

RESEARCH DIVISION

Nuclear strategy in the 21st century: continuity or change?

edited by Andrea Gilli and Pierre de Dreuzy

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Workshop

Contributors

Oliver Barton is a Senior Principal Analyst at the Defence Science and Technology Laboratory (the research and analysis agency of the UK's Ministry of Defence). He read History at Christ's College, Cambridge, and holds an MA in War Studies from King's College London. He is currently studying for a PhD in International History at the London School of Economics, where his thesis focuses on the role of the Thatcher Government during the Euromissile Crisis.

Pierre de Dreuzy is a Research Assistant with the NATO Defense College Research Division, where he researches nuclear coercion, international arms control, and emerging technologies. Prior to joining the College, he was a researcher with the NATO Parliamentary Assembly (NATO PA) in Brussels, Belgium. He holds an MA (with Honours) in International Relations from the University of Chicago and a Joint Honours BA in Political Science and History from McGill University.

Tom W. Etienne is a dual PhD student in Political Science and Communication at the University of Pennsylvania. He has a master's degree in Political Geography from the University of Amsterdam, as well as extensive experience in survey methodology acquired through his fellowship developing voting advice applications at the Dutch *Kieskompas* research institute. Leveraging large-n panels stemming from these applications, he focuses on foreign policy and misinformation topics in political communication, psychology, and behaviour in European multiparty systems through the lens of mass and partisan ideology.

Andrea Gilli is Senior Researcher at the NATO Defense College where he works on issues related to technological change and military innovation. He has been visiting and postdoctoral fellow at Johns Hopkins University and Columbia University as well as Stanford University (where he remains an Affiliate) and Harvard University. Andrea holds a BA from the University of Turin, a MSc from the London School of Economics and a PhD from the European University Institute.

Cameron Hunter is a specialist in the intersection of technology and security, with a particular focus on nuclear weapons, outer space, and critical theory. He is currently a postdoctoral researcher at the ERC-funded "Towards a Third Nuclear Age?" project at the University of Leicester, where he leads on the East Asia case study and conflict simulation efforts. He was awarded a PhD from the University of Bristol after completing a project on American responses to China's "rise" in space. Cameron also worked as a British Research Council Fellow at the Library of Congress, and taught politics at Bristol and Leicester Universities.

Cynthia Roberts is a Professor of Political Science at Hunter College, City University of New York; Senior Research Scholar at the Saltzman Institute of War and Peace Studies and Adjunct Professor of International Affairs at Columbia University. In 2019, she worked as a policy adviser at the Joint Staff, U.S. Department of Defense in J-5, Strategy, Plans and Policy. Her research spans the military and financial statecraft of major powers and European security problems. She is the author of two books on these topics and numerous articles, book chapters and reports in scholarly and policy journals. She holds a PhD from Columbia University.

Benjamin Silverstein is the Research Analyst for the Space Project at the Carnegie Endowment for International Peace. His research investigates arms racing dynamics, space capability management within alliances, and the evolution of national space policies. Before joining Carnegie, he worked on space policy issues at Lawrence Livermore National Laboratory and at the United Nations Institute for Disarmament Research. Silverstein completed his MA in international relations at Syracuse University's Maxwell School of Citizenship and Public Affairs and received his BA in international affairs from George Washington University.

J. Alexander Thew is a US Army Major and instructor of economics at West Point's Department of Social Sciences. His research interests include nuclear proliferation, nuclear industrial development, military strategy, and economic statecraft. He earned an MBA at the Yale School of Management and a BS in nuclear engineering from the United States Military Academy.

Lydia Wachs is a Research Associate at the German Institute for International and Security Affairs (SWP) in Berlin. Her research focuses on nuclear issues, especially Russia's nuclear and arms control policy, and emerging technologies. Prior to that, she worked as a Research Assistant at SWP on autonomous weapon systems and arms control and as a Research Assistant in the Proliferation and Nuclear Policy Programme at the Royal United Services Institute (RUSI). She holds an MA in Arms Control and International Security from King's College London and a BA in International Relations from Dresden University, Germany, and Saint Petersburg University, Russia.

List of abbreviations

ACCS	Air Command and Control System
ABM	Anti-Ballistic Missile
CDA	Christian Democrat Appel
CEP	Circular Error Probable
CHU	Christian Historical Union
CU	Christian Union
DA-ASATs	Direct Ascent Kinetic Anti-Satellite Interceptors
DCA	Dual Capable Aircraft
ESA	European Space Agency
GT	Grim Trigger
IAEA	International Atomic Energy Agency
ICBM	Intercontinental Ballistic Missile
INF	Intermediate-range Nuclear Forces
JCPOA	Joint Comprehensive Plan of Action
NAC	North Atlantic Council
NATO	North Atlantic Treaty Organization
NPG	Nuclear Planning Group
NPT	Non-Proliferation Treaty
PvdA	Coalition of Christian Sister Parties and Labour Party
SAC	Strategic Air Command
SACEUR	Supreme Allied Commander Europe
SAGE	Semi-Automatic Ground Environment System
SALT	Strategic Arms Limitation Talks
SEAD	Suppression of Enemy Air Defences
SLBM	Sea-Launched Ballistic Missile
SLCM-N	Nuclear-Armed Sea-Launched Cruise Missile
SPD	Social Democratic Party

START	Strategic Arms Reduction Treaty
TFT	Tit-for-tat
TPNW	Treaty on the Prohibition of Nuclear Weapons
UK	United Kingdom
UNGA	United Nations General Assembly
US	United States
USAF	United States Air Force
VVD	People's Party for Freedom and Democracy

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Andrea Gilli and Pierre de Dreuzy

Foreword

Cynthia Roberts

Nuclear weapons are once again central to international politics. The resurgence of nuclear weapons marks the true end of the post-Cold War era, a time when the nuclear arsenals of Russia and the United States were significantly downsized and the role of nuclear weapons was de-emphasized. Great power competition has returned, with military force once again being used to revise state borders amid coercive nuclear threats. In February 2022, Russian President Vladimir Putin deliberately launched a war against Ukraine, issuing nuclear threats to shield Russia's war-making from direct intervention by the United States and other NATO countries. Putin has likewise declared that occupied territories – from Crimea to the four provinces annexed by Russia – are protected by Russian nuclear guarantees, even though Ukrainian forces have already launched counter-offensives to retake these regions.

No one, perhaps not even Putin himself, can predict whether and under what circumstances Russia would employ tactical nuclear weapons, either to end the war on favorable terms or avert a politically costly defeat. Russian nuclear doctrine offers some guideposts and red lines, such as prescribing a nuclear response in the event of an existential threat to the state or in case of attack on critical facilities that undermine the operation of Russia's nuclear forces.¹ But doctrine is not the same as operational planning, and once a leader has crossed the Rubicon, plans are unlikely to survive contact with the enemy. Plans are contingent on conditions and on leaders' decisions at critical times. If Russia finds itself facing accumulating losses, Putin may act like a vulnerable autocrat, gambling on nuclear escalation in a dangerous attempt to ensure his regime's survival.

Observers decry Russia not only for its extreme measures to destroy Ukraine's sovereignty but also for "taking a sledgehammer to the global nuclear order".² World leaders such as UN Secretary General Antonio Guterres warn that Putin has brought the prospect of nuclear war "back in the realm of possibility". Russia's aggression, if it succeeds, may tempt dictators in Pyongyang, Beijing, and possibly Tehran to follow suit. Russia's actions

¹ C. Roberts, "Revelations about Russia's Nuclear Deterrence Policy", War on the Rocks, June 19, 2020.

² A.K. Bollfrass and S. Herzog, "The war in Ukraine and the global nuclear order", Survival, Vol.64, No.4, 2022, pp.7-32.

could also spur nuclear proliferation – or at least tempt potential proliferators like South Korea and Japan to bolster their hedging strategies (where states move closer to acquiring a nuclear weapons option without going all the way). That Russia's large-scale invasion of Ukraine occurred 26 years after Kyiv voluntarily gave up the equivalent of the world's third-largest nuclear weapons arsenal, inherited when the Soviet Union collapsed, has led Ukrainians and others to question the wisdom of their non-nuclear status. Meanwhile, instead of hedging or headlong nuclear acquisition, partners from Seoul to Warsaw may seek more direct participation in US nuclear sharing programmes.

Upbeat conclusions about a less fraught nuclear order in the future also appear premature and exaggerate prior achievements. The Treaty on the Prohibition of Nuclear Weapons (TPNW), for instance, has had no impact on the expansion and modernization of nuclear programmes in China, North Korea, Russia, and Pakistan. In the United States, the Obama administration's aspirations to de-emphasize the role of nuclear weapons in US defense policy were offset by a bipartisan modernization programme carried forward by successive presidential administrations, which looks to replace the aging US nuclear force, upgrade nuclear command and control, and restore nuclear weapons R&D and production infrastructure. Moreover, successive US Nuclear Posture Reviews affirm that deterrence against a nuclear attack remains the fundamental but not the sole purpose of US nuclear weapons. Washington has affirmed the need for tailored nuclear capabilities in order to deter major conventional war, to counter catastrophic non-nuclear attacks, and to respond to an opponent's first use of nuclear weapons, thus reassuring allies concerned about the credibility of US extended deterrence commitments.

In assessing this renewed period of nuclear competition, analysts can thankfully engage a deep and expanding body of theoretical and historical knowledge. From this vantage point, the Russian-Ukraine war looms as the post-Cold War era's most notable example of the stability-instability paradox, a theory arguing that stability at the strategic level through Mutually Assured Destruction (MAD) engenders instability at lower levels of conflict. Pakistani-sponsored violence in Kashmir and against India fits this pattern – but so far on a smaller scale. By decreasing the chance of nuclear war, mutual second-strike capabilities have made it safer for aggressors like Russia to engage in provocations and warfighting at lower levels of violence. Russia's coercive nuclear threats aim to deter the US and NATO Allies from joining the war as fully-fledged combatants or significantly escalating its support of Ukraine. The Kremlin is ambiguous about its future course of action, as the thresholds it considers salient are unclear. Nonetheless, the goal is to intimidate opponents into exercising prudence and restraint all while Russia commits aggression. Ultimately, a leader like Putin does not need to convince his opponents that limited nuclear use is a plausible option; he needs only shape others' beliefs that he believes nuclear weapons have utility.³

At the war's outset, this form of nuclear signaling proved effective, as the Biden administration moved to reassure Russia that they understood direct confrontation meant World War III. President Joseph Biden publicly reckoned that the world was closer to "Armageddon" than any time since the 1962 Cuban Missile Crisis.⁴ Subsequently the administration pivoted to deter Russian nuclear use and strove to diminish the impact of Putin's saber rattling, warning the Kremlin that any use of nuclear weapons would bring on "catastrophic consequences".⁵

In case of Russia's limited nuclear use, informed analysts have set about to evaluate the merits of alternative responses, including a robust conventional response to take out significant Russian capabilities arrayed against Ukraine or a proportionate limited nuclear response to demonstrate resolve and deter further escalation. Doing nothing is the least likely option, as it would set a precedent that could undermine the credibility of US extended deterrence.⁶ It is worth pondering, then, to what extent the United States can stretch its extended deterrent to a partner like Ukraine – not to mention whether such behavior reinforces similar deterrent signals sent to China regarding aggression against Taiwan.

It is impossible to assess which strategic, behavioral, or perceptual factors will exert a greater impact on leaders' decision-making during nuclear crises. What is certain is that one should never fail to consider the non-employment of nuclear weapons in combat, or why the proverbial dog doesn't bark. Paradoxically there may be a tendency among nuclear leaders, given their awareness of the extreme dangers, for cautious behavior, to avoid going over the brink. This propensity contrasts not only with brinkmanship, but also with standard bargaining models that expect states to act assertively as well as behavioral models in which leaders take excessive risks because they see their situations as hopeless.⁷

Judging from his extensive comments, Putin grasps the objective facts of large-scale nuclear war and recognizes the condition of mutual vulnerability. Indeed, both Moscow and Beijing have persistently sought to persuade Washington to reaffirm the 1985 mutual

³ R. Jervis, How Statesmen Think: The Psychology of International Politics, Princeton, Princeton University Press, 2017, p.10.

⁴ K. Rogers and D. E. Sanger, "Biden calls the 'prospect of Armageddon' the highest since the Cuban missile crisis," *The New York Times,* 6 October 2022. https://www.nytimes.com/2022/10/06/world/europe/biden-armageddon-nucle-ar-war-risk.html

⁵ D. E. Sanger and J. Tankersley, "U.S. warns Russia of 'catastrophic consequences' if it uses nuclear weapons," *The New York Times,* 25 September 2022. https://www.nytimes.com/2022/09/25/us/politics/us-russia-nuclear.html

⁶ R. K. Betts, "Thinking about the unthinkable in Ukraine." *Foreign Affairs*, 4 July 2022. https://www.foreignaffairs.com/articles/russian-federation/2022-07-04/thinking-about-unthinkable-ukraine.

⁷ R. Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon*, Ithaca, NY: Cornell University Press, 1989; R. Jervis, "The Nuclear Age: During and After the Cold War," in Nuno P. Monteiro and Fritz Bartel, eds. *Before and After the Fall: World Politics and the End of the Cold War*, Cambridge: Cambridge University Press, 2021, chap. 6.

statement made by Reagan and Gorbachev, endorsed by all the world's "permanent five" (P5) nuclear states in January 2022, that "a nuclear war cannot be won and must never be fought". Still, both sides have their interests in reaffirming (or not) this mutual statement. Following the logic of the stability-instability paradox, Russia's behavior in Ukraine suggests that Moscow and Beijing seek to constrain the United States and NATO at the strategic nuclear level in order to open the door to assertive behavior below the nuclear threshold. On the other hand, it is also evident that Russia and China have long feared that the United States seeks to escape mutual vulnerability through technological innovations, which they consider to be undermining the foundations of nuclear deterrence.

So how fragile is this emerging multipolar nuclear world? China is approaching nuclear peer status and, in the worst case, may ally with a belligerent Russia. Meanwhile, nuclear threats from North Korea and potentially Iran are accelerating. Given the large and growing number of extended deterrence commitments, US and NATO planners will face difficult questions about escalation management, about whether existing nuclear forces are sufficient, and on whether evolving deterrence strategy will prove less credible and potentially undesirable if it fails to provide limited options and some measure of damage limitation. US Strategic Command (STRATCOM) is already grappling with the challenges of a tripolar nuclear power world – which its leadership defines as the political equivalent of trying to solve the "three body problem" in physics, one that requires a more "dynamic" and multi-domain concept of deterrence.⁸ In sum, the number of consequential challenges facing policy makers today and in the years ahead is large. To help address the wide range of questions and navigate the options, this volume published by the NATO Defense College and its Research Division contributes important new perspectives that demonstrate the vitality and value of a next generation of nuclear experts.

^{8 &}quot;SMD Symposium 2022," *Breaking Defense*, 11 August 2022. https://breakingdefense.com/2022/08/the-nuclear-3-body-problem-stratcom-furiously-rewriting-deterrence-theory-in-tri-polar-world/

Introduction

Pierre de Dreuz y and Andrea Gilli

In 2022, nuclear weapons have returned to centre stage in international politics. Russian President Vladimir Putin's faltering war against Ukraine has left him isolated, and with few options available he has brandished his country's nuclear sword in an attempt to compel Ukraine into submission and to deter the West from assisting Kyiv. His chilling nuclear rhetoric and signalling has plunged the Euro-Atlantic region back into the fraught politics of nuclear weapons and concentrated collective minds on the perennial problems of nuclear strategy.

The study of nuclear politics, then, has reemerged as a critical research agenda in security studies. Yet, compared to the Cold War, where the faceoff between East and West prompted significant interest in nuclear strategy, accumulated knowledge on nuclear strategy has arguably faded. At the NATO Defense College, we endeavour to contribute to bridging this intellectual gap. Every July, the NDC's Early Career Nuclear Strategists Workshop (ECNSW) brings together young nuclear scholars from both sides of the Atlantic to engage directly with senior nuclear scholars and NATO officials. We convene between 40 and 50 scholars and experts from a wide variety of backgrounds, giving junior scholars the opportunity to present their ideas and receive expert feedback.

This NDC *Research Paper* offers the fruits of the 2021 and 2022 editions of these workshop presentations. We are proud to publish this collection of six chapters authored by our workshop presenters and to share the forward-thinking arguments contained therein. Its contents are divided into three parts: nuclear weapons and emerging technology, extended deterrence in Europe, and arms control and non-proliferation.

