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UNITED KINGDOM'S NUCLEAR STRATEGY: A CONTEMPORARY ANALYSIS

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INTRODUCTION

In its March 2021 Integrated Review of Security, Defence, Development and Foreign Policy (from now on referred to as Integrated Review), the United Kingdom (UK) announced that it no longer intends to reduce its nuclear arsenal.¹ On the contrary, the UK has decided to increase its nuclear warheads from a maximum of 225 to 260.² The Integrated Review does not mention a timeline for the announced increase in the warhead stockpile; however, scholars assume it to be during the mid-2020s.³

The announcement has drawn the interest of nuclear strategists and scholars tracking developments in nuclear disarmament and nonproliferation. They have accused the UK of breaching its commitment to "pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and nuclear disarmament" and values

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^{1.} HM Government, "Global Britain in a Competitive Age: The Integrated Review of Security, Defence, Development and Foreign Policy", March 16, 2021, p. 76. https://www.gov.uk/government/collections/the-integrated-review-2021. Accessed on July 4, 2021.

^{2.} Ibid.

Hans Kristensen, "British Defence Review Ends Nuclear Reductions Era", Federation of American Scientists, March 17, 2021. https://fas.org/blogs/security/2021/03/british-defencereview-2021/. Accessed on August 8, 2021.

The disparity between the UK's past nuclear behaviour and the one projected by the Integrated Review raises some compelling questions. of multilateral diplomacy endorsed in the Integrated Review.⁴ To be sure, even after the completion of the announced upswing, the UK will house the smallest nuclear arsenal among the Nuclear Weapon States (NWS) recognised by the Non-Proliferation Treaty (NPT). In the

last three decades, the UK has walked the talk on nuclear disarmament by reducing its nuclear arsenal by more than 50 percent.⁵ However, the UK has set such high standards for itself as a leader of arms control and nuclear disarmament that it is being scrutinised, not surprisingly, using a stricter yardstick.

While the Integrated Review is a comprehensive document encompassing defence and security, geopolitics, geoeconomics, biosecurity, cybersecurity and climate change, this article will focus primarily on the nuclear aspects of the Integrated Review, especially the decision to increase the nuclear warhead stockpile.⁶ The disparity between the UK's past nuclear behaviour and the one projected by the Integrated Review raises some compelling questions. What is the rationale behind the UK's decision to spike its nuclear arsenal? How do commentators and scholars look at the development? Does the announcement make sense from the deterrence perspective? This article attempts to answer these questions and analyse issues of theoretical significance raised by the Integrated Review. The article is divided into five sections. The first section gives a historical overview of the UK's nuclear deterrent and special nuclear partnership with the United States. The following section outlines the evolution of the UK's nuclear strategy, significant developments

^{4.} Daryl G. Kimball, "The UK's Nuclear U-Turn", *Arms Control Today*, April 2021. https://www.armscontrol.org/act/2021-04/focus/uks-nuclear-u-turn. Accessed on July 6, 2021.

^{5.} Hans M. Kristensen and Matt Korda, "United Kingdom Nuclear Weapons, 2021", *The Bulletin of the Atomic Scientists*, vol. 77, no. 3, 2021, pp. 153-58.

^{6.} The Integrated Review has nothing to do with integrated deterrence, the concept guiding the upcoming US National Defence Strategy. The Integrated Review has been so named for its comprehensive and inclusive strategic framework: It looks beyond the traditional scope of security by encompassing issues such as soft power, climate change, global economy, human rights, health resilience and technological innovation.

in the Integrated Review, and departure points from previous strategic and defence White Papers. The third section expounds on the rationale behind the decision to increase the nuclear arsenal. The fourth section addresses questions of theoretical salience raised by the Integrated Review. Section five gives an Britain maintains a minimum, credible and independent nuclear deterrent. It does not reveal minute details about when, under what conditions and at what scale it would use its nuclear weapons.

overview of the political position and future of the UK's nuclear deterrence.

EVOLUTION OF THE UNITED KINGDOM'S NUCLEAR POSTURE

The United Kingdom's Nuclear Deterrent

Demonstrating the workability of its warhead concept, the UK detonated its first atomic bomb in the hull of the HMS *Plym*, a Royal Navy frigate, off the coast of Monte Bello Islands, Western Australia, on October 3, 1952.⁷ By 1991, it had conducted 45 nuclear tests, when it stopped atomic testing. It ratified the Comprehensive Test Ban Treaty (CTBT) in 1998. Britain maintains a minimum, credible and independent nuclear deterrent. It does not reveal minute details about when, under what conditions and at what scale it would use its nuclear weapons. Even less is known about the history and evolution of the UK's nuclear weapons, since it has never declassified the history of its nuclear weapons development.

