncertainty. As delivery methods evolve, delivery speed also increases, lowering the time for leadership to react to potential nuclear weapons inbound. Shortening the decision cycle for leaders disrupts their ability to orient themselves to the situation and forces a hasty decision. With potential times for hypersonic weapons being below 5 minutes from launch to delivery, adversaries must be assured they are not nuclear armed. This comes from renewed multi-lateral negotiations and ultimately arms control limitations on nuclear tipped hypersonic weapons.

Bibliography

Al Jazeera. "Taiwan Says 46 Incidents Involving Chinese Planes in Last 9 Days." *Al Jazeera*, September 25, 2020. Accessed December 5, 2020. https://www.aljazeera.com /news/2020/9/25/taiwan-says-china-has-made-46-air-incursions-in-past-nine-days.

Asia Maritime Transparency Initiative. "China Tracker." Accessed February 8, 2021. https://amti.csis.org/island-tracker/china/.

Bele, Jean M. "Thermal Radiation Calculator." Nuclear Weapons Education Project. Accessed January 4, 2021. https://nuclearweaponsedproj.mit.edu/Node/108.

Best, Marina. "The Ethnic Russian Minority: A Problematic Issue in the Baltic States." *Verges: Germanic and Slavic Studies in Review* 2, no. 1 (2013): 33-41. Accessed February 13, 2021. https://journals.uvic.ca/index.php/verges/article/view/11634.

Boston, Scott, Michael Johnson, Nathan Beauchamp-Mustafaga, and Yvonne Crane. "Assessing the Conventional Force Imbalance in Europe: Implications for Countering Russian Local Superiority." Research Report, RAND Corporation, Santa Monica, CA, 2018. Accessed November 20, 2020. https://doi.org/10.7249/RR2402.

Bureau of Arms Control, Verification and Compliance. "Adherence to and Compliance with Arms Control, Non-proliferation, and Disarmament Agreements and Commitments." US Department of State, July 2014. Accessed May 23, 2021. https://2009-2017.state.gov/documents/organization/230108.pdf.

———. "U.S. Response to the Russian Federation's INF Treaty Violation: Integrated Strategy." US Department of State, December 8, 2017. Accessed December 12, 2020. https://www.state.gov/u-s-response-to-the-russian-federations-inf-treaty-violation-integrated-strategy/.

Center for Strategic and International Studies. "How Much Trade Transits the South China Sea?" China Power Project, Center for Strategic and International Studies, August 2, 2017. Accessed January 2, 2021. http://chinapower.csis.org/much-trade-transits-south-china-sea/.

Central Intelligence Agency. "Explore All Countries-Estonia." The World Factbook. Accessed January 7, 2021. https://www.cia.gov/the-world-factbook/countries/estonia/#people-and-society.

Chase, Michael S., Evan S. Medeiros, J. Stapleton Roy, and Eugene B. Rumer, Robert Sutter, and Richard Weitz. "Russia-China Relations: Assessing Common Ground and Strategic Fault Lines." Special Report, National Bureau of Asian Research, July 2017. Accessed February 13, 2021. https://carnegieendowment.org/files/SR66_Russia-ChinaRelations_July2017.pdf.

Corin, Eli. "Presidential Nuclear Initiatives: An Alternative Paradigm for Arms Control." Nuclear Threat Initiative, March 1, 2004. Accessed January 2, 2021. https://www.nti.org /analysis/articles/presidential-nuclear-initiatives/.

Defense Information Systems Agency. “Li-Fi Technology Offers Benefits in Mobility, Speed, Cost, Security.” Accessed January 10, 2021. http://www.disa.mil/NewsandEvents/2017/Li-Fi.

Defense Intelligence Agency. *China Military Power: Modernizing a Force to Fight and Win*. Washington, DC: Defense Intelligence Agency, 2019. Accessed January 7, 2021. https://www.dia.mil/Portals/27/Documents/News/Military%20Power%20Publications/China_Military_Power_FINAL_5MB_20190103.pdf.

———. *Russia Military Power: Building a Military to Support Great Power Aspirations*. Washington, DC: Defense Intelligence Agency, 2017. Accessed October 7, 2020. https://www.dia.mil/Portals/27/Documents/News/Military%20Power%20Publications/Russia%20Military%20Power%20Report%202017.pdf.

Defense24.com. “Russian Nuclear Warheads Deployed In Crimea?” Defence24.com, March 12, 2015. Accessed January 1, 2021. https://www.defence24.com/russian-nuclear-warheads-deployed-in-crimea.

Department of Homeland Security. “National Risk and Capability Assessment.” Federal Emergency Management Agency. Last updated September 10, 2020. Accessed January 13 2021. https://www.fema.gov/emergency-managers/risk-management/risk-capability-assessment.