To begin, Cameron Hunter opens with a discussion of nuclear strategy in an age of technological change. Hunter questions whether nuclear strategy in the 21st century is undergoing a shift, arguing that the challenges presented by technology today are eerily similar to those faced by our predecessors in the 1950s. Mining Bernard Brodie's seminal 1959 *Strategy in the Missile Age* for insights, Hunter concludes that technological determinism in nuclear deterrence is as misleading an approach to nuclear strategy as it was half a century ago.

Benjamin Silverstein then takes us to the emerging domain of outer space, exploring how novel means of coercion in space enable the world's great powers to compete with one another below the threshold of war. Without guidelines and communication between these powers, he argues, measures short of war in space could lead to misperception, escalation, and even war between the great powers.

Moving on to the subject of extended deterrence, Lydia Wachs examines the changed security context in Europe and asks whether US extended nuclear deterrence in the Euro-Atlantic region deserves an update. NATO's current nuclear posture in Europe, she argues, may not be enough to deter a weakened and increasingly desperate Russia, suggesting that new options should be examined to shore up deterrence and provide assurance for European NATO Allies.

Tom W. Etienne then dives into the domestic politics of nuclear use, exploring the partisan dynamics that underpin nuclear sharing in Europe. He examines whether divergent party politics between the United States and European Allies impacts host nations' willingness to use US nuclear weapons stationed on European soil. Using an original dataset surveying the Dutch public, Etienne concludes that partisan politics do in fact matter, raising questions about the sturdiness of the US deterrent in Europe.

In the final section, on arms control and non-proliferation, Oliver Barton brings us back to the Euromissile Crisis of the 1980s, demonstrating that patterns of US-Soviet arms control from this era resemble arms control dynamics between the US and Russia today. Through a careful examination of the archival record, Barton reveals how Soviet insistence on British inclusion in US-Soviet arms control ultimately led to tensions within NATO over the status of British nuclear forces. This, he argues, should serve as a historical warning, where similar demands made by Moscow today could impact future arms control negotiations.

Finally, J. Alexander Thew offers an analysis of the ill-fated Joint Comprehensive Plan of Action (JCPOA), the so-called "Iran Deal", arguing that the Deal, which the United States withdrew from in 2018, was likely doomed to fail from the start. By modelling the Deal using game theory, Thew aims to demonstrate that the Iran Deal resembled a Prisoner's Dilemma, whereby lack of trust, incomplete information, and commitment problems between the United States and Iran put the deal on shaky footing from day one. Nuclear weapons and emerging technology

Bernard Brodie's strategic theory in the third nuclear age

Cameron Hunter

"It is not always true that views which have passed out of vogue deserve to be forgotten" – Bernard Brodie¹

While by no means forgotten, today Bernard Brodie's strategic theory is not appreciated for its special relevance to 21st century nuclear politics. Brodie's body of work boasts the earliest articulation of how nuclear deterrence would come to dominate great power politics.² Brodie argued that nuclear deterrence is not primarily rooted in technical specifications but in the interplay of emotions, policy, and chance. He argued this under a fraught context of destabilising technological developments and little to no international agreement on how to restrain nuclear competition, yet he still concluded that the significance of technological change always follows from these overarching dynamics.

Brodie's counterarguments to now-forgotten ideas function as a guide to the intellectual fault lines among the "Wizards of Armageddon" before 1960.³ By addressing its critics, Brodie provides a masterclass in the nuances of deterrence itself. He thereby helps nuclear strategists discern when emerging technologies impact the viability of deterrence – and when they do not. Used this way, Brodie provides a latent critique of both excessively optimistic and fatalistic narratives of technology's impact on nuclear politics today. Brodie's time has important similarities to our present "Third Nuclear Age" (3NA), making his strategic theory unusually useful for today. Andrew Futter and Ben Zala argue that the

¹ B. Brodie, Strategy in the missile age, Princeton, Princeton University Press, 1959 [1965], p.227.

² B. Brodie, *The absolute weapon: atomic power and world order*, New Haven, Yale Institute of International Studies, 1946, p.62. See also Gregg Herken who argues Brodie "is responsible for popularizing 'deterrence' as it applied particularly to nuclear weapons" in "The not-quite-absolute weapon: deterrence and the legacy of Bernard Brodie", *Journal of Strategic Studies*, Vol.9, No.4, 1986, p.15.

³ F. Kaplan, The wizards of armageddon, Stanford, Stanford University Press, 1991; K. Young and W. Schilling, Superbomb: organizational conflict and the development of the hydrogen bomb, Ithaca, Cornell University Press, 2019, p.15.

3NA is characterised by unpredictable changes in technology and politics.⁴ Brodie is, of course, mostly silent on 21st century concerns around strategic non-nuclear weaponry or multipolar nuclear competition. Nevertheless, his career saw the emergence of atomic weapons and then later the maturation of guided missile technology, early-warning systems, and active defences. These are the predecessors of the current tranche of technologies forecast to "disrupt" contemporary stability. The impact of technological developments was uncertain then too, and Brodie's time was quite literally a textbook case of intense great power competition. Perhaps more than any other strategist since, therefore, the intellectual context of the "dean" of civilian nuclear strategists most resembles our own 21st century nuclear predicament.

This chapter draws out three key points from Brodie's most important text, *Strategy in the Missile Age*. The first is that, like any good Clausewitzian Brodie is not first and foremost concerned with weaponry but rather willing to pragmatically weigh the importance of political factors, chance, and emotions. The second point draws out Brodie's exposition of the impact of speed and precision in the nuclear age. Third, I explore Brodie's conceptual tests for determining whether a defence to nuclear attack will be possible. Brodie provides a clear path to identifying what thresholds technologies need to meet to challenge deterrence. I conclude by adopting Brodie's emphasis on cautious optimism about agency in nuclear policy, even in the face of seemingly intractable technological and political problems.

Clausewitzian scepticism of the centrality of technology

"Today the basic conditions of war seem to change almost from month to month. It is therefore hard for the professional soldier to avoid being preoccupied with means rather than ends" – Bernard Brodie⁵

Brodie analyses technical developments with a cool detachment that is sorely lacking in the "disruptive tech" narratives of the "Third Nuclear Age". Intellectually rooted in Clausewitz, *Strategy in the Missile Age* draws on the Dead Prussian's dismissal of attempting to elucidate every possible detail of military means as "absurd" and "pedantic".⁶ Importantly,

⁴ A. Futter and B. Zala, "Strategic non-nuclear weapons and the onset of a third nuclear age", *European Journal of Internation*al Security, Vol.6, No.3, 2021, pp.1-21. Jenny Naylor provides a similar argument, albeit more focused on technology and taking a more determinist position. See J. Naylor, "The third nuclear age", *Comparative Strategy*, Vol.38, No.4, 2019, pp.276-288.

⁵ Brodie, Strategy, p.17.

⁶ C. von Clausewitz, On War, O.J. Matthijs Jolles (trans.), in Caleb Carr (ed.), New York, *The book of war*, The Modern Library, 2000, p.351, p.359; see also D. Betz, "Clausewitz and connectivity", *Infinity Journal*, Vol.3, No.1, 2012, p.5.

neither theorist argued that technology is irrelevant to war, but rather that the significance of any technological change is ultimately relative to strategic and political factors. A classical Clausewitzian position does not exclude the possibility that technology can shape the specific strategic situation facing a decisionmaker but rather places technological factors in a subordinate position of importance to Trinity - passion, reason, and chance. Debates over the relevance or applicability of Clausewitzian theory to the so-called "Revolution in Military Affairs" of the late 20th century, for example, can in part be understood as fundamental disagreements on the role of chance and unpredictability in war.7 Brodie adopts a moderate techno-scepticism. In Strategy in the Missile Age, he does not entirely rule out another technological change on the scale of the atomic bomb, but it is clear that he saw no evidence that trends such as increasing missile accuracy or more capable active defence measures would invalidate his core commitment that nuclear wars would remain unwinnable. Despite this, his text is heavily caveated throughout, usually presenting a claim about the state of technology and strategy in the 1950s while also explicitly clarifying what kind of technological change would invalidate his argument. Invariably, these thresholds of technological capability have not been met in the half-century since. Brodie's advice not to become bogged down in endless discussions of technical means, but to approach strategic issues holistically (situating the specific situation in a broader philosophy of war), has therefore aged rather well.

Famously, Brodie did not dogmatically argue every technological development was irrelevant to strategy: he was one of the first to understand that nuclear weapons would necessitate a drastic shift in strategy if the great powers were to avoid disaster.⁸ Crucially, this central claim was rooted in his understanding of the mass-killing capabilities afforded by nuclear fission, and later fusion weapons. He wrote that "we have a situation for the first time in history where the opening event by which a great nation enters a war... can decide irretrievably whether or not it will continue to exist".⁹ Nor could the new type of weapon be used directly in a defensive role. In the past, offensive capabilities had an inherent defensive utility too but this was not the case for nuclear forces. However, even these technical ground-truths are contextualised by Brodie within a critique of contemporary military leaders' inability to accept "the most obvious consequences of the use of such weapons against us".¹⁰ That is, unacceptable damage in almost any scenario of nuclear use.¹¹ Within

⁷ Betz, "Clausewitz and Connectivity", p.5.

⁸ Brodie, Absolute Weapon, p.62.

⁹ Brodie, Strategy, p.7; see also pp.39, 148, 152.

¹⁰ Ibid, p.172, see also p.168.

¹¹ Ibid, p.227.

these passages, Brodie grasps that in practice, the strategist's wisdom is likely to be ignored in favour of institutional culture, a lack of willingness to think through policy choices to their logical conclusion, and a sense of helplessness in the face of technological change.¹² The challenge for nuclear strategists, both then and today, seems to be to correct these unhelpful tendencies where they run counter to the development of realistic strategies. Brodie is wise enough to know that simply being correct is not enough for these ideas to be put into practice because in reality "men's [sic] opinions have an importance apart from the facts that may or may not support them".¹³ In practice, opinions about nuclear technology often matter more than facts of technical specification.

Nuclear strategy, speed, and precision

Brodie was among the first generation of strategists to grapple with the potential strategic impact of "hypersonic" speeds for nuclear attack.¹⁴ He participated in the debates of the late 1950s on the strategic implications of the increasing speeds of weapons technologies.¹⁵ Even the earliest ICBMs could reach speeds of around Mach 20, well above the hypersonic threshold.¹⁶ Additionally, intercontinental cruise missiles of the time promised speeds of over Mach 3.¹⁷ Scientists and engineers had also gradually begun to prove the "accuracy sceptics" wrong,¹⁸ to the extent that Brodie could foresee a time when stationary launchers of any type would be vulnerable to missile attack.¹⁹ Today, strategists debate the future

¹² D. Rosenburg, "The origins of overkill: nuclear weapons and American strategy, 1945-1960", *International Security*, Vol.7, No.4, 1983, p.10.

¹³ Brodie, Strategy, p.324.

¹⁴ More than a simple similarity of speed, the time to target of these technologies at intercontinental range remains very similar. Furthermore, active defences were effectively strategically useless against ICBM attacks in the 1950s and 1960s, mirroring 21st century discourse that new hypersonic weapons systems are "unstoppable". See C. L. Tracy and D. Wright, "Modeling the performance of hypersonic boost-glide missiles", Vol.28, No.3, Science and Global Security, 2021, pp.135-170, 16 January 2021.

¹⁵ For example, Brodie, *Strategy*, p.194 (f.n.) referring to Miles, "The impact of high speeds on conventional strategy", *Interavia*, Vol.12, No.1, pp.30-32. Many thanks to my colleague, Ben Zala, for retrieving the original article from the archives on my behalf.

¹⁶ Minuteman Missile National Historic Site, "The minuteman IA & IB missiles", https://www.nps.gov/articles/minuteman-ia-ib.htm (accessed 28 September 2021). Note: the use of Mach numbers is for ease of comparison only – Mach has little utility for describing speeds in a near-vacuum.

¹⁷ B. Chertok, Rockets and people volume II: creating a rocket industry, Washington DC, NASA, 2006, p.232.

¹⁸ See D. Mackenzie, Inventing accuracy: a historical sociology of nuclear missile guidance, Cambridge, MIT Press, 1990, pp.61, 352-357.

¹⁹ Brodie, Strategy, p.220.

impact of hypersonic glide and cruise missiles. The questions of the two eras remain eerily consistent. Will warning or reaction remain possible? Will a disarming strike become thinkable?

Writing in 1946, Brodie had carefully explained that long range rockets without nuclear warheads were not superior to their fixed-wing competitors because they could deliver less destruction over time, despite the unique capability of a rocket to bypass enemy defences.²⁰ Even with the advent of nuclear-armed ballistic missiles, the US military establishment emphasised the superiority of the bomber arm.²¹ In an official 1958 Strategic Air Command (SAC) training film, for example, it is strange for modern viewers to see how dismissive SAC officers are of the impact of Soviet ICBM strikes during an all-out thermonuclear war.²² Such a view was not restricted to SAC. President Eisenhower had told the Joint Chiefs of Staff in 1956 that he did "not think too much of the ballistic missiles as military weapons".²³ In Brodie's time, it was not obvious to the military elite that the speed of ballistic missiles would make much of a difference in-and-of-itself. Perhaps the strongest argument for why ICBMs would remain of secondary importance to bombers was from the "accuracy sceptics" - those that argued missiles would remain so inaccurate that they could only ever be a marginal contribution to nuclear postures.²⁴ However, Brodie's contribution to the debate effectively side-stepped the questions of accuracy and speed and refocused his analysis on what it would mean in *political* terms.

Brodie's analysis of new levels of speed and precision in nuclear warfare were always tempered by a grounding in factors of chance, geography, and political objectives. While not dismissing the aspects of war that were likely to be changed by hypersonic delivery vehicles, Brodie ultimately brought his discussion back to questions of whether it would overturn his proposition of deterrence made in 1946. That is, that the costs of any nuclear war would be so great that deterrence was far more important than any considerations of "winning" wars. It was not the speed or precision of weapons enabled by emerging technologies that really challenged Brodie's 1946 proposition. Instead, it was the "almost insuperable" lack of effective defence to ICBMs that was the most important attribute of

²⁰ Brodie, Absolute weapon, p.57.

²¹ Phillip S. Meilinger, Bomber: the formation and early years of strategic air command, Montgomery, Air University Press, 2012, p.281.

²² USAF Air Photographic and Charting Service, *Power of Decision*, Reel 3, https://archive.org/details/AirForceSpecial-FilmProject416powerOfDecision/VTS_03_1.VOB (accessed 20 October 2022).

²³ As quoted in Rosenburg, p.46.

²⁴ In the early 1950s, the Atlas ICBM had a goal Circular Error Probable (CEP) of 5 miles, although USAF insiders demanded similar accuracy to bombers (a CEP of several hundred feet) to be deemed suitable. See Mackenzie, p.114 (f.n.) and p.115.

the new technology.²⁵ Retaliation could be slow and imprecise, and still deter.

Is a defence possible? Data integration, sensors, and interceptors

Concerns about technological change during a "Third Nuclear Age" are constituted at the intersection of remote sensors, networks, and strike capabilities.²⁶ Brodie wrote at a time when Soviet and American decisionmakers were moving away from a definition of "early warning" based entirely on relatively short-ranged radar detection and reliance on human intelligence. Emerging technologies of the time promised unparalleled data integration, processing, and rapid response times. Active defences seemed to be imminently maturing from unguided, short-range anti-aircraft artillery to networked, semi-automated anti-aircraft missiles. Serious people in the 1950s (albeit a minority) made arguments that the age of the bomber was over not because ICBMs were "better" but because active defences totally undermined the credibility of bomber attacks.²⁷ While developments in interceptor technologies – fighter aircraft, surface to air missiles (SAMs), and anti-missile missiles – were a key part of the debate, networks and sensors were also important to strategic planning in the 1950s. Brodie carefully analysed the potential for technological changes to these supporting systems and the weapons that would target them in order to assess whether nuclear victory might be possible in the future.

Brodie goes so far as to say that "Warning is the key of the entire defence problem".²⁸ In the 1950s, compiling disparate sources of data from human observation all the way to the most advanced early-warning radars posed a considerable data processing challenge. The very real possibility existed that a sensor (be it human or electronic) might detect an attack, but for that information to never reach a decisionmaker who could make use of it. The USAF placed its hopes (and its budget) on the Semi-Automatic Ground Environment (SAGE) System. SAGE utilised 1950s supercomputers to synthesise all of the early-warning data available to the US military into one human-comprehensible picture. The hope was to seamlessly link the early-warning mission into control of active defences, such as the BOMARC anti-aircraft missile.²⁹

²⁵ Brodie, Strategy, p.180.