The United Kingdom's Airborne Nuclear Deterrent

For about two decades before 1969, when the Royal Navy's Resolution class submarines armed with Polaris missiles assumed the role of a strategic deterrent, the strategic bomber force led by V-bombers provided Britain with its initial nuclear deterrent capability. Indeed, the UK's first

Claire Taylor, Tim Youngs, Ross Young and Gavin Berman, *The Future of the British Nuclear Deterrent*, 06/53 (London: House of Commons Library, 2006), p. 9.

In the early 1950s, opting for a bomber force to carry and deliver nuclear bombs was a straightforward choice for Britain. The Air Staff selected three different bomber aircraft designs to deliver the British nuclear deterrent: the Vickers Valiant, Handley-Page Victor and Avro Vulcan.

operational warhead—the Blue Danube free-fall bomb⁸—was air-dropped from the Vickers Valiant, the first of the three V-bombers, on October 11, 1956, at Maralinga, Australia.⁹ In the early 1950s, opting for a bomber force to carry and deliver nuclear bombs was a straightforward choice for Britain. Since, at the end of World War II, its economy was in shambles and it had a limited budget to develop nuclear bombs, let alone seek standoff weapon

delivery systems. Also, the significant role played by the Royal Air Force (RAF) during World War II in bombing German cities made it an obvious choice to deliver a strategic deterrent.

The Air Staff selected three different bomber aircraft designs to deliver the British nuclear deterrent: the Vickers Valiant, Handley-Page Victor and Avro Vulcan—the Valiant being the simplest and most straightforward and Vulcan being the most advanced and sophisticated of the three bombers.¹⁰ As a result of their name initials, the bombers together came to be known as the V-bombers. The V-bombers were the backbone of the UK's nuclear deterrence. They carried a succession of air-launched atomic weapons developed during the 1950s and 1960s such as the Yellow Sun thermonuclear

^{8.} The Blue Danube, the plutonium triggered fission bomb, partially based on the design of 'Fat Man', was the first British atom bomb deployed during the Cold War. The RAF received the first Blue Danube in November 1953, and the Valiant carried out the first live test on October 11, 1956. For an evolutionary technological development of the Blue Danube, see Jonathan Aylen, "First Waltz: Development and Deployment of the Blue Danube, Britain's Post-War Atomic Bomb", *The International Journal for the History of Engineering and Technology*, vol. 85, no. 1, 2015. https://www.tandfonline.com/doi/full/10.1179. Accessed on October 12, 2021.

Sebastien Roblin, "Meet Britain's Very Own B-52: The V Bombers", *The National Interest*, December 8, 2018. https://nationalinterest.org/blog/buzz/meet-britains-very-own-b-52-vbombers-38197. Accessed on October 8, 2021.

^{10.} David Jordan, "The Royal Air Force and the Strategic Nuclear Deterrent: An Introduction", *Air Power Review*, vol. 20, no. 2, 2017, p. 48.

bombs, Blue Steel air-launched missiles and WE177 tactical free-fall bombs.¹¹ Initially, they lacked any counter-measures and relied upon high-speed and high-altitude flying to evade detection and interception. In the mid-1950s, the advancement in Soviet anti-aircraft missiles and integrated air defence instilled concerns about the vulnerability of the V-bombers. Apprehensions about the credibility of airborne nuclear deterrence led the UK to develop the ground-launched, Intermediate-Range Ballistic Missiles (IRBMs) named the Blue Streak.¹² However, in 1960, the Macmillan government cancelled the programme due to concerns about the vulnerability of silo-based nuclear missiles to preemptive strikes.¹³ A few months later, Britain announced that it would purchase American Skybolt air-launched missiles; however, in November 1962, the Kennedy Administration scrapped the Skybolt. The Nassau Accord, signed in 1962 in the Bahamas by US President Kennedy and UK Prime Minister Macmillan, resolved the Skybolt crisis but with severe consequences for the airborne British strategic forces.¹⁴ Under the agreement, the United States decided to transfer Polaris submarine-launched ballistic missiles to the United Kingdom. Subsequently, V-bombers were withdrawn from the nuclear role in 1969, shortly after the Resolution class submarines became operational.¹⁵ However, the Vulcan remained in a tactical strike role, carrying the WE177 free-fall tactical nuclear bombs. Under the 1998 strategic defence review, the Labour government finally withdrew the last of the UK's air-launched WE177 free-fall bombs.¹⁶

UK Ministry of Defence and Foreign and Commonwealth Office, "The History of the UK's Nuclear Weapons Programme", p. 1. https://assets.publishing.service.gov.uk/government/ uploads/system/attachment_data/file/Factsheet5.pdf. Accessed on October 5, 2021.

^{12.} Ibid., p. 2.

^{13.} Ibid.

^{14.} Jordan, n. 10, pp. 49-50.

^{15.} The Victor and Vulcan bombers continued to serve the RAF in reconnaissance and aerial refuelling operations.