Freedberg Jr., Sydney J. “Army Wants New Mega-Jammer In 2023: TLS-EAB.” *Breaking Defense*, September 29, 2020. Accessed September 30, 2020. https://breakingdefense.com/2020/09/army-wants-new-mega-jammer-in-2023-tls-eab/.

Giles, Gregory, Christine Cleary, and Michele Ledgerwood. *Minimum Nuclear Deterrence Research*. Washington, DC: Defense Threat Reduction Agency, 2003. Accessed January 2, 2021. https://fas.org/irp/agency/dod/dtra/minimum.pdf.

Giles, Keir, James Sherr, and Anthony Seaboyer. *Russian Reflexive Control.* Kingston, On, Canada: Canadian Defence Research and Development, October 2018. Accessed November 30, 2020. https://www.researchgate.net/profile/Keir_Giles/publication/328562833_Russian_Reflexive_Control/links/5bd4b1714585150b2b8b2a21/Russian-Reflexive-Control.pdf.

Glaser, Bonnie S., Matthew P. Funaiole, and Brian Hart. “Breaking Down China’s 2020 Defense Budget.” Center for Strategic and International Studies, May 22, 2020. Accessed September 30, 2020. https://www.csis.org/analysis/breaking-down-chinas-2020-defense-budget.

Huang, Kristin. “Chinese Government Drops References to ‘Peaceful’ Taiwan Reunification.” *South China Morning Post*, May 22, 2020. Accessed September 30, 2020. https://www.scmp.com/news/china/politics/article/3085700/chinese-government-drops-references-peaceful-reunification.

Kahneman, Daniel. *Thinking Fast and Slow*. New York: Farrar, Strous, and Giroux, 2011.

Kristensen, Hans, and Matt Korda. "Tactical Nuclear Weapons, 2019." *Bulletin of the Atomic Scientists* 75, no. 5 (August 2019): 252–61. Accessed August 24, 2020. https://www.tandfonline.com/doi/full/10.1080/00963402.2019.1654273.

Lee, Yimou. "China's Latest Weapon against Taiwan: The Sand Dredger." *Reuters*, February 5, 2021. Accessed February 8, 2021. https://www.reuters.com/article/us-taiwan-china-security-idUSKBN2A51EJ.

McDermott, Roger N. *Russia's Electronic Warfare Capabilities to 2025*. Estonia: International Center for Defense and Security, September 2017. Accessed September 16, 2020. https://icds.ee/wp-content/uploads/2018/ICDS_Report_Russias_Electronic_ Warfare_to_2025.pdf.

Mearsheimer, John J. "The Liberal Delusions that Provoked Putin." *Foreign Affairs*, September 2014. Accessed May 23, 2021. https://www.foreignaffairs.com/articles/russia-fsu/2014-08-18/why-ukraine-crisis-west-s-fault.

Missile Defense Advocacy Alliance. "Hypersonic Weapon Basics." Last updated May 30, 2018. Accessed October 21, 2020. https://missiledefenseadvocacy.org/missile-threat-and-proliferation/missile-basics/hypersonic-missiles/.

Missile Defense Project. "DF-12 (M20 / CSS-X-15)." *Missile Threat,* Center for Strategic and International Studies. Last updated June 23, 2020. Accessed September 19, 2020. https://missilethreat.csis.org/missile/df-12/.

———. "Missiles of China," *Missile Threat*, Center for Strategic and International Studies. June 14, 2018. Accessed September 17, 2020. https://missilethreat.csis.org/country/china/.

Mohon, Lee. "What is the Laser Communications Relay Demonstration?" National Aeronautics and Space Administration, Last updated December 9, 2020. Accessed January 10, 2021. http://www.nasa.gov/mission_pages/tdm/lcrd/overview.html.

National Cybersecurity and Communications Integration Center. *Electromagnetic Pulse (EMP) Protection and Resilience Guidelines for Critical Infrastructure and Equipment*. Arlington, VA: National Cybersecurity and Communications Integration Center, February 2019. Accessed January 3, 2021. https://www.cisa.gov/sites/default/files /publications/19_0307_CISA_EMP-Protection-Resilience-Guidelines.pdf.

North Atlantic Treaty Organization (NATO). "Why Was NATO Founded?" We are NATO. Accessed February 8, 2021. https://www.nato.int/wearenato/index.html.

O'Rourke, Ronald. R42784, *U.S.-China Strategic Competition in South and East China Seas: Background and Issues for Congress*. Washington, DC: Library of Congress, December 29, 2020.

Office of the Secretary of Defense. *Nuclear Posture Review*. Washington, DC: Government Publishing Office, 2018. Accessed August 26, 2020. https://fas.org/issues/nuclear-weapons/nuclear-posture-review/.

Permanent Court of Arbitration. "UNCLOS South China Sea Arbitration Award." Accessed February 12, 2021. https://pcacases.com/web/sendAttach/2086.