²⁶ See for example K. A. Lieber and D. G. Press, "The new era of counterforce technological change and the future of nuclear deterrence", *International Security*, Vol.41, No.4, 2017, pp.9-49.

²⁷ J. Gavin, War and peace in the space age, New York, Harper, 1958, pp.4-5; Brodie, Strategy, p.219.

²⁸ Brodie, Strategy, p.184.

²⁹ T. Hughes, Rescuing prometheus, New York: Vintage Books: 1998, p.42-43.

Brodie exhibits a fairly good understanding of what SAGE hoped to achieve in *Strategy in the Missile Age.*³⁰ He was versed in the technical knowledge of the day and exhibited an open-mindedness to the possibility that, although very unlikely, technological developments might prove him wrong in the future. Developments in warning and active defences at the time did not lead Brodie to doubt his 1946 commitment to nuclear deterrence, however – even as he probably gave the effectiveness of SAGE more credit than it was due. Assessing the possibilities of SAGE, he remained committed to a holistic approach to strategic theorising, rather than becoming caught up in ever more fine-grained discussions of the means of war.

Brodie shows a laudable willingness to specify his definition of what a "successful" defence might be. He argues that a successful defence would need to be able to prevent any Soviet atomic weapons dropping on the US and certainly less than around 30.³¹ The definition is perhaps less important than the strategic theory Brodie deploys to draw his conclusion. Brodie makes a case that the emotional nature of war means that a few, or perhaps even one, atomic weapon used against a city would produce so much suffering as to be beyond human comprehension – beyond the ability of leaders to emotionally process.³² The unpredictable nature of war also features in Brodie's confidence that technology would not enable a successful defence against nuclear attack. An adversary could have very high certainty about how much retaliation might occur after a first strike and still be deterred by the possibility that a few bombs would evade defences.³³ Such technical realities are inevitably bounded by political factors, however. Brodie notes that if a defender had "extraordinary faith in technology" they might still rely on active defences, and such sociopolitical forces trump technical fact - at least until tested in war. Today, we might learn from this that debating what constitutes "unacceptable damage" may be a more useful focus of discussion than analysing specific technologies in a way that artificially separates them from politico-strategic context.

³⁰ Brodie, Strategy, p.196.

³¹ Ibid, p.225.

³² Ibid, p.76.

³³ Ibid, p.278, see also p.281.

Conclusion

Whether they are drawn in terms of fantasy or nightmare, phantasms of technological determinism are a major impediment to strategic thought. The core problems facing nuclear-armed states remain fundamentally unchanged from those faced by the Soviet Union and the United States in the 1940s, grounded as they are ultimately in the grim reality of nuclear weapons' mass killing capabilities.³⁴ In his own time, Brodie saw no reason to expect technology to provide a way out from this core predicament. Yet, he also refused to equate this with an end to strategic and political choice. In words that bear repeating today, he argues, it is important especially for the citizens of a great power like the United States to bear in mind that, within wide margins delimiting the choices available to us, what happens to us is largely affected by what we do.³⁵

These margins limiting action remain wide today. While unilateral or multilateral action may never deliver perfect security, or force the denuclearisation of hostile rivals, Brodie challenges us not to fall into fatalism. After all, he argues these limits on freedom of action are comparatively minor compared with the freedom of action great powers retain over their own strategic choices. Not every technology pursued by an adversary requires a corresponding new offensive or defensive system because many apparently impressive technical developments do not fundamentally change a strategic relationship between nuclear-armed states.

Equally, techno-optimism has a tendency to promise options outside of what is possible. Fantasies of victory in the nuclear age are folly³⁶ and it is not clear how the current niche of "new age of counterforce" thinking seriously tackles Brodie's argument.³⁷ Instead, it appears that 21st century counterforce advocates fundamentally disagree with Brodie on what constitutes "unacceptable damage". Brodie warns against nuclear strategies that promise a paltry form of "survival" and instead sets the bar much higher: the survival of key values, including personal freedom.³⁸ These kinds of normative motivations are alien to much of the contemporary policy-focused discourse on nuclear strategy. Brodie is confident enough to make the inherently normative claim that "nuclear war is to be avoided

³⁴ See T. Schelling, Arms and influence, New Haven, Yale University Press, 2008 [1966] for a similar argument about the core departure of the nuclear "age".

³⁵ Brodie, Strategy, p.233.

³⁶ Ibid, pp.258, 314, 347.

³⁷ See for example M. Kroenig, *The logic of American nuclear strategy: why strategic superiority matters*, Oxford, Oxford University Press, 2018; K. Lieber and D. Press, *The myth of the nuclear revolution: power politics in the atomic age*, Ithaca, NY, Cornell University Press, Ithaca, NY, 2020.

³⁸ Brodie, Strategy, pp.268-269.

at almost any cost".³⁹ Although he does mean "cost" partly in the financial sense of the term (only one step removed from outright normative concerns in any case), Brodie is not suggesting endless procurement of technology can deliver "perfect" deterrence. Effective deterrence, in practice, is grounded in the political activities of creating a subjective feeling in the mind of an adversary, to which choices of weapons systems and their supporting infrastructure must necessarily be a subsidiary concern.⁴⁰ This is a lesson that 21st century proponents of deterrence need to revisit, rather than be "preoccupied with means rather than ends".⁴¹

³⁹ Ibid.

⁴⁰ Ibid, p.397.

⁴¹ Ibid, p.17.

Above, but not beyond: characterising measures below the threshold of war in orbit

Benjamin Silverstein

States routinely practice hostile behaviours in Earth's orbits, using tools ranging from radiofrequency jammers that interfere with satellite communications to anti-satellite missiles that destroy test targets. Yet, no state has thus far indicted another of perpetrating acts of war in space. The absence of tacit or negotiated escalation thresholds in space raises the potential for misperception among competitors as states stretch the limits of acceptable behaviour in space. This condition complicates how states address and respond to hostile space behaviours that are not generally considered explicit acts of war.

Today, states use novel technology to amplify the coercive levers available to them. Blending time-tested tactics with new technologies elevates the relevance of the thresholds that separate peace and war. One recent US strategy document notes the heightened possibility of inadvertent escalation due both to a lack of these thresholds and competitors' penchants for employing "coercive approaches that may fall below perceived thresholds for US military action".¹

This chapter evaluates antagonistic space capabilities by using a rubric that examines measures short of war in other domains. Analysing measures short of war that states employ outside the space domain reveals that these behaviours share key characteristics across domains, in particular their ability to induce misinterpretation and miscalculation between competitors. As there are no globally established thresholds related to the use of these capabilities, disparities between aggressors' intent and victims' interpretations raises the risks of inadvertent escalation. States can gradually push the boundaries of acceptable space behaviours and determine implied thresholds, but such a process prolongs high-risk exposure to misinterpretation.

NATO can play an integral role in formulating widely accepted thresholds for space

¹ US Department of Defense, "2022 National Defense Strategy of the United States of America", 27 October 2022.

behaviour without magnifying escalatory risks. Working towards consensus among Allies would support consistent and credible strategies for deterring hostilities in space. The Alliance's refreshed space doctrine is a good first step. NATO can improve upon the status quo by fostering deeper space expertise among Allies while building consensus on how space hostilities might trigger collective defence under Article 5. An Alliance-wide space curriculum would also support a united front among Allies' domestic space policies and doctrine. It is vital that NATO undertake such an effort prior to being forced into action by crises.

A field guide to traditional measures short of war

Individual measures short of war range in severity. The least intense measures appear mundane while the most severe tactics toe the threshold of war. Assessments of these activities reveal several distinguishable features. Michael Mazarr's characterization of "gray zone aggression" is useful here. Such measures:

- fall below the threshold for military response
- unfold gradually
- are not attributable
- are justified by legal and political claims
- · threaten only secondary national interests
- · are state sponsored
- · employ mostly non-military tools
- exploit weaknesses and vulnerabilities in targeted countries and societies.²

Other qualities add nuance to this set. For instance, the consistency in how states apply coercion is a crucial factor.³ It is often impossible to discern how a specific measure short of war generates a discrete outcome or impacts strategic success.⁴ Measures short of war are generally single ingredients in coercive cocktails and may appear only obliquely

² M. Mazarr et al., What deters and why: applying a framework to assess deterrence of gray zone aggression, Santa Monica, CA, RAND Corporation, 2021.

³ B. Connable et al., Stretching and exploiting thresholds for high-order war: how Russia, China, and Iran are eroding American influence using time-tested measures short of war, Santa Monica, CA, RAND Corporation, 2016.

⁴ B. Connable et al., Russia's bostile measures: combating Russian gray zone aggression against NATO in the contact, blunt, and surge layers of competition, Santa Monica, CA, RAND Corporation, 2020.

related, if at all, to broader strategy. Aggrieved parties have relative latitude in interpreting specific measures short of war and may thus misinterpret these behaviours. Additional aspects include the legal status of the behaviour in question. Measures short of war are often un- or under-governed by legal frameworks surrounding interstate conflict. In the context of space, this complicates adjudicating interference with satellites as there is no consensus on what constitutes the "use of force" as per the UN Charter.⁵ In composite, these characteristics help interpret several space activities.

Measures short of war in space

Technological advances have widened the aperture of state competition in space. Pervasive military uses of space further smudges the line between "normal" non-violent behaviour and the doorstep of war. Civil or commercial activities might be entirely nonthreatening, but a state might have a drastically different interpretation of the same behaviour if it involved a military satellite. For instance, states may accept an unexpected close approach between civil satellites but stridently denounce a close approach involving a military satellite. Furthermore, attributing hostile interference in space to a particular actor can be complicated. The origin of interference may not be obvious, and the interference itself may not always be hostile or even intentional. These factors increase the likelihood of misperception and misinterpretation.

Satellite networks are inherently vulnerable to a variety of threats, including physical attacks, directed energy harassment, and electronic interference. States can interfere with rivals' space systems through several methods, ranging from destructive kinetic intercepts to radiofrequency interference.⁶ These modes of interference can be separated into kinetic and non-kinetic, and further divided to classify the nature and permanence of the action.

It is impossible to adjudicate all aggressive space activities, as several have yet to be used against adversaries (i.e., they have only been tested), confirmed by victims, or observed by the public. This reduces the significance of evaluating behaviours based on whether they instigated a military response or exceeded the threshold of war. This issue is most evident in the case of direct ascent kinetic anti-satellite interceptors (DA-ASATs). States

⁵ Amb. G. Patriota, Report by the Chair of the Group of governmental experts on further practical measures for the prevention of an arms race in outer space, New York, NY, United Nations, 2019.

⁶ States may also use cyber capabilities to disrupt satellite activities, but it is unclear if these attacks would, or should, be treated differently than targeting terrestrial data and cyber infrastructure. Cyber interference may be best addressed through broader cyber-specific efforts.

have only tested DA-ASATs; there is no evidence that destroying another's satellite would necessarily incite a military response. It is further unclear if the purpose of the targeted satellite would influence states' perceptions and reactions. In contrast, DA-ASAT tests have thus far not invited military responses. Kinetic intercept tests do not directly threaten any particular national interest but are objectionable due to the debris created.⁷ Because DA-ASAT testing does not reveal which satellites an adversary may attack in the future, testing objectives are open for interpretation. It is plausible that a test could be used to signal or coerce a competitor as a measure short of war.

Non-kinetic satellite interference includes directed energy tools such as lasers or microwave capabilities. Strong lasers can disrupt or permanently blind satellite optics, denying observations;⁸ high-powered microwaves can interrupt or permanently damage onboard electronic systems.⁹ These tools are not necessarily unattributable, but victims are sometimes able to control public narratives by not announcing or confirming they have been affected by hostile interference. Ascertaining successful non-kinetic attacks is difficult because they generally target internal components. Doubts about an attack's efficacy may incite an adversary to escalate to more forceful behaviour to achieve the same goals.

Electronic interference with signals emitted from and received by satellites is a pervasive feature of interstate competition. Excessive radiofrequency noise can jam the flow of recognizable data between a satellite and other nodes in the system. Spoofing introduces deliberately false radiofrequency data.¹⁰ Attribution to specific actors is often difficult, especially in conflict areas crowded by several factional adversaries. Consistency is key for many electronic interference techniques; because these measures are not permanent, they must be incessant to meaningfully disrupt normal service. The end goals of jamming and other types of electronic interference can be difficult to ascertain, and there are many plausible purposes, ranging from disrupting civil logistics to hindering troop movements or targeting. Thus, electronic interference could instigate misinterpretation among adversaries.

There are several nuances in each of the above cases, but some patterns are broadly evident. Temporary harassment reflects more of the characteristics of measures short of war than permanent methods of interference. Hostile interference with satellites such as dual-use command, control, and communications assets that serve both conventional

⁷ A. Panda, "The dangerous fallout of Russia's anti-satellite missile test", Washington, DC, Carnegie Endowment for International Peace, 17 November 2021.

⁸ G. Faulconbridge, "Russia uses new laser weapons in Ukraine, Zelenskiy mocks 'wonder weapon'", Reuters, 18 May 2022, Europe section.

⁹ E. Kania, "PLA's potential breakthrough in high-power microwave weapons", *The Diplomat*, 11 March 2017, Asia Defense section.

¹⁰ S. Erwin, "Space data used to detect sources of GPS disruptions", SpaceNews, 5 October 2021.
and nuclear missions may be misperceived or misinterpreted and carries severe risks of accidental escalation.

NATO's evolving perspective

Measures short of war in space are especially salient for the Alliance as it reviews its deterrence and defence posture in space. Often referred to as "hybrid threats" within NATO, defending against measures short of war does not fit neatly within the Alliance's three core tasks of deterrence and defence, crisis prevention and management, and cooperative security. At the 2014 Wales Summit, NATO Heads of State pledged to "ensure that NATO is able to effectively address the specific challenges posed by hybrid warfare threats, where a wide range of overt and covert military, paramilitary, and civilian measures are employed in a highly integrated design".¹¹ Successful implementation hinges on Allies' internal efforts; as NATO affirms, the primary responsibility to prepare for and respond to coercive hybrid threats rests with individual Allies.¹² As an organization, however, NATO has a distinct role in ensuring the Alliance cohesion and resolve in countering measures short of war. In concert, these steps enhance NATO's deterrent posture by improving military capability and political credibility. These same practices can support NATO's treatment of space.

NATO recently renewed its focus on space issues, elevating the domain during high level talks while adopting policy that guides how the Alliance addresses space. NATO's new overarching Space Policy explicitly supports discussions about "a range of potential options, for Council approval, across the conflict spectrum to deter and defend against threats to or attacks on Allies' space systems".¹³ In the 2021 Brussels Summit Communique, Heads of State agreed that decisions to invoke Article 5 in response to "[space] attacks [...] would be taken by the North Atlantic Council on a case-by-case basis".¹⁴

This approach has significant implications for how NATO contends with hostile space activities, beginning with recognizing the events that the North Atlantic Council (NAC) is most likely to consider. The range of hostile activities that might be referred to the NAC includes some activities that could be considered measures short of war. Highlighting the space activities that reflect the core characteristics of historic measures short of war can help the NAC proactively focus its deliberations.

¹¹ NATO, Wales Summit Declaration, 5 September 2014.

¹² NATO, "NATO's response to hybrid threats", 21 June 2022.

¹³ NATO, "NATO's overarching space policy", 17 January 2022.

¹⁴ NATO, Brussels Summit Communique, 14 June 2021.

Back to school with a new curriculum

Understanding which space activities are measures short of war can help NATO Allies develop sound deterrence and defence strategies. As intended by the Overarching Space Policy, Allies remain the collective enabler by both fielding space infrastructure used for Allied operations and by providing for the defence of those space assets. While NATO does not intend to develop its own space-based capabilities, the Alliance is procuring space-enabled services to support readiness and operations. Thus, interference or attacks would necessarily target sovereign or, in the case of the European Space Agency (ESA), an international organization's space assets.

The space assets available to the Alliance are not evenly distributed and are concentrated among a few states. Several Allies have neither national space agencies nor space experience through cooperative agreements with the ESA. Thus, there is a potential gap in space expertise among NATO Allies, a looming obstacle as the NAC prepares to field questions related to the invocation of Article 5 in space. Inequity challenges NATO's unanimity during both peacetime and crises.¹⁵ This condition erodes NATO's ability to develop and message credible resolve in deterring coercive space activities.

Thankfully, NATO has a proven roadmap that potentially outlines how to overcome this inequality. Just as Allies have uneven ownership of space-based assets, not all NATO Allies contribute nuclear weapons or participate in sharing arrangements. However, the long-standing primacy of nuclear issues within the Alliance coupled with institutional efforts to ensure non-nuclear Allies' education on nuclear issues has elevated the collective baseline of nuclear expertise. Applying this pattern of institutional focus and Alliance-wide education can help NATO develop a robust space doctrine over time. Strong policies and plans help the Alliance communicate credible resolve.

NATO has several options for developing space expertise across the Alliance. NATO is an ideal forum through which Allies could collaboratively develop cohesive models for deterring hostile space behaviours, which would in turn aid consensus building at the NAC and simplify critical debates by prescribing what types of space hostilities, if any, would trigger Article 5. With this deeper understanding, the NAC would be able to determine appropriate contingencies in the event Article 5 is not triggered. For instance, NATO may look to the commercial sector to procure on-demand space services that would fill in if Ally-operated satellites were disabled.

¹⁵ A. Gilli et al., "Strategic shifts and NATO's new Strategic Concept", NDC Research Paper 24, Rome, NATO Defense College, 2022.

All these paths have benefits and disadvantages. For instance, NATO is not likely to publicly communicate NAC-decided redlines in space, limiting the adversaries' perception of Allied resolve; space deterrence models are often hampered by cross-domain interests; and commercial space systems may be inappropriate for hosting nuclear command, control, and communications assets or other extremely sensitive needs. Nevertheless, an institutional effort to raise the baseline of space expertise among Allies is vital in achieving consensus on all three fronts.

NATO's way forward

Instances of adversarial space behaviours indicate that at least some hostile activities, however regrettable or distasteful, fall below the threshold of inciting major war. Using a rubric that identifies core characteristics of measures short of war in Earth-bound domains, it appears that certain space activities – specifically, temporary non-kinetic harassment of satellites and electronic interference of satellite signals – reasonably resemble the archetypal measure short of war. These activities remain unrestrained and could precipitate misperception, misinterpretation, miscalculation, and ultimately inadvertent escalation.

As on Earth, states and alliances must consider how to deter a broad spectrum of space behaviours. General deterrence is most effective when states clearly communicate their intent to protect core interests, bound commitments with stark thresholds, and reinforce the bounds of competitive relationships through decades of practice. Few relationships between states in space reflect all, if any, of those characteristics.

NATO can reduce the risks of costly misperception by facilitating improved space proficiency among Allies. A high baseline of expertise would likely streamline consultations on critical space issues when they arise, allowing the Alliance to respond to incidents more rapidly and decisively. This, in turn, helps the Alliance communicate credible resolve in deterring hostile space behaviours while still allowing for flexible response on a case-bycase basis, without public redlines.

At the strategic level, NATO's focus on space must permeate into broader guidance. Space weaves through nearly all Allied activities, and actions in space have wide ranging consequences for operations in and through other domains. NATO is adapting to an evolving threat landscape in which measures short of war have an outsized impact on Euro-Atlantic security and stability. NATO's strategy to counter the broad spectrum of coercive activities that fall below the threshold of major war must incorporate how the Alliance plans to address space-based hostilities. By focusing on the general characteristics of measures short of war, independent of domain, states can better tailor strategic guidance to address all forms of antagonism.

Extended deterrence in Europe

Limited nuclear options and extended deterrence: adapting to the changing strategic context

Lydia Wachs

The war in Ukraine marks a watershed moment for European security. Russia's belligerence and demonstrated willingness to alter the European security architecture has motivated NATO to bolster its conventional military capabilities. But the war has implications beyond conventional forces. As Russia's flawed military campaign in Ukraine continues and NATO takes steps to strengthen its military posture *vis-à-vis* Russia, Russian perceptions of its own conventional military inferiority will likely further deteriorate, increasing its reliance on nuclear weapons and its non-strategic nuclear arsenal in the coming years. Against this background, questions about limited nuclear use and the credibility of US extended deterrence in Europe deserve renewed scrutiny. Is US extended deterrence robust enough for the emerging Euro-Atlantic security environment? What role can US non-strategic nuclear weapons play to deter Russia?

In this article, I argue that a main task for NATO in the years ahead will be to maintain a robust deterrence posture *vis-à-vis* Russia, which will also serve as the basis for effective reassurance. To that end, a credible, non-strategic nuclear option remains essential, both to complicate Russia's risk calculus and to reassure Allies of continued US security guarantees.

The emerging strategic context in Europe

Russia's war in Ukraine has exposed Russia's conventional weakness. Following its war with Georgia in 2008, Russia launched a comprehensive reform of its military forces and used its involvement in the Syrian conflict to test new equipment and gain operational

experience.¹ Despite these improvements, Russia's operation in Ukraine demonstrates that structural problems in its military persist. And while the war in Ukraine continues to weaken Russia's conventional forces and capabilities, heavy sanctions imposed by Western nations will further hamper Russia's access to Western dual-use components, limiting its ability to replenish its arsenal.²

NATO is also likely to strengthen its force posture as a consequence of the war. A number of NATO countries have committed to increasing their defence budgets while Finland's and Sweden's accession to NATO will significantly improve the strategic military situation for the Alliance in the Baltic Sea region. This will help counter Russia's anti-access and area denial capabilities around Kaliningrad and reinforce Baltic NATO members' security.³ Furthermore, NATO is significantly strengthening its conventional posture on the Eastern flank.⁴

These efforts will bolster NATO's ability to defend the most exposed Allies, but it is still unclear whether this will enable a credible deterrence-by-denial posture *vis-à-vis* Russia.⁵ Moscow's operation in Ukraine has brought to light a number of inadequacies in Russia's military forces, but this should not lead to the conclusion that Russia is overall conventionally weak. After all, much depends on the context in which Moscow uses its forces and its operational planning assumptions. Furthermore, the war has not only demonstrated Moscow's unpredictability and proneness to miscalculation, but also underlined the Kremlin's revisionist ambitions in Europe, its willingness to take increased risks, and its ability to endure high costs to achieve its interests.

Beyond that, Russia's conventional campaign in Ukraine will likely impact its nuclear strategy.⁶ In the 1990s, Russia's perceived conventional inferiority in light of advanced Western precision strike capabilities motivated Russia to increase its reliance on nuclear deterrence and the threat of nuclear use early in a conflict. This position gradually shifted as Russia modernized its conventional capabilities and developed new conventional land-, sea- and air-launched missiles in the 2010s. While the assessed utility of nuclear weapons for deterrence and escalation management did not fade and Russia retained a

- 3 W. Alberque and B. Schreer, "Finland, Sweden and NATO membership", Survival, Vol.64, No.3, 2022, pp.67-72.
- 4 NATO, Strategic Concept 2022, Brussels, NATO.
- 5 Much will depend on how the war ends as well as a detailed assessment of Russia's strength and weaknesses and the outcome of NATO's continuing efforts.
- 6 L. Wachs, "Die Rolle von Nuklearwaffen in Russlands strategischer Abschreckung", *SWP Comment* No.48, Berlin, Stiftung Wissenschaft und Politik, 11 June 2020. https://www.swp-berlin.org/10.18449/2020A48/.

¹ A. Lavrov, "Russian military reforms from Georgia to Syria", Washington, DC, Center for Strategic and International Studies, 2018.

² J. Byrne et al., Silicon lifeline: Western electronics at the heart of Russia's war machine, London, Royal United Services Institute, 2022.

large arsenal of non-strategic nuclear weapons, the role of conventional strike options to deter and manage escalation short of nuclear employment increased. Russia developed a more holistic concept of "strategic deterrence", conceptualizing nuclear and non-nuclear means for deterrence.⁷ Also Russia's recent military doctrines suggest a higher threshold for nuclear use.⁸

The war in Ukraine could mark a shift in this policy. Russia's campaign has exposed the low effectiveness of its precision-guided weapons.⁹ With a dwindling inventory of these weapons and ongoing challenges to replenish its arsenal due to sanctions, Russia could increase its reliance on nuclear coercion, especially its non-strategic nuclear arsenal. This could lead to a lower nuclear threshold and a strategy resembling Russia's approach in the early 2000s, with a corresponding adaptation in its posture. If Russia does not already store nuclear warheads in Kaliningrad, for instance, Russian perceived vulnerability could cause it to strengthen its nuclear capabilities in the exclave bordering NATO.¹⁰ In addition, after the constitutional referendum in Belarus in February 2022 eliminating that country's nuclear-weapons-free status, Moscow could also deploy nuclear weapons on Belarussian territory.¹¹ In June 2022, President Putin and Alexander Lukashenko discussed this step.¹² Several questions seem unresolved, but the possibility of some sort of a Russian nuclear sharing arrangement with Belarus cannot be entirely discounted.

⁷ M. Kofman et al., "Russian strategy for escalation management", Washington, DC, Center for Naval Analyses, 2020; A. Sterlin et al., "Sovremennye Transformatsii Kontseptsyi I Silovykh Instrumentov Strategicheskovo Sderzhivaniya [Contemporary transformation of concepts and power instruments of strategic deterrence]", Voennaya Mysl", 2019.

⁸ Kremlin, "Ukaz Prezidenta Rossiyskoy Federatsii Ot 02.06.2020 G. No. 355" [Decree of the President of the Russian Federation of 02.06.2020. No. 355], http://kremlin.ru/acts/bank/45562 (accessed 26 May 2022); Kremlin, "Voyennaya Doktrina Rossiyskoy Federatsii" [Military Doctrine of the Russian Federation], 2014, http://static.kremlin.ru/media/events/files/41d527556bec8deb3530.pdf (accessed 26 May 2022).

⁹ D. Barrie, "Ukraine: Russia's air-launched cruise missiles keep coming up short", *Military Balance Blog*, London, International Institute for Strategic Studies, 1 April 2022.

¹⁰ Since 2017/18, Russia deploys nuclear-capable missiles in Kaliningrad. Although it has been renovating storage facilities for nuclear warheads, it remains unclear whether it has moved warheads there, see H. Kristensen, "Russia upgrades nuclear weapons storage site in Kaliningrad", Federation of American Scientists, 2018; CSIS, "Russia deploys Iskander missiles to Kaliningrad", 5 February 2018, https://missilethreat.csis.org/russia-deploys-iskander-missiles-kaliningrad-2/ (accessed 12 October 2022).

¹¹ W. Alberque, "Belarus seeks to amend its constitution to host Russian nuclear weapons", *Analysis*, International Institute for Strategic Studies, 4 February 2022.

¹² Kremlin, Meeting with President of Belarus Alexander Lukashenko, 25 June 2022, http://en.kremlin.ru/events/president/news/68702 (accessed 19 July 2022).

Biden's nuclear policy and deterrence and reassurance in Europe

Any limited nuclear use by Moscow in Europe would likely stem from the assumption that the United States lacked either the will or the appropriate means to respond and impose a high cost on Russia. Thus, to convince Russia that the costs of a limited nuclear use exceed any potential benefits, the United States must not only demonstrate sufficient resolve but also credible capabilities to respond to such a scenario.

US resolve to defend Allies, risking its own security, has always been contentious. During the Cold War, the relative economic and political importance of Western Europe lent greater credibility to Washington's commitment to follow through on its threat to defend its Allies with nuclear weapons. NATO's strategic geography and situation today as well as ongoing US steps to circumscribe the role of nuclear weapons in its declaratory policy and posture and the increasing US focus on the Indo-Pacific give greater reason to question US resolve.¹³

One could nevertheless argue that the Biden administration's response to the war in Ukraine rebuts perceptions of fading US resolve. By providing substantial military and economic aid to Ukraine – a country that is "not even" part of NATO – and by strengthening its troop presence in Europe, the United States has demonstrated its sustained interest in the region and its readiness to prevent a destabilization of the European order. At the same time, however, Russia's willingness to endure high costs in its quest to alter the post-Cold War order, as well as its ability to fight a conventional war in Europe under the shield of its nuclear deterrent, suggests that Russia could believe that its stake in a potential conflict with a Central or Eastern European NATO country would outweigh US resolve to defend its Allies.

In addition to stakes and resolve, appropriate military capabilities also factor into perceptions of the credibility of deterrence. Russia's non-strategic nuclear arsenal far exceeds NATO's limited options. Russia retains and has modernized a diverse arsenal of up to 2000 non-strategic nuclear weapons, launchable from air, sea, and land. In contrast, NATO's nuclear deterrence is primarily based on the 100 to 150 US non-strategic nuclear weapons, all of a single type (B-61 gravity bombs), that are deployed in Europe under NATO's nuclear sharing arrangement.¹⁴ Beyond that, the strategic arsenals of the United States, France, and the United Kingdom (UK) are of significant deterrent value. But while deterring Russia from a limited nuclear use in the European theatre with strategic weapons

¹³ J. Shifrinson, "Time to consolidate NATO?", *The Washington Quarterly*, Vol.40, No.1, 2017, pp.109-123; B. Roberts, "On adapting nuclear deterrence to reduce nuclear risk", *Daedalus*, Vol.149, No.2, 2020, pp.69-83.

¹⁴ A. Woolf, "Nonstrategic nuclear weapons", CRS Report, Washington, DC, Congressional Research Service, 7 March 2022, pp.23-25.

lacks credibility due to its extremely escalatory and potentially suicidal nature, the direct military value and deterrent effect of US non-strategic nuclear weapons is questionable. This is so for three reasons. First, the US non-strategic weapons are forward-based gravity bombs to be launched by host states' dual-capable aircraft (DCA), who would deliver them from well-known locations in Europe. This renders these weapons highly vulnerable to pre-emption. Second, the political coordination process within NATO - consensus decision-making - likely restricts their deterrent value vis-à-vis Russia. Third, due to Russia's modern air defence systems, it would be difficult to deliver these weapons to their targets.¹⁵ Suppression of enemy air defences (SEAD) operations could enhance the effectiveness of DCA missions but may themselves prove escalatory.¹⁶ The effectiveness of DCA missions and their deterrent effect is somewhat improving with the procurement of the F-35 fighter aircraft in several European air forces, but this will not solve the vulnerability of these weapons' basing locations and political coordination problems.¹⁷ Therefore, the politicalsymbolic function of nuclear sharing - coupling US and European security and providing a platform for nuclear consultations – remains significant. But its direct military value is questionable.

To increase the credibility of US extended deterrence against Russian limited nuclear use, however, it is not necessary to match Russia's capabilities.¹⁸ What is instead required is a robust limited option that would signal to Russia that NATO has the ability to respond to a Russian limited use, making it difficult for Russia to predict NATO's reactions and therefore the course of escalation. In this context, President Biden's decision to retain the W76-2 low-yield nuclear warheads for sea-launched ballistic missiles (SLBMs) is of importance.

Biden has long argued for a reduced role for nuclear weapons in US strategy. During his 2020 campaign, he promised to critically review US declaratory policy and posture, especially two non-strategic nuclear options that the Trump administration had introduced.¹⁹ This notwithstanding, his administration has decided against making major changes since entering office. While it eliminated a Trump-era programme aimed at developing a new nuclear-armed sea-launched cruise missile (SLCM-N) – a move criticised by a number of

¹⁵ G. Perkovich and P. Vaddi, *Proportionate deterrence: a model nuclear posture review*, Washington, DC, Carnegie Endowment for International Peace, 2021, p.53.

¹⁶ Ibid.

¹⁷ D. Barrie et al., Sub-optimal deterrence, SLCM-N and the US posture, London, International Institute for Strategic Studies, 6 May 2022.

¹⁸ R. Jervis, The illogic of American nuclear strategy, Ithaca, NY, Cornell University Press, 1984, pp.143-145.

¹⁹ L. Horovitz *et al.*, "Biden's proposal for a US 'sole purpose' nuclear declaratory policy", *SWP Comment* No.62, Berlin, Stiftung Wissenschaft und Politik, 23 December 2021.

Congress members – the Biden administration has opted to maintain the already deployed W76-2 low-yield warheads for SLBMs.²⁰

For different reasons, this option carries greater deterrent value. SLBMs are not vulnerable to pre-emption due to their mode of deployment. Besides being operationally survivable, SLBMs are on higher alert and can reliably penetrate air defences.²¹ Moreover, while the warheads are deployed on strategic delivery vehicles, their lower yield arguably renders them more usable. In a crisis, Russia might expect US leaders to shy away from employing strategic nuclear weapons due to their escalatory nature. Low-yield warheads still carry the risk of great damage, but Russia might be less sure of US leaders' restraint. Thus, the threat to use lower-yield weapons might be more credible than if the United States only had strategic nuclear weapons at its disposal.