Putin, Vladimir. “Conference of Russian Ambassadors and Permanent Representatives.” July 1, 2014. Accessed January 7, 2021. http://en.kremlin.ru/events/president/news/46131.

Reuters. “Putin Criticizes NATO Expansion as Alliance Holds London Summit.” *Reuters*, December 3, 2019. Accessed May 23, 2021. https://www.reuters.com/article/us-nato-summit-putin/putin-criticizes-nato-expansion-as-alliance-holds-london-summit-idUSKBN1Y71K5.

Roth, J. Reese. “Interaction of Electromagnetic Fields with Magnetized Plasmas.” Scientific Report, UTK Plasma Science Laboratory, Knoxville, April 1989–March 1994. Accessed December 20, 2020. https://apps.dtic.mil/sti/pdfs/ADA285496.pdf.

Schwartz, Peter. *The Art of the Long View*. New York: Crown, 1996.

Shlapak, David A., and Michael Johnson. *Reinforcing Deterrence on NATO’s Eastern Flank: Wargaming the Defense of the Baltics*. Santa Monica, CA: RAND Corporation, 2016. Accessed December 30, 2020. https://www.rand.org/pubs/research_reports/RR1253.html.

Smagh, Nishawn S. *Intelligence, Surveillance, and Reconnaissance Design for Great Power Competition*. Washington, DC: Congressional Research Service, 2020. Accessed January 3, 2021. https://fas.org/sgp/crs/intel/R46389.pdf.

Taleb, Nassim Nicholas. *Antifragile*. New York: Random House, 2012.

Thomas-Noone, Brendan. “Tactical Nuclear Weapons in the Modern Nuclear Era.” Lowy Institute, September 2016. Accessed September 17, 2020. https://www.lowyinstitute.org/publications/tactical-nuclear-weapons-modern-nuclear-era.

Trump, Donald. *2017 National Security Strategy*. Washington, DC: Office of the President of the United States, 2017. Accessed December 12, 2020. https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf.

US Department of the Army. *Department of Defense, Fiscal Year (FY) 2021 Budget Estimates*. Washington, DC: Government Publishing Office, February 2020. Accessed January 11, 2021. https://www.asafm.army.mil/Portals/72/Documents/BudgetMaterial/2021/Base%20Budget/Procurement/OPA_BA_2_FY2021_PB_Other_Procurement_BA2_Communications_and_Electronics.pdf.

———. *Department of Defense, Fiscal Year (FY) 2020 Budget Estimates*. Washington, DC: Government Publishing Office, March 2019. Accessed December 30, 2020. https://www.asafm.army.mil/Portals/72/Documents/BudgetMaterial/2020/Base%20Budget/rdte/04%20RDTE%20-%20Vol%202%20-%20Budget%20Activity%204.pdf.

———. Field Manual (FM) 100-2-2, *The Soviet Army: Specialized Warfare and Rear Area Support.* Washington, DC: Government Printing Office, 1984.

US Department of the Army, PEO IEW&S. “PEO IEW&S Army Industry Day Slides.” AFCEA. Accessed January 8, 2021. https://www.afcea.org/event/sites/default/files/files/PEO%20IEW%26S%20Army%20Industry%20Day%20Slides.pdf.

US Department of Defense. “DOD Reaffirms Original JEDI Cloud Award to Microsoft.” Defense.gov, September 4, 2020. Accessed January 11, 2021. https://www.defense.gov/Newsroom/Releases/Release/Article/2337557/dod-reaffirms-original-jedi-cloud-award-to-microsoft/.

———. *Electromagnetic Spectrum Superiority Strategy*. Washington, DC: Government Publishing Office, 2020. Accessed January 8, 2021. https://media.defense.gov/2020/Oct/29/2002525927/-1/-1/0/ELECTROMAGNETIC_SPECTRUM_SUPERIORITY_STRATEGY.PDF.

———. *Global Deterrence Joint Operating Concept*. Washington, DC: Government Printing Office, 2006. Accessed February 15, 2021. https://www.jcs.mil/Portals/36/Documents/Doctrine/concepts/joc_deterrence.pdf?ver=2017-12-28-162015-337.

———. Office of the Secretary of Defense (Comptroller). *FY2021 Program Acquisition Costs by Weapons System*. Washington, DC: Government Publishing Office, 2020. Accessed December 30, 2020. https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2021/fy2021_Weapons.pdf.

Wezemen, Seiman T. “Russia’s Military Spending.” Stockholm International Peace Research Institute, April 27, 2020. Accessed November 11, 2020. https://www.sipri.org/commentary/topical-backgrounder/2020/russias-military-spending-frequently-asked-questions.

Zedong, Mao. *Selected Military Writings of Mao Tse-Tung*. Beijing: Foreign Languages Press, 1967.