While the deployment of low-yield warheads for SLBMs adds a capability that the United States does not already possess, the additional military value of developing and deploying nuclear-armed SLCMs is limited. The United States already possesses and is currently modernizing air-launched cruise missiles for bombers which have nearly identical military characteristics.²² These are not usually on alert and thus not a prompt response option, but in a potential crisis bombers would most likely already be in state of heightened readiness. Furthermore, the low-yield warhead on SLBMs already represents a limited capability that can penetrate Russian air defences. Lastly, the submarines on which the SLCM-N would be deployed are needed for conventional missions.²³ Thus, nuclear-armed SLCMs would add little flexibility while potentially weakening conventional deterrence.

To be credible, limited nuclear options must be proportional and not overly escalatory.²⁴ In this context, several critics have argued that Russia might have difficulties determining whether an SLBM was carrying a single low-yield warhead or high-yield warheads instead, leading it to respond with a strategic strike and thus risking general nuclear war.²⁵ However this discrimination problem is not new. The UK has deployed low-yield warheads atop

- 24 P. K. Davis et al., Exploring the role nuclear weapons could play in deterring Russian threats to the Baltic States, Santa Monica, CA, RAND Corporation, 2019.
- 25 V. Narang, "The discrimination problem, why putting low-yield nuclear weapons on submarines is so dangerous," in Policy roundtable: the Trump administration's nuclear posture review, *Texas National Security Review*, 2018.

²⁰ C. O'Brien, "Political brawl looms over nuclear cruise missile Biden plans to scrap", *Politica*, 13 April 2022; Executive Office of the President, *Statement of Administration Policy: S. 4543 – James M. Inhofe National Defense Authorization Act for Fiscal Year 2023*, The White House, October 2022, https://www.whitehouse.gov/wp-content/uploads/2022/10/S4543-NDAA-SAP.pdf (accessed 20 October 2022).

²¹ A. Long, "Nuclear strategy in an era of great power competition", in Policy Roundtable: The Trump administration's nuclear posture review, *Texas National Security Review*, 2018.

²² G. Perkovich, "Taxpayers should question the pitch to fund another naval nuclear weapon", Washington, DC, Carnegie Endowment for International Peace, 12 May 2022.

²³ Op. Cit., "Nuclear strategy in an era of great power competition".

Trident D5 missiles – the same missiles that the United States deploys – for decades. Furthermore, New START verification procedures and the general international political context should give Russia a good sense of whether it was facing a large-scale attack or a limited response.²⁶

Nevertheless, the escalatory nature of any given capability also depends on the targets it is supposed to strike. During the Cold War, NATO could threaten limited nuclear use against the territory of Soviet allies before having to strike the Soviet Union itself.²⁷ Today, while Russia could attack key military and infrastructure targets of European NATO countries – something arguably less escalatory than directly striking the US homeland – NATO would likely respond with a strike on Russian territory, therefore risking retaliation against US territory.²⁸ Deploying more capabilities, therefore, will not solve the problem that a US president might hesitate to use nuclear weapons due to the risk of uncontrolled escalation. But this is the dilemma of deterring limited nuclear use – to be credible, a capability must be appropriate and employable but also risk setting off a greater escalation dynamic. As Elbridge Colby writes, "the distinct prospect that any nuclear use might well lead to cataclysm was and remains a vital component of effective deterrence".²⁹

In the end, credibility hinges on an adversary's perception. What a credible limited option can engender is greater uncertainty in the adversary's mind about whether and how the United States would respond to Russian limited use. This would thus manipulate nuclear risk at lower levels of escalation. In that sense, Biden's decision to retain low-yield warheads on SLBMs – despite his disarmament goals – can help redress any potential doubts in Moscow about the capability and resolve of the United States to defend NATO's interests and to respond to limited use, convincing Russia that a conflict would not remain confined.

Beyond that, Biden's decision is also of importance for reassurance. Effective reassurance is based on robust deterrence. With the war in Ukraine, and Russia's ability to shield a conventional campaign under nuclear threats, NATO Allies (especially on the Eastern flank) may increasingly question the desirability of strategic stability between Russia and the Unites States. While it is difficult to judge whether Russia's invasion of Ukraine makes a similar scenario involving a NATO country more likely, threat perceptions

²⁶ A. Long, "Discrimination details matter: clarifying an argument about low-yield nuclear warheads", *War on the Rocks*, 16 February 2018.

²⁷ Although NATO always signaled that Soviet territory would remain no sanctuary. Josef Joffe, "NATO and the dilemmas of a nuclear alliance", *Journal of International Affairs*, Vol.43, No.1, 1989, p.37.

²⁸ As an arguably less escalatory alternative, the United States could only conduct a demonstration strike against Russian naval assets or strike Belarus.

²⁹ E. Colby, "The United States and discriminate nuclear options in the Cold War", in Jeffrey A. Larsen (ed.), On Limited Nuclear War in the 21^a Century, Stanford, CA, Stanford University Press, 2014, p.71.

and concerns about Russian nuclear blackmail will likely increase. Thus, in the fluctuating security environment decisions about US nuclear declaratory policy and posture are of even greater concern for Allies and an indicator of the credibility of US commitments. In this sense, Biden's decision to keep a credible non-strategic option alongside the nuclear sharing arrangement has the potential to strengthen Allies' trust in US security guarantees.

Conclusion

In the increasingly confrontational security environment in Europe, a credible nonstrategic nuclear option is essential to both challenge Russia's own nuclear strategy and to reassure US Allies. But it will not be enough to put the onus for developing credible tailored deterrence strategies on the United States. After years of neglect, today's threat environment demands renewed attention to the possibility of escalation dynamics that threaten to cross the nuclear threshold in Europe. As the rise of China will sooner or later pull US attention and military resources to Asia, more must be done by Europeans to determine ways to preclude such dynamics. As a recent report by the Zurich Center for Security Studies has underlined, military burden sharing should be complemented by intellectual burden sharing.³⁰ Specifically, European NATO states should try to reach a better understanding of the future threat posed by Russia and the impact of the war in Ukraine on Russia's deterrence policy and posture. Furthermore, as NATO is strengthening its conventional posture, Allies in Europe should give more attention to the question of how a more robust conventional posture and limited nuclear options can jointly strengthen deterrence vis-à-vis Russia and raise the nuclear threshold. Addressing these questions is of vital importance for European NATO countries, as it directly affects their security. Beyond that, avoiding these questions could lead Europe to become a sidelined spectator to US policy. Historically, European Allies sought nuclear sharing not least due to the institutional framework that allowed them a say in nuclear deterrence issues in Europe. Yet, one likely reason why the Trump administration sought sea-based platforms was to circumvent host nation support and domestic controversies in Europe. Thus, nuclear sharing states should seize renewed public interest in security and defense issues to engage more deliberately with questions of deterrence and defense, both within the Alliance and amongst their domestic publics. Otherwise, they risk losing their influence on US and NATO nuclear policy altogether.

³⁰ A. Péczeli et al., Redesigning nuclear arms control for new realities, Zurich, Centre for Security Studies, 2021.

US Government ideology and Dutch support for the use of nuclear weapons

Tom W. Etienne *

The North Atlantic Treaty Organization's (NATO) nuclear deterrence posture depends on the "maintenance of a credible military capability and strategy with the clear political will to act".¹ This chapter addresses a potential weakness in this posture stemming from domestic political considerations amongst Europe's nuclear sharing Allies.

The Nuclear Planning Group (NPG) is tasked with formulating NATO nuclear strategy decisions via consensus.² While all represented Allies technically possess a veto in this forum, the United States would presumably seek a leadership position whenever the use of nuclear weapons is considered. Nuclear sharing countries' voices would be subsequently amplified when decision-making pertains to weapons stationed on their soil. If a unanimous NPG decision to use the sharing weapons materialises, the US President would order the release of the B-61 weapons stationed European soil, and the respective Ally's dual-capable aircraft (DCA) would deliver the weapons under SACEUR (Supreme Allied Commander Europe) command. While these specifics are governed largely through bilateral agreements, this framework is often characterised as the "dual key".³

In a nuclear crisis – and particularly in case transatlantic relations deteriorate or political interests diverge – nuclear sharing states' national leaders may find themselves facing domestic opposition and political backlash, while simultaneously feeling compelled to comply with US demands. This may lead them to weigh conflicting considerations in approving their military's use.

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¹ NATO, "Allied Administrative Paper AAP-06, Edition 2019", 2019.

² NATO, "NATO's nuclear sharing arrangements", Factsheet, February 2022, https://www.nato.int/nato_static_fl2014/assets/pdf/2022/2/pdf/220204-factsheet-nuclear-sharing-arrange.pdf

³ A. Mattelaer, "Nuclear sharing and NATO as a 'nuclear Alliance", in S. Frühling and A. O'Neil (eds.), Alliances, nuclear weapons and escalation: managing deterrence in the 21^a century, 1st ed., Canberra, ANU Press, 2021, pp.123-131.

This chapter investigates the extent to which popular Dutch political alignment with the US government predicts approval of a US request to deliver nuclear weapons stationed in the Netherlands. Out of the five nuclear sharing Allies, the Netherlands displays the highest frequency of pertinent parliamentary debate on the topic of nuclear sharing.⁴ The country therefore provides a principal case to study the effect of public opinion on nuclear policy decisions. This study finds that agreement is higher when such a request comes from the Democratic Party than when it comes from the Republican Party, and that even the most right-wing Dutch citizens on average are more willing to comply with Democratic demands than with Republican demands.

The political history of nuclear sharing in the Netherlands

Nuclear sharing arrangements between the US and European countries were first put in place in the 1950s and 1960s. The Dutch nuclear sharing agreement was formalized in 1960 after negotiations between the Republican administration of US President Dwight Eisenhower. At the time, the governing Dutch centre-right coalition consisted of three parties belonging to the Christian religious pillar, all of which would later merge into the present-day Christian Democratic Appel (CDA), as well as the centre-right People's Party for Freedom and Democracy (VVD). The Netherlands first extended the invitation for the arrangement in 1956 to the US through its then Defence Minister Kees Staf,⁵ a member of the Christian Historical Union (CHU), which at the time was in a centre-left coalition with both of its Christian sister parties and the Labour Party (PvdA).

The Netherlands is, at the time of writing, governed by a four-party coalition consisting of the Christian Union (CU), CDA, a liberal centrist party (D66), and the centre-right VVD. These parties maintain divergent attitudes regarding nuclear non-proliferation. D66 and CU, who are traditionally opposed to nuclear weapons, advocated for accession to the Treaty on the Prohibition of Nuclear Weapons (TPNW) during the 2021 election campaign, encouraged by their electorates, of which a majority is in favour of unilateral accession. CDA and VVD electorates, in contrast, are mostly opposed to unilateral TPNW accession.⁶

⁴ M. Onderco and R. Joosen, "Nuclear weapons in the tweede kamer: analysis of nuclear motions in the Dutch House of Representatives in times of contestation", *Global Studies Quarterly*, Vol.2, No.3, 20 July 2022.

⁵ C. Wiebes and W. Burr, "US nuclear weapons in the Netherlands: a first appraisal", Washington, DC, George Washington University - National Security Archive, 15 January 2021.

⁶ M. Onderco et al., "When do the Dutch want to join the Nuclear Ban Treaty? Findings of a public opinion survey in the Netherlands", *The Nonproliferation Review*, Vol.28, No.1-3, pp.1-15.

In fact, in its 2021 electoral platform, VVD was the sole party to explicitly endorse the Dutch Air Force's nuclear mission within NATO.⁷ This divide is visible in the coalition's governing agreement, which states its intention to contribute to a world free of nuclear weapons immediately followed by an explicit recognition of Alliance responsibilities.⁸

The role of ideology in policy agreement

Such elite positioning and rhetoric impact the way the public forms opinions. People generally view policy decisions more favourably when they come from a party they support.⁹ Similarly, such support wanes if a position is adopted by an opposing party.¹⁰ Parties can shift voters' positions by presenting frames that resonate with their voters' pre-existing beliefs,¹¹ and, stronger yet, certain party loyalists adopt positions that contradict their ideological convictions if those positions are supported by their party.¹²

Even though elite positions are not the sole source of the public's opinions¹³ and citizens can incorporate substantive information even when presented with party cues,¹⁴ polarization encourages partisan motivated reasoning, the process by which people are more inclined to seek out information that is consistent with their beliefs and political identity¹⁵ and more heavily scrutinize information that is not.¹⁶

While there is no direct equivalence between the two dominant parties in the US and

12 M. Barber and J. C. Pope, "Does party Trump ideology? Disentangling party and ideology in America", *American Political Science Review*, Vol.113, No.1, February 2019, pp.38-54.

⁷ D. Zandee and N. Broeders, "Veiligheid En Defensie in de Verkiezingen: Tussen Ambitie En Realisme", *Atlantisch Perspectief* 45, No.1, 2021, pp.10-16.

⁸ VVD et al., "Coalitieakkoord 2021 – 2025: Omzien Naar Elkaar, Vooruitkijken Naar de Toekomst", The Hague, 15 December 2021, https://open.overheid.nl/repository/ronl-f3cb0d9c-878b-4608-9f6a-8a2f6e24a410/1/pdf/coalitieakkoord-2021-2025.pdf.

⁹ G. L. Cohen, "Party over policy: the dominating impact of group influence on political beliefs", *Journal of Personality and Social Psychology*, Vol.85, No.5, November 2003.

¹⁰ J. N. Druckman, E. Peterson, and R. Slothuus, "How elite partisan polarization affects public opinion formation", *American Political Science Review*, Vol.107, No.1, February 2013, pp.57-79.

¹¹ R. Slothuus, "When can political parties lead public opinion? Evidence from a natural experiment", *Political Communication* 27, Vol.27, No.2, 14 May 2010, pp.158-177.

¹³ J. L. Gibson, G. A. Caldeira, and L. Kenyatta Spence, "Why do people accept public policies they oppose? Testing legitimacy theory with a survey-based experiment", *Political Research Quarterly* 58, No.2, 1 June 2005, pp.187-201.

¹⁴ J. G. Bullock, "Elite influence on public opinion in an informed electorate", *American Political Science Review*, Vol.105, No.3, August 2011, pp.496-515, https://doi.org/10.1017/S0003055411000165

¹⁵ T. Bolsen, J. N. Druckman, and F. Lomax Cook, "The influence of partisan motivated reasoning on public opinion", *Political Behavior*, Vol.36, No.2, 1 June 2014, pp.235-262.

¹⁶ Z. Kunda, "The case for motivated reasoning", Psychological Bulletin, Vol.108, 1990, pp.480-498.

the several parties represented in the Dutch parliament, there are nevertheless important ideological parallels that allow for meaningful comparison. Relying on the Comparative Party Manifesto's left-right scores for the US and Dutch parties,¹⁷ I hypothesize that leftwing and centrist electorates will be more open to a Democratic request, whereas only the right-most citizens will be more inclined to support a Republican request. Additionally, I hypothesize that ideological distance between the respondent and the US party requesting the weapons' use will influence approval of such a request.

Method

Data

To test these hypotheses, a survey experiment was fielded in June 2022, when the Russian invasion of Ukraine reached an inflection point. The non-probability sample data was collected by the Kieskompas – Election Compass research institute, a Dutch polling company that works within the ethical norms of the Vrije Universiteit Amsterdam. A total of 1,520 respondents participated in the experiment. To offset common biases of such non-probability samples,¹⁸ I applied a poststratification and iterative proportional fitting weighting procedure.¹⁹ This experiment was pre-registered.²⁰

Experimental design

In this experiment, respondents were first presented with a hypothetical scenario in which Russia had executed a demonstrative nuclear detonation above the Black Sea close to the Ukrainian coastline to show resolve regarding its current invasion of Ukraine. It should be noted that this hypothetical was embedded in a larger experiment that also varied the ideology of the Russian government after a coup had taken place in the country.²¹

20 https://osf.io/ka69g

¹⁷ A. Volkens *et al.*, "The manifesto data collection, Manifesto project (MRG/CMP/MARPOR), version 2021a", Berlin, Wissenschaftszentrum Berlin für Sozialforschung, 2021.

¹⁸ T. Etienne, "The persistent nature of differential participation at different phases of nonprobability sampling", 2021.

¹⁹ A. Mercer, A. Lau, and C. Kennedy, "For weighting online opt-in samples, what matters most?", Washington, DC, Pew Research Center, 2018.

²¹ T. Etienne, "Ideology and the red button, part 2: how ideology shapes nuclear weapons use preferences in Europe", in *Session 5 - Major Powers and Nuclear Challenges*, Early-Career Nuclear Strategists Workshop, NATO Defense College, Rome,

Respondents were then randomly presented with a hypothetical request from either the Democratic or the Republican Party in the US Congress to use American nuclear weapons stationed in the Netherlands to conduct a similarly demonstrative explosion above an unspecified, unpopulated area in response to Russia's demonstrative nuclear explosion. A demonstrative second strike has previously shown to elicit relatively high approval among the Dutch population²² and would thus facilitate analysis. I opted to present the parties in Congress requesting the use of the weapons, rather than the executive branch, due to the difficulties that would surface in attempting to convincingly manipulate the partisanship of the sitting US President. The Ukraine crisis, furthermore, provides a credible scenario where both parties in Congress press President Biden to enact more assertive policy.²³ Respondents were debriefed after completing the experiment.

Measures and models

I asked respondents to what extent they agreed with the respective US political party that the weapons stationed in the Netherlands should be used to execute a similar demonstrative nuclear explosion above an unspecified unpopulated area. Answers were given on a sixpoint Likert-scale ranging from "strongly disagree" (1) to "strongly agree" (6), which, for the purposes of this research paper, were subsequently binarized into agreement (1) and disagreement (0) to allow for more policy-relevant interpretation.

As an inclusion criterion, I asked how respondents rated both US parties' ideology on an 11-point left-right scale. Respondents who rated the Democratic party as more rightwing than the mean of the Republican party's evaluation (7.3) and respondents who rated the Republican party more left-wing than the mean of the Democratic party (4.9), and respondents who rated the Democratic party as more right-wing than the Republican party were excluded, resulting in a dataset of 1,129 respondents which was subsequently reweighted.²⁴ Respondents placed themselves on the same left-right self-placement scale.

Hawkishness is included in some models as a control and constructed as an index based on 5 items, such as "military power is the best way to ensure world peace." All data and analyses can be found on OSE²⁵

^{2022.}

²² M. Onderco, T. W. Etienne, and M. Smetana, "Ideology and the red button: how ideology shapes nuclear weapons' use preferences in Europe", *Foreign Policy Analysis*, Vol.18, No.4, 1 October 2022.

²³ R. Bade, "POLITICO playbook: something unusual is happening between Biden and Congress", Politico, 14 March 2022.

²⁴ Inclusion of all respondents yields substantively similar results.

²⁵ https://osf.io/vuhc8/files/osfstorage

In the next section, I first describe the effect of which US party requests the use of the weapons on the willingness of the Dutch to comply using a simple t-test. I continue by comparing the pattern of support over the left-right self-placement scale through a logistic regression (model 1). Similarly, I will parse out the effect of ideological distance, which is calculated as the absolute value between a respondent's placement of either US party on the left-right scale and their self-placement on that same scale (model 2).

Findings

The experiment shows that a request made by the Democratic party is significantly more favourably received than a request by the Republican party (p < 0.001), with 29 percent support when the request came from the Democrats and 20 percent support when the request came from the Republicans in Congress.



Regressing agreement to use the nuclear weapons on respondents' left-right selfplacement²⁶ demonstrates that this effect is perpetuated along the entire ideological spectrum, with a Democratic request consistently yielding a higher probability of agreement than a Republican request, although not significantly so. Despite allowing for interaction effects between the requesting party and respondent ideology in this model, even respondents

²⁶ Logistic regression model 1: agreement= $\beta_0 + \beta_1$ *ideology+ β_2 *ideology/2+ β_3 *party_US+ β_4 *ideology*party_US

on the far-right are more inclined to comply with a Democratic request. This finding remains when controlling for hawkishness, thus providing evidence for the hypothesis that a Democratic request is met with higher approval than a Republican request, but not for the hypothesis that the Dutch far-right is more inclined to approve of a Republican request.



When considering the same question in a partisan framework rather than on the ideological scale, similar patterns emerge. The figure below displays the average agreement for the four Dutch coalition parties' electorates as well as for opposition on the left and for opposition on the right. These results show that support for nuclear weapon use is higher among all electorates when the request comes from the Democratic Party compared to when it comes from the Republican Party. Coalition party electorates agree significantly more with the request on average than opposition parties (28 percent compared to 22 percent respectively, p = 0.03).



Agreement to use NWs, by which US party requests their use

A logistic regression model²⁷ regressing approval on absolute ideological distance shows that as people consider the requesting political party ideologically more distant, they are less supportive of the party's request. While the difference between the Democratic party and the Republican party requesting the nuclear weapons use is not significant, the figure below shows the significantly declining slope with respect to absolute ideological distance. Furthermore, as respondents consider the party equivalent to themselves on the left-right selfplacement scale, the predicted probability that they approve of the use of nuclear weapons is nearly identical at 36 percent for the Republican party and 37 percent for the Democratic party. This decreases to 13 percent and 26 percent respectively when respondents consider themselves ideologically the furthest removed from the respective requesting party.



27 Logistic regression model 2: agreement= $\beta_0 + \beta_1^*abs(distance) + \beta_2^*party_US + \beta_3^*abs(distance)^*party_US$

Discussion

These results show that that a request to use US nuclear weapons to retaliate against a demonstrative nuclear strike by Russia is more likely to be met with approval when coming from Democrats in Congress than when coming from Republicans. Interestingly, this favourability towards a Democratic request persists across the entire ideological spectrum, with the far-right still more inclined to comply with the Democratic request. In addition, the results demonstrate how perceived ideological distance between Dutch voters and the US parties decreases the probability of agreement with the request.

Should the current Dutch coalition be asked to use the Dutch military's DCA to deliver the weapons stationed on Dutch soil under the sharing arrangements, then their electorates are on average more approving than the opposition's electorates. On the other hand, the different coalition parties' voters are not homogenous in this sense, thus potentially presenting pressure on some coalition members to oppose such a decision, perhaps further bolstered by the opposition's disapproval.

The implication from these findings is that political divergence between the US and the European nuclear sharing allies may pose a threat to NATO's deterrence posture. With a Democratic President in the White House, these results can simultaneously be interpreted as comforting in light of the current crisis in Ukraine, but nevertheless signal a potentially exploitable weakness in NATO's deterrence posture, as politics on both sides of the Atlantic become more polarized and populist.²⁸ In an extended interpretation of these findings, given the unanimous nature of NPG decision-making, similar weaknesses can be projected onto any NATO member state's domestic political dynamics.

Weaknesses of this study

While this study proffers an informative framework to consider political pitfalls of NATO's deterrence posture as it relates to its nuclear sharing arrangements, it also has drawbacks that readers should consider when interpreting its findings.

Specifically, even though the survey was fielded during Russia's invasion of Ukraine, a US request to use nuclear weapons stationed in the Netherlands would likely only come at a time of severe escalation. When that situation presents itself, we can assume a substantial

²⁸ O. Meier and M. Vieluf, "Upsetting the nuclear order: how the rise of nationalist populism increases nuclear dangers", *The Nonproliferation Review*, Vol.28, No.1-3, 2022, pp.13-35.

rally-around-the-flag effect, which could shift the results from this study towards higher levels of agreement with either party. The use of nuclear weapons is a relatively low-salience topic, generally considered insulated from public opinion in part due to limited knowledge on the public's side.²⁹ These results may be indicative of such unfamiliarity. Additionally, Allies other than the Netherlands may not necessarily display similar dynamics.

Furthermore, this study cannot separate the effect of partisan credibility from ideological distance, nor can it determine if the results would transfer to requests made by the US President as opposed to parties in Congress. It is, however, possible that respondents took into consideration that the White House is currently occupied by President Joseph Biden, a Democrat, which may further sway results in favour of the Democrats. Simultaneously, respondents may have related Donald Trump to Republican manipulation. Cue theories have furthermore suggested that decisions that contradict party brand are considered as stronger signals.³⁰ Additionally, this study disregards framing effects, thus assuming that both the Democratic Party and the Republican Party present similar arguments supporting their request. The literature on political cues and framing, however, stresses the importance of arguments brought forward in position-taking as well as these arguments' strength.³¹

Lastly, the sample used for the quantitative analyses in this study is not optimally fit for drawing precise descriptive inferences. While the applied weighting techniques offset in part the biases inherent to samples like these, they do not guarantee precision.

²⁹ P. Beattie and D. Snider, "Knowledge in international relations: susceptibilities to motivated reasoning among experts and non-experts", *Journal of Social and Political Psychology*, Vol.7, No.1, 2019, pp.172-191.

³⁰ E. N. Saunders, "Leaders, advisers, and the political origins of elite support for war", *Journal of Conflict Resolution*, Vol.62, No.10, 1 November 2018, pp.218-249.

³¹ Op. cit., "How elite partisan polarization affects public opinion formation"; R. Slothuus and C. H. de Vreese, "Political parties, motivated reasoning, and issue framing effects", *The Journal of Politics*, Vol.72, No.3, 2010, pp.630-645.

Arms control and non-proliferation

"No special privileges"? British nuclear forces, transatlantic relations, and arms control

Oliver Barton

Based on recently released archival evidence, this chapter examines British anxieties about the potential impact that arms control during the 1980s could have had on Britain's nuclear forces. It focuses on the months leading up to the controversial deployment of a new generation of US intermediate-range nuclear forces (or INF) in Western Europe in December 1983. While preparing for these new deployments, the United States was engaged in arms control talks with the Soviet Union, with the expressed aim of eliminating all INF, both US and Soviet. By mid-1983, these negotiations were deadlocked. Although the negotiations only dealt with INF and not strategic forces, the Soviets blamed the exclusion of British and French nuclear forces from the negotiations for the impasse. Britain's European Allies came under growing pressure from a reinvigorated anti-nuclear movement to kick-start the negotiations. Germany and other European Allies in turn put pressure on Britain and France to explain how and when they might contribute to multilateral arms control in the hope that this would help convince their publics that the Soviets, not NATO, were responsible for sabotaging the negotiations.

The British faced a dilemma. Either they could concede to Allied pressure or they could resist and draw ire from their Allies, if not undermine Allied support for the INF deployment programme itself. Ultimately, the British chose to give as little ground as possible. In this chapter, I argue that the British made this choice for fear that clarifying when they might be prepared to accept legally binding limits on their nuclear force risked a slippery slope that could compromise the viability and credibility of Britain's independent strategic deterrent. Ultimately, preserving Britain's nuclear force trumped wider Alliance considerations.

Background

On 26 June 2020, in response to repeated calls by the Trump administration for China to join negotiations for a successor to New START, the Russian Deputy Foreign Minister Sergei Ryabkov told the TASS news agency that "we insist that the United States' closest NATO Allies possessing nuclear weapons should join these hypothetical talks".¹ In so doing, Ryabkov revived a long-standing Russian claim that so-called third-party systems must be included in the arms control process if negotiations were to result in significant reductions in US and Russian stockpiles. The Russian government made similar claims after the British government recently announced an increase in the cap on the size of the British nuclear stockpile.²

Such claims date back to the start of the first strategic arms limitation talks (SALT I) in 1969, when the Soviets called for limits on the transfer of nuclear delivery systems to third-parties.³ Such constraints jeopardised the future of the UK's strategic deterrent, since the United Kingdom was entirely dependent upon the United States for providing it with the ballistic missile technology upon which the British nuclear force relied. To the British government's immense relief, the Soviets agreed to defer the issue of British and French nuclear forces in order to secure an arms control agreement with the United States. However, as the historian John Walker, has highlighted, Britain's "[u]nderlying anxiety refused to go away despite US repeated assurances and reflected clearly the level of UK dependence on American assistance to sustain an effective deterrent".⁴ A similar pattern would repeat itself during SALT II, when the Soviets agreed to defer the issue on the condition that third-party systems and other so-called "grey area" systems not currently subject to arms control would be included in future negotiations.

The grey area system of greatest concern to European Allies was a new generation of road-mobile, intermediate-range ballistic missiles, the SS-20, which provided the Soviets with the capability to strike targets across Western Europe with little warning. The development of the SS-20 prompted the NATO Allies in December 1979 to take the socalled "dual track decision", whereby the Allies would deploy in Western Europe a new generation of their own intermediate-range nuclear forces should the Soviets refuse to

^{1 &}quot;Russia's priority is to involve UK, France in future nuclear arms control talks – diplomat", TASS, 26 June 2020, https://tass.com/politics/1172109

² UK decision to build up nuclear arsenal defies disarmament logic: Russian foreign ministry", TASS, 18 March 2021, https://tass.com/politics/1267647

³ R. Dietl, Equal security: Europe and the strategic arms limitation talks, 1968-1976, Stuttgart, Steiner, 2013, p.45.

⁴ J. R. Walker, Britain and disarmament: the UK and nuclear, biological, and chemical weapons arms control and programmes, 1956-1975, Abingdon, Routledge, 2016, p.216.

eliminate all of their equivalent systems as part of an arms control agreement. Three years later, with the INF negotiations in deadlock, the Soviets mounting a renewed propaganda campaign, and anti-nuclear sentiment growing across Western Europe, the Allies faced an enormous challenge to meet their self-imposed deadline either to secure an unlikely arms control agreement or to begin the deployment of their own controversial new nuclear systems by December 1983.

As the deadline fast approached, Britain's top foreign policy priority in mid-1983 was the successful implementation of NATO's dual track decision. To the British, failure risked fatally undermining the credibility of the North Atlantic Alliance. At the same time, as a nuclear power the UK's pre-eminent national interest was the protection of its independent strategic deterrent, the four-boat Polaris force and its successor, Trident. These goals were increasingly in tension the more that the Soviets found a sympathetic audience amongst European Allies for their claim that the exclusion of British and French nuclear forces was the main obstacle to reaching an agreement on INF.

Having effectively blunted domestic opposition to INF deployment by winning the 1983 general election, the Thatcher government encouraged the Allies to show unflinching resolve in the face of continued Soviet machinations. However, the German government, which faced a much tougher time from its peace movement, wanted to avoid NATO being blamed for failing to reach an arms control agreement. Consequently, the Germans and other European Allies called for the British and French to be much more forthcoming about when and how their nuclear forces would be included in arms control. Although they claimed "no special privileges", the British fiercely resisted such calls, fearing a slippery slope that could undermine the independence and viability of Britain's nuclear deterrent.⁵

Finding themselves increasingly isolated on an issue that they believed threatened their most vital national interest, the British eventually conceded that in the unlikely event that negotiations gave rise to "substantial reductions" in US and Soviet arsenals, "Britain would want to review its position."⁶ Why, when the dual track decision had reached its critical stage and European public support for INF deployment hung in the balance, were the British not prepared to be more accommodating of their Allies' legitimate concerns? In short, the Thatcher government had reached a tipping point, where protecting the viability of the British strategic deterrent trumped the imperative to implement the dual track decision by bailing out Britain's wobbly Allies.

⁵ United Nations General Assembly, Thirty-Eighth Session, 10th plenary meeting, 28 September 1983, para. 171-172, https://undocs.org/en/A/38/PV.10

⁶ Ibid.

The Soviet Union and third party systems

Why were the British so worried in the first place that their nuclear forces might be included in negotiations in which they did not themselves participate, and which in early 1983 were completely deadlocked? The answer was that the Soviets were successfully painting the exclusion of British and French nuclear forces as the principal obstacle to the negotiations, and the reason why Western Europe would soon host controversial new nuclear missiles.

The leaders of the continental basing nations – West Germany, Netherlands, Belgium, and Italy – were under great pressure from their publics to do everything possible to ensure that arms control negotiations were successful. The challenge was that the gulf separating the United States and the Soviet Union in the negotiations remained essentially unbridgeable. Fundamentally, the Soviet concept of "equal security" – whereby the Soviets claimed that they were entitled to possess the same number of nuclear systems that the Allies arrayed against them – was incompatible with the Allies' principle of strict equality between the superpowers.⁷ The former assumed parity between the competing blocs; the latter only between the United States and the Soviet Union.

The discrepancy between the two concepts centred upon whether British and French nuclear forces should be taken into account in US-Soviet arms control. To the Soviets, the existence of third-party systems was an inescapable fact that they could ill-afford to ignore when considering the East-West balance. By contrast, the Reagan Administration regarded both the INF and strategic arms control (or START) negotiations as strictly bilateral affairs in which it would be inappropriate to take account of Allies' systems.

The Soviets skilfully played upon the issue of British and French nuclear forces by offering to retain only as many SS-20s as the number of warheads that Britain and France fielded. British officials encouraged their Allied counterparts to resist becoming embroiled in a divisive debate about the number of British warheads, particularly since this could grow significantly once Trident entered service in the 1990s.

The trouble for the British government was that not all Allied citizens agreed. The UK's planned increase in its future nuclear potential complicated Britain's traditional argument that it possessed only a minimum deterrent force. Indeed, Mrs Thatcher acknowledged to the French President, Francois Mitterrand, that while the British "Polaris fleet was at an irreducible minimum...[t]he plans for Trident raised the possibility of us having a

⁷ For an in-depth study of the impact the two conflicting concepts of "equal security" and "parity" had on the SALT negotiations see op. cit., Equal security: Europe and the strategic arms limitation talks, 1968-1976, and R. L. Dietl, Beyond parity: Europe and the Salt process in the Carter era, 1977-81, Stuttgart, Franz Steiner Verlag Wiesbaden GmbH, 2016.

deterrent of more than irreducible minimum size".⁸ This strengthened the Soviet claim for compensation for third party systems, particularly in the eyes of those on the left of the German opposition party, the Social Democratic Party (SPD), who were already sympathetic to Soviet calls for balance between East and West, not just between the United States and the Soviet Union.

German pressure meets British intransigence

The German government thought that the best way of countering arguments for inclusion was to make clear that whilst third party systems were not relevant to INF, Allies recognised that they could not be excluded from arms control negotiations indefinitely. It was therefore to the German's immense frustration that the British refused point-blank to say how British nuclear forces might be included at some future point in the arms control process.

The British Foreign Office strongly resisted the contention that a more flexible public line would bring progress in the INF negotiations, arguing instead that the Soviets had fabricated the whole issue of third-party systems in order to shift the blame on to the Allies for the stalemate. However, even UK Ministry of Defence officials accepted that Britain's "interest in ensuring exclusion is perhaps rather stronger than our logical case for it".⁹ For example, at the same time as arguing for exclusion, the British claimed that their nuclear forces made a "significant" contribution to NATO's overall deterrence posture.¹⁰ By this logic, the Soviets argued with some force that they could not "fail to include [British] nuclear potentials in the European balance of forces."¹¹

However, with the arrival of the first US INF missiles imminent, and the issue of thirdparty systems proving a lightning rod for popular opposition to deployment, why was the Thatcher government so averse to explaining how British nuclear forces might be taken into account in arms control at some distant point in the future? After all, as a signatory to the 1968 Non-Proliferation Treaty (NPT), the UK had committed itself to the goal of nuclear disarmament.¹² Furthermore, the Soviet position was "not to reduce the British and

⁸ TNA, FCO 46/3513, Record of a conversation between the Prime Minister and the President of France at 1920 hours on Thursday 20 October 1983 at 10 Downing Street, 21 October 1983.

⁹ TNA, FCO46/2730, Quinlan to Gillmore, 21 July 1981.

¹⁰ TNA, FCO 46/3475, "Soviet Delegation Cites [sit] of British Quotes on UK Forces", undated.

¹¹ Ibid.

^{12 &}quot;Treaty on the Non-Proliferation of Nuclear Weapons (NPT)", https://www.un.org/disarmament/wmd/nuclear/npt/text/ (accessed on 26/05/20); TNA, PREM 19/693, "Comprehensive Test Ban Treaty", Carrington to Thatcher, 21 January 1982.

French systems but to take them into account".¹³ In short, wherein lay the danger should the Thatcher government concede to German pressure to be more forthcoming?

Britain's primary concern was the long-term viability and independence of its strategic deterrent. Financial considerations meant that both the British and the French had adopted a minimum deterrence posture, possessing only as many warheads as they required to satisfy their respective national deterrence criteria. Publicly, the Thatcher government defined minimum deterrence as the ability to hold at risk "key aspects of Soviet state power", commonly understood to refer to Moscow and its environs.¹⁴ In contrast to the United States, officials argued that British force requirements had "no particular relationship to Soviet warhead numbers, but a direct relation to Soviet defensive capabilities."¹⁵ Indeed, it was the deployment and modernisation of the Moscow anti-ballistic missile (ABM) system that had persuaded the United Kingdom to undertake the costly Polaris Improvement Programme, Chevaline. Although the British Polaris force consisted of four submarines, only one boat would be guaranteed to be on patrol at any one time. Consequently, Britain had to be able to meet its national targeting criteria using only the 32 Chevaline warheads deployed aboard a single submarine. Although Trident represented a significantly more potent system, further improvements in the Moscow ABM system could not be discounted. In short, any concessions made by Britain, even if principally rhetorical, risked a slippery slope that could in the long run undermine the future credibility of the British deterrent.

Howe's speech to the United Nations General Assembly

Despite its public intransigence, the Thatcher government explored at length its limited options. Officials concluded that even if counting in did not undermine the military effectiveness of the British deterrent, many would interpret it as "apparent confirmation... that British systems had little or no independent status and were merely an extension of the US arsenal".¹⁶ Unaware of the irony, officials also said that "there could be no question of making any move towards including our deterrent in arms control negotiations without

¹³ TNA, FCO 46/3518, "Vogel's Visit to Moscow 11/12 January 1983: Arms Control", British Embassy (BE) Moscow to Foreign and Commonwealth Office (FCO), telegram number (TELNO) 35, 12 January 1983.

^{14 &}quot;The Future United Kingdom Strategic Nuclear Deterrent Force: Defence Open Government Document 80/23", London, Ministry of Defence, July 1980, https://www.margaretthatcher.org/document/113961 (accessed on 25/06/20).

¹⁵ TNA, FCO 46/3512, "British and French Nuclear Weapons and Arms Control", BE Washington to FCO, TELNO 2840, 1 October 1983.

¹⁶ TNA, FCO 46/3512, "Record of a Meeting between the Defence Secretary and the French Defence Minister Held at the Hotel de Brienne at 1645 on Thursday 21st July 1983", 25 July 1983.

the most thorough prior consultations with the United States".¹⁷

Unfortunately for the British, the Americans had concluded that it was time for Britain and France to be more flexible in their public positions. The US State Department in particular thought that the British grossly underestimated the Germans' difficulties. American officials told their British counterparts not to "become too theological",¹⁸ especially since their position was now "increasingly untenable".¹⁹ The seriousness with which the United States treated the issue hit home when the British learnt that President Reagan had held off replying to a recent letter from Andropov because of his "concern over the problem of how, in due course, the UK and French national deterrents might be associated with the arms control process".²⁰

The realisation that US support for the exclusion of third-party systems was less than unqualified proved pivotal. On 28 September, Sir Geoffrey Howe announced a more forthcoming position in his speech to the United Nations General Assembly (UNGA).

When it comes to arms control and disarmament, we in Britain claim no special privileges and no sanctuary [...] On the contrary, we have made it clear that, if Soviet and United States strategic arsenals were to be very substantially reduced and if no significant changes had occurred in Soviet defensive capabilities, Britain would want to review its position and to consider how best it could contribute to arms control in the light of the reduced threat.²¹

Although a comprehensive articulation of the British position, Howe's address fell short of the Germans' expectations. However, the Germans were not alone in continuing to call for the British to be more flexible. On 29 September, President Reagan told Mrs Thatcher that while British and French systems had "no place" in either the INF or the START negotiations, "if agreement was reached on sizeable reductions on both sides it would be necessary to make allowances for the strategic weapons of other countries".²² The Prime Minister responded with characteristic vehemence and at great length (her response filled two-pages of typically sparse Foreign Office minutes). However, at the same time, Mrs Thatcher's response betrayed the limited shift in the British position.

¹⁷ Ibid.

¹⁸ TNA, FCO 46/3477, "INF: US Negotiating Position", Thomas to Weston, 16 August 1983.

¹⁹ TNA, FCO 46/3512, "INF", Fuller to Weston, undated.

²⁰ TNA, PREM 19/979, "INF", Bone to Coles, 13 September 1983.

^{21 &}quot;United Nations General Assembly, Thirty-Eighth Session, 10th plenary meeting, 28 September 1983, para. 171-172 https://undocs.org/en/A/38/PV.10

²² TNA, FCO 46/3513, record of a conversation between the prime minister and the president of the United States at the White House at 11:37 hours on Thursday, 29 September 1983.

The facile arguments about the inclusion of the British and French deterrents were worrying [...] Unless the American and Russian holdings of strategic weapons were reduced to some 10 or 20 percent of what they were at the moment, our own weapons were almost immaterial.²³

As usual, when faced with a Thatcherite barrage, President Reagan made no reply.²⁴ Several days later, George Shultz, the US Secretary of State, pressed the point again.²⁵ Having co-ordinated his response with the French, Howe politely but firmly informed Shultz that "attempts to persuade us to say exactly how and when in future hypothetical circumstances third party systems could enter into arms control, are likely to be counterproductive."²⁶

The issue of third-party systems would continue to bedevil negotiations; however, with neither the British nor the French prepared to go any further, the Allies resigned themselves to facing the challenges ahead with Howe's UNGA speech to protect their dignity. On 23 November 1983, the INF negotiations collapsed, following the arrival of the first Pershing II missiles in West Germany and the subsequent Soviet walkout. Negotiations would not resume until 1985, when Gorbachev unilaterally conceded to the exclusion of British and French nuclear forces, leaving open the path towards an INF agreement. Up until that point, the Soviets had skilfully, if misleadingly, presented the issue of third-party systems not only as the principle obstacle to progress, but as a question of fairness. After all, why did the Allies need new American systems in Europe when they already had British and French nuclear forces upon which they could rely?

Conclusion

As a nuclear power with a minimum deterrent, Britain regarded the potential inclusion of third-party systems in arms control as a threat to the long-term viability of its independent strategic deterrent. With the deadline for INF deployment fast approaching, the British favoured steadfastness in the face of continued Soviet machinations. Although the

²³ Ibid.

²⁴ Ibid.

²⁵ TNA, FCO 46/3512, "British and French nuclear weapons and arms control", BE Washington to FCO, TELNO 2840, 1 October 1983.

²⁶ Ronald Reagan Presidential Library (RRPL), Lehman, Ronald, RAC Box 2, British-French Nuclear Forces 83-84, Howe to Shultz, 13 October 1983.

European Allies continued to pile on the pressure, it was ultimately the intervention of the Americans in September 1983 that finally broke the Thatcher government's resolve. The result was Howe's speech to the UN General Assembly, which has remained very broadly the British position on arms control ever since.

What insights can one draw from this episode for policymaking today? First, it sheds light on Russia's historic interest in taking third-party systems into account in arms control. Second, it shows how divisive the potential inclusion of British and French nuclear forces in arms control negotiations can prove within NATO, particularly when negotiations take place against the backdrop of popular anti-nuclear sentiment. Third, it underscores the importance of Allied consultation during arms control negotiations, especially when faced with pressure both from within and outside the Alliance. Fourth, it highlights the paradox at the heart of Britain's status as a nuclear power, namely Britain's dependence upon the United States for its independent strategic deterrent. Finally, as the UK continues its nuclear modernisation programme, and the pursuit of follow-on negotiations to New START remains both the US and Russia's stated policy (if a dim prospect), one can safely assume that the issue of third-party systems will eventually rear its head again in the future. NATO Allies should prepare for the challenges that this will present. History is as good a place to start as any.
Escaping the Iran deal prisoner's dilemma

J. Alexander Thew

Beginning in early 2016, the implementation of the Iran Deal commenced a novel experiment in diplomacy. Iran agreed to forgo development of a major industry and key component of its security strategy without the binding legality of a formal arms control treaty.¹ In so doing, Iran avoided declaring its nuclear programme to serve a military purpose while the West received assurances of nuclear security. Despite tangible reductions in Iran's nuclear activity,² the Joint Comprehensive Plan of Action (JCPOA, or "Iran Deal") failed to demonstrate durability. When the United States withdrew on 8 May 2018, the brief period of uncomfortable cooperation between the two adversaries ended. Eighteen months later, Iran recommenced full activity of its nuclear supply chain, and both countries' postures returned to a hostile status quo.

Efforts to revive the Iran Deal suggest a degree of optimism for resolving nuclear matters through diplomacy rather than coercion – this, despite recent experience. Such a strategy relies on mutual willingness to cooperate, and mutual trust that withstands political opposition. What, then, is to blame for the collapse of the original Iran Deal? Some identify inconsistency between American presidential administrations for killing the deal while others recognize Iranian military misbehavior for energizing mistrust to an irrevocable breaking point. This paper argues that the negotiated terms of JCPOA 1.0 offered the United States little upside to remain compliant, with the Iran Deal resembling a prisoners' dilemma: the individual benefits from reneging on agreed concessions outweighed the benefits of sustained cooperation. Flaws in its design guaranteed the deal's collapse.

Enhancing the Iran Deal relies on solving this coordination problem, which can be achieved in three ways: *reassessing future potentials* to reflect a nuclear-armed Iran as the worst

¹ D. S. Jonas, and D. M. Taxman, "JCP-no-way: a critique of the Iran nuclear deal as a non-legally-binding political commitment", *Journal of National Security Law & Policy*, Vol.9, No.3, 2018, p.589.

² S. M. Hickey, *FAQs: Iran nuclear deal*, Center for Arms Control and Non-Proliferation, 2022, https://armscontrolcenter. org/faqs-iran-nuclear-deal/#accomplishments (accessed 10 October 2022).

of all outcomes; *improving deal enforcement* by pairing the threat of snap-back sanctions with the credible and imminent use of military force; and *extending the game* as long as possible by pushing any "sunset clause" to its maximum potential.

Establishing the prisoners' dilemma³

Crafting the original JCPOA required the United States and Iran to abdicate certain elements of their national power. For Iran, the veiled pursuit of a nuclear weapon lent credence to its governing regime. The deal consequently targeted four major aspects of Iran's nuclear supply chain: heavy water stock, low enriched uranium stock, number and type of enrichment centrifuges, and design of its Arak nuclear power plant.⁴ The net result raised estimates of Iran's "breakout" time – the amount of time necessary to obtain a functional nuclear weapon device – to one year from its original two-to-three month assessment. In exchange, the United States committed to lifting key sanctions targeting Iran's economy, notably bolstering Iran's crude oil sales and returning a portion of the USD100 billion of Iranian assets frozen in overseas accounts.

The Iran Deal ostensibly improved the disposition of both states – Iran economically and the United States in terms of security. But the deal also placed into tension a motivation to revert to individual leverage points against a willingness to continue cooperating. If Iran could stockpile slightly more than the allowable 130 metric tons of heavy water while maintaining sanctions waivers on its oil production, it could bolster its position. Likewise, were the United States to reapply sanctions on tangential issues such as ballistic missile activity, it could curtail Iran's economic opportunity while still securing reduced capacity for nuclear weaponization. Such a situation models a classic prisoners' dilemma, which predicts that individual incentives can dominate the benefits of a mutual agreement, even when cooperation leads to the better outcome:

³ All game theory notes adapted from A. K. Dixit, S. Skeath, and D. H. Reiley Jr., "Chapter 10: the prisoners' dilemma and repeated games", in *Games of Strategy*, 4th ed., New York, W.W. Norton & Company, 2014.

⁴ G. Samore, *The Iran deal: a definitive guide*, Cambridge, MA, Belfer Center for Science and International Affairs, Harvard Kennedy School, 2015.

		United States	
		Comply	Defect
Inon	Comply	C _I , C _{US}	L_{I}, H_{US}
Iran	Defect	H_{I}, L_{US}	D _I , D _{US}

Both nations receive a benefit of (C) for deal compliance. For Iran, this value (C_i) represents renewed access to global markets. The United States' value of (C_{us}) is derived from the reduced threat emanating from Iran's nuclear activity. Defection from agreed commitments risks escalating hostilities. Yet, defection also results in some perceived short-term benefit (H) while imposing a short-term cost (L) on the opposing state, as described. The absence of a deal, and the subsequent conflicts that exist thereafter, results in a payoff of (D). Importantly, a prisoners' dilemma satisfies the relationship such that the values of H > C > D > L for both states.

The distilled prisoners' dilemma model suggests that the decision to comply or defect occurs only once. Of course, the reality of deal implementation requires repeated efforts. State interactions between 2016 and 2020 (depicted in Appendix A and Appendix B), demonstrate a shift between different quadrants of the prisoners' dilemma matrix at different points in time. In-game decisions to defect are explained according to three scenarios.

First, a state will defect when the net benefit (H - C) is high. The decision by the United States to renew the Iran Sanctions Act in early 2017 is illustrative. This act sanctioned businesses investing in Iran's development, especially its petroleum industry. Although many of these measures were subsequently waived as a result of the JCPOA, merely extending the act enabled the US executive branch to levee economic pressure at will, forgoing prolonged legislative debate. The Countering Iran's Destabilizing Activities Act that followed in mid-June of the same year did apply sanctions5 to entities related to Iran's ballistic missile programme, military affiliates, and suspected human rights abusers, while carefully avoiding JCPOA-violating measures. Remarkably garnering a senate vote of 98-2, the United States clearly viewed addressing an expanded list of Iranian malfeasance, peripheral to nuclear issues, as an integral component to its foreign policy, reflective of a high $H_{US} - C_{US}$ value.

Second, a state will defect when the net loss from punishment (L - C) is low. A lack of

^{5 &}quot;Senators introduce comprehensive legislation to hold Iran accountable", Washington, DC, Senate Foreign Relations Committee, 2017, https://www.foreign.senate.gov/press/rep/release/senators-introduce-comprehensive-legislation-to-hold-iran-accountable

punitive measures can make defection an attractive option. The JCPOA attempted to avoid this by incorporating the threat of "snap back" sanctions in the event of a substantive violation. Unfortunately, business investment decisions are not reactive to such ideal shortterm changes and the official JCPOA dispute mechanism required a full 65 days to be resolved. For the United States, defections demonstrate a near null value for $L_{US} - C_{US}$ entirely. Even after the United States passed the Countering Iran's Destabilizing Activities Act, Iran feebly condemned it⁶ and unveiled and publicly paraded⁷ a new medium-range ballistic missile – provocative yet lacking in substantive damage.

Finally, game defections are guaranteed when the end of the game is nigh. The terminal play of the prisoners' dilemma yields its predicted outcome of mutual defection. For the United States and Iran, the term length of the Iran Deal offered a logical conclusion to the utility of the negotiation. The phase out of key stockpile limitations beginning between 10 and 15 years from deal implementation identified an immutable end state. Fear of nuclear breakout beyond deal longevity imply that a forward-looking $L_{US} - C_{US}$ value enters negative territory. This potential threat would be compounded by a decade's worth of sanctions relief, funneling investment towards building human (and possibly physical) capital pertinent to a nuclear programme, or imprudently financing proxy military activity in the interim. The rollback consequences of the deal's expiration imply that when the future value of continued cooperation is zero, defection remains the only logical choice.

Game strategies and the JCPOA

Faced with these incentives to defect, players (states) can pursue one of two strategies. A player may use tit-for-tat (TFT) by modeling the behavior of the counterpart of the round immediately prior which establishes a leader/follower relationship. Alternatively, a player may choose to defect permanently if its counterpart defects even once, which is known as a grim trigger (GT) strategy. Accordingly, the period before May 2018 (Appendix A) represents the first phase of the Iran Deal prisoners' dilemma where the United States and Iran employed a TFT style of play.

Progressive experimentation by the United States eventually revealed both high benefits for defection $(H_{US} - C_{US})$ and low costs of punishment $(L_{US} - C_{US})$, as previously explained. When the net value of permanent defection approached zero $(C_{US} = D_{US})$, the United

⁶ TOI Staff, "Iran condemns 'worthless' US sanctions, responds with its own", The Times of Israel, 18 July 2017.

⁷ B. Chappell, "Iran shows off new ballistic missile at military parade", NPR, 22 September 2017.

States no longer retained incentives to cooperate. If the JCPOA implementation day on 16 January 2016 represents the beginning of cooperation, then the prisoners' dilemma first arrived at its predicted outcome on 8 May 2018, when the United States withdrew. US actions thereafter (Appendix B) reflected a grim-trigger posture, manifest in its "maximum pressure" campaign.⁸

Because Iran now competed against an opponent committed to defection, its own incentive to defect from the deal posed little downside. Faced with continued and harsh sanctions through 2019, Iran attempted to coerce the United States back into the deal. Increasing the United States' $L_{US} - C_{US}$ liabilities, by escalatory attacks in the Persian Gulf were followed by rehabilitated activity in its nuclear programme. On 1 July 2019, the IAEA first reported⁹ a stockpile of enriched uranium above the maximum allowable 300 kilograms. The fifth step of remedial action¹⁰ in January 2020 marked Iran's final and permanent defection from the deal.

The JCPOA purportedly benefitted both the United States and Iran by reducing nuclear proliferation and enhancing global trade. Yet, the deal to arrange an enhanced Middle Eastern stability eventually unraveled. By 2020, Iran's announcement to no longer adhere to the key provisions of the JCPOA deal clearly represented a settled state of non-cooperation. Over the four years that the deal remained intact, the game shifted from tit-for-tat, to grim trigger, to its equilibrium destination of mutual defection. The prisoners' dilemma outcome held true.

Escaping prisoners' dilemma

Avoidance of the prisoners' dilemma defective outcome requires a deal designed to reflect the power imbalance inherent to the US-Iranian relationship. Presuming that Iran has more to gain from the JCPOA than does the United States, but the United States retains more geopolitical maneuverability, an asymmetric payoff matrix can be modeled accordingly:

⁸ L. Nelson, "Pompeo threatens Iran with 'strongest sanctions in history", Politico, 3 May 2018.

^{9 &}quot;Verification and monitoring of [Iran]", International Atomic Energy Agency, 1 July 2019, https://www.iaea.org/sites/default/files/19/07/govinf2019-8.pdf

¹⁰ J. Zarif, "As 5th & final REMEDIAL...", Twitter, 2020. https://twitter.com/JZarif/status/1213900666164432900 (accessed 10 October 2022).

		United States	
		Comply	Defect
Inon	Comply	6, 4	0, <u>9</u>
Iran	Defect	7, 2	<u>3, 3</u>

Here, underlined values emphasize the preferred choice. Beginning at this starting point, with a settled equilibrium in the defect-defect quadrant, the deal can be improved by several means.

Foremost, the United States must be prepared and willing to tolerate minor incursions by Iran as it seeks leverage in the international arena. However, these defections should be deemed inconsequential relative to nuclear "breakout", which represents the worst of all outcomes. This perspective leads to a subtle change in the payoff matrix, such that $H_{US} > C_{US} > L_{US} > D_{US}$:

		United States	
		Comply	Defect
Iron	Comply	6, 4	0, <u>9</u>
man	Defect	7, <u>2</u>	<u>3,</u> 0

If the JCPOA limits the stockpile of enriched uranium to 300 kilograms and Iran is found to have retained 305 kilograms, it is not realistically so close to a weapon to incite snap-back sanctions. In this sense, the United States considers the arrangement as a necessary evil in pursuit of its policy goals and will trade periodic defections by Iran for sustained cooperation.

Another solution focuses on altering Iran's incentives by increasing the penalties for defection. If $(H_1 - C_1)$ is zero, then Iran only has something to lose by non-compliance. This can be achieved were the United States to guarantee the Iran Deal with the imminent and credible threat of military hard power in the Gulf region. In-game defections risk incurring damning punishment on the backside. Thus, so long as the United States complies, Iran will continue to comply. Encouraging the application of a "big stick" military strategy to the US deal negotiation keeps Iran in check beyond the utility of snap-back sanctions.

Finally, the most direct means to improve a new round of JCPOA talks is to extend the length of the deal's terms as far into the future as possible. Uncertainty about the end of

the game is critical to avoid a rollback analysis that places the states in a *de facto* prisoners' dilemma. Here, history can be informative. If a nominal ten-year deal unraveled after two years (when the United States shifted its strategy from tit-for-tat to grim trigger), then cooperation in this context can be assessed to last roughly 20 percent of its stated longevity. It is important to note that all arms control treaties contain a sunset clause¹¹ so it is not realistic to seek an Iran Deal without one. However, the success of treaties such as the nuclear Non-Proliferation Treaty (NPT)¹² are in part predicated on their endurance.

Revising the JCPOA to address the tension between individual state incentives and the benefits of collective action can be achieved by combining the aforementioned solutions:

		United States		
		Comply	Defect	
Iran	Comply	<u>6,</u> 4	0, <u>9</u>	
	Defect	4, <u>5</u>	<u>3,</u> 0	

First, leadership assumed by the United States allows for the occasional defection by Iran. In this case, the United States's best response is to continue to cooperate. Iran risks incurring huge costs, however. Punitive reprisal for crossing unstated redlines is exacted by combining snap back sanctions with the threat of US military action ($L_1 - C_1 = -6$ and $H_1 - C_1 = -2$). Second, the United States maintains its overwhelming power and ability to extract huge rewards from defection reflective of its inherent power. But, should the United States move to defect first, Iran's best response is to pursue a grim trigger strategy where it jeopardizes its international reputation and stated commitment to nuclear nonproliferation.¹³ Under this framework, the United States leads and encourages a pursuit of TFT strategies.¹⁴ With a collective action benefit of 10 and mutual defection payout of 3, the United States and Iran have escaped from their prisoners' dilemma, rendering the Middle East marginally safer and more prosperous.

¹¹ R. Nephew, "False flag: the bogus uproar over Iran's nuclear sunset", Brookings Institution, 8 March 2015.

¹² M. E. O'Hanlon, R. Einhorn, S. Pifer, and F. A. Rose, "Experts assess the nuclear Non-Proliferation Treaty, 50 years after it went into effect", *Order from chaos*, Brookings Institution, 3 March 2022.

^{13 &}quot;Iran and the NPT", The Iran Primer, United States Institute of Peace (USIP), Januaruy 22, 2020.

¹⁴ R. Axelrod, "The evolution of cooperation", The Journal of Politics, Vol.48, No.1, 1986, pp.234-236.

Appendix A

PERIOD 1: 2016 – 2018, A Tit-for-Tat Arrangement					
		Iran Action	US Action	Payoff	
	16 JAN	JCPOA Implementation	Related sanctions lifted; escrow accounts unfrozen	C _p , C _{us}	
	17 JAN		Imposes sanctions for ballistic missile activity	L _I , H _{US}	
5	26 FEB	Exceeds heavy water stock by 0.9 mt		H _I , L _{US}	
2010	27 MAY	IAEA Verifies Compliance		CI	
	1 DEC		Iran Sanctions Act (ISA) extended by 10 years	L _I , H _{US}	
	13 DEC	Iran announces intention to research and develop nuclear propulsion for marine vessels		H_{p}, L_{us}	
	12 JAN		US Secretary of Defense James Mattis reaffirms US commitment to JCPOA	C _{us}	
	15 JAN	Removes infrastructure and excess centrifuges from the Fordow facility		CI	
	24 FEB	IAEA Verifies Compliance		CI	
2017	15 JUN		Countering Iran's Destabilizing Activities Act	L_{I}, H_{US}	
	10 JUL		US delegates at the G20 encourage foreign leaders to avoid business deals with Iran	L _I , H _{US}	
	31 AUG	IAEA Verifies Compliance		CI	
	22 SEP	Iran unveils and tests the Khoramshahr medium-range ballistic missile		H _P , L _{US}	
	13 OCT		POTUS decertifies the Iran Nuclear Agreement Review Act (INARA) and encourages Congress to legislate against the JCPOA sunset clauses	L ₁ , H _{US}	
	12 JAN		POTUS reissues sanctions waivers for the stated final time unless JCPOA flaws addressed	L_{l}, H_{US}	
80	22 FEB	IAEA Verifies Compliance		CI	
2018	8 MAY		US withdraws from the JCPOA and announces "maximum pressure" strategy	D _{US}	
	6 JUN	Iran opens a new centrifuge assembly facility at Natanz		H_{I}, L_{US}	

Appendix B

Period 2: 2018 – 2020, Grim Trigger Strategy				
		Iran Action	US Action	Payoff
	2 AUG	Iran-supported Houthi rebels attack a Saudi-flagged oil tanker in the Bab- el-Mandeb strait		H _I , L _{US}
	7 AUG		US levies sanctions on USD, precious metals, shipping, port operations, oil, and automotive exports	L _I , H _{US}
18	12 SEP	Increases U stockpile (3.67%) to 139.4 kg		H_{I}, L_{US}
20	5 NOV		Full sanctions regime comes into full effect targeting Iran's banking, oil and ship-building sectors; sanctions waived for nonproliferation projects at Arak, Busher, and Fordow to continue	L ₁ , H _{US}
	22 NOV	Increases U stockpile (3.67%) to 149.4 kg		H_{I}, L_{US}
	6 MAR	Increases U stockpile (3.67%) to 163.8 kg		$H_{\rm p}, L_{\rm US}$
	8 APR		Designates the IRGC a foreign terrorist organization	L _I , H _{US}
	9 APR	Iran designates CENTCOM a terrorist organization and threatens to restart its nuclear program		H_{I}, L_{US}
	3 MAY		US allows sanctions waivers for nuclear site conversion at Arak and Fordow	C _{us}
2019	8 MAY	1 st remedial action: Iran announces its noncompliant posture regarding enriched uranium and heavy water stockpiles		H _p , L _{us}
	12 MAY	Four oil tankers (two of which Saudi flagged) are damaged by limpet mines off the coast of UAE		H_{I}, L_{US}
	13 JUN	Two oil tankers attacked in the Gulf of Oman		H_{I}, L_{US}
	20 JUN	IRGC shoots down a US RQ-4A Global Hawk UAV		H_{I}, L_{US}
	24 JUN		US sanctions Iranian supreme leader	L, H _{us}

2019	8 JUL	2 nd Remedial Action: Iran stockpiles more than 300 kg limit on enriched uranium and begins enriching uranium to 4.5%		H _I , L _{US}
	31 JUL		US sanctions Iran's Foreign Minister and lead negotiator of the JCPOA, Javad Zarif	L _I , H _{US}
	3 SEP		US sanctions Iran space agency and shipping network related to IRGC	L _I , H _{US}
	5 SEP	3 rd remedial action: intention to remove all limitations on nuclear R&D verifies installation of cascades of advanced centrifuge designs		H _P , L _{US}
	14 SEP	Drone attack cripples Saudi Arabia's largest oil refinery		H _I , L _{US}
	20 SEP		US levies sanctions on Central Bank of Iran, National Development Fund of Iran	L _I , H _{US}
	5 NOV	4 th Remedial Action: Iran announces it will begin enriching uranium at the Fordow facility		H _I , L _{US}
	11 NOV	U stockpile 372.3 kg; installation and testing of IR-s, IR-8 and IR-9 centrifuge types; D_2O stockpile 131.5 mt		H _I , L _{US}
2020	2 JAN		Lethal strike targets IRGC leader Qassim Suleimani	D_{I}, D_{US}
	5 JAN	5 th Remedial Action: Iran announces it will no longer limit its installation of centrifuges		D ₁ , D _{US}

Annex I

The Participants of the 4th Early Career Nuclear Strategists Workshop

6th – 8th July 2022 *Senior scholar or mentor Giacomo Andolfatto Oshri Bar-Gil Elena Batani Lotie Boswinkel Pia Johanna Brinkschulte Aleksander Bukowski Elaine Bunn* Mary Chesnut Jessica Cox* Hugo Dijkers Joseph Dobbs* Atasay Erongun Tom W. Etienne Federica Fazio Carlo Ferruzzi Abigail Garden Camille Grand* Marwa Hassan Fabian Hoffmann Michael A. Hunzeker* James Wesley Hutto Elsa B. Kania Sophie Kippen Angus Lapsley*

Rafael Loss Jacklyn Majnemer Alexander Mattelaer* Marlène Meunier Youssef Mnaili Nicola Maria Mossone Tomas A. Nagy Joseph Petrucelli* Cynthia Roberts* Todd Robinson Lucrezia Scaglioli Oliver Schmidt Oleksadr Shykov Benjamin Silverstein Franziska Stärk Bruno Tertrais* J. Alexander Thew Adelina Trolle Andersen Deniz Ünsal Wannes Verstraete Iulia Vladescu Lydia Wachs Angela Weaver

The participants to the 3rd Early Career Nuclear Strategists Workshop

7th – 8th July 2021 * Senior scholar or mentor

Oliver Barton	Cameron Hunter
Heinrich Brauss*	Karen Van Loon
Malfrid Braut-Hegghammer*	Claudio Malavenda
Dominic Brennan	Aylin Meryem Matlé
Elaine Bunn [*]	Neil Melvin
Francesca Buratti	Rebecca Naretto
Julie Clark	Lorenzo Noro
Julia Cournoyer	Tom Plant*
Jessica Cox*	Severin Pleyer
Amaury Crucy	Andrew Shead
Anne Cukier	Brian Radzinsky
Joseph Dobbs*	Bruno Tertrais*
Janice Ely-Larsson	Spenser A. Warren
Zenobia Homan	Jack Wilson
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