¹⁶ With the eventual retirement of the Vulcan bombers in 1984, the RAF's Jaguar, Tornado, and Buccaneer carried the W-177 until its retirement in 1998.

The UK is the only NWS with a single nuclear deterrent system: the submarine-launched Trident system. The UK's nuclear deterrence flagship is the Vanguard class submarine, armed with the Trident II D5 missiles carrying Mk4/A or Holbrook nuclear warheads.

Operation Relentless

Since April 1969, the United Kingdom has maintained a Continuous at Sea Deterrent (CASD) under Operation Relentless, with at least one of its nucleararmed ballistic missile submarines always on patrol. In addition to assuring its security, the UK's nuclear deterrent supports the collective security for the Euro-Atlantic area through the North Atlantic Treaty Organisation (NATO).¹⁷

The UK is the only NWS with a single nuclear deterrent system: the submarine-launched Trident system. The UK's nuclear deterrence flagship is the Vanguard class submarine, armed with the Trident II D5 missiles carrying Mk4/A or Holbrook nuclear warheads. The HMS *Vanguard* entered service in December 1994, and the last in the class, the HMS *Vengeance*, joined the Royal Navy in 2001.¹⁸ Initially, the Vanguard class submarine had a design life of 25 years.¹⁹ However, with three in-service life extensions, it now has an extended lifespan of approximately 37-38 years.²⁰ The submarines in the class will be phased out in the next decade, starting in the early 2030s. Each of the Vanguard class submarines is capable of carrying 16 independently controlled missile tubes. The United Kingdom operates 58 Trident missiles bodies, "which are held in a communal pool at the Strategic Weapons Facility at the Kings Bay Submarine Base in Georgia, USA."²¹ Each missile is capable of carrying 12 independently targetable nuclear warheads. Trident missiles have Mk/4A nuclear warheads based on the United States' (US')

^{17.} The UK has earmarked its nuclear forces—prospectively available but subject to approval from the UK government—for potential NATO missions. For a succinct study on UK-NATO relations, see Martin A. Smith, "British Nuclear Weapons and NATO in the Cold War and Beyond", *International Affairs*, vol. 87, no. 6, 2011, pp. 1385-1399.

^{18.} Taylor et al., n. 7, p. 14.

Claire Mills, Replacing the UK's Strategic Nuclear Deterrent: Progress of the Dreadnought Class, 8010 (London: House of Commons Library, 2021), p. 7.

^{20.} Ibid.

^{21.} Taylor et al., n. 7, p. 15.

W76 warhead, a thermonuclear warhead with an explosive yield of around 80-100 kiloton deployed by the US on its Trident missiles based on the Ohio class submarines.22

Concerning the UK's official position on non-proliferation and disarmament, it has consistently endorsed the banner of a world without nuclear weapons and

Concerning the UK's official position on non-proliferation and disarmament, it has consistently endorsed the banner of a world without nuclear weapons and multilateral disarmament for decades.

multilateral disarmament for decades. It has reduced its nuclear weapon stockpile gradually since the 1980s, and has supported arms control and nuclear stability among the great powers. It has continuously pressed for the "entry into force of the Comprehensive Nuclear Test Ban Treaty, and successful negotiations on a Fissile Material Cut-Off Treaty in the Conference on Disarmament."23

SPECIAL NUCLEAR RELATIONSHIP BETWEEN THE US AND UK

The nuclear partnership between the United States and United Kingdom began with the study and development of the world's first atomic bomb. Along with Canada, British scientists played a crucial role in the American success of the Manhattan Project.²⁴ After the war ended, Britain felt entitled to US nuclear weapon technology because of its significant contribution to the American atomic weapon programme and a series of war-time agreements (1943 Quebec Agreement and 1944 Hyde Park Agreement) that promised continued post-war nuclear cooperation. However, the enactment of the McMahon Act of 1947 by the United States shelved the British involvement

Ibid., p. 16.
HM Government, "National Security Strategy and Strategic Defence and Security Review 2015: A Secure and Prosperous United Kingdom", p. 34, November 2015. https://www.gov. uk/government/publications/national-security-strategy-and-strategic-defence-and-securityreview-2015. Accessed on July 14, 2021.

^{24.} Because of its close involvement in the Manhattan Project, the UK emerged from the war as effectively the world's 'second atomic power'; see A. J. R Groom, British Thinking About Nuclear Weapons (London: Pinter, 1974), pp. 17-18.

The US secrecy over the nuclear weapons programme led the United Kingdom to start its independent nuclear weapon programme in January 1947. It detonated its first atomic explosion on October 3, 1952. in the post-war US atomic weapons programme.²⁵ The Act prohibited sharing classified nuclear information and atomic weapon technology with foreign countries, including the United Kingdom. The US secrecy over the nuclear weapons programme led the United Kingdom to start its independent nuclear weapon programme in January

1947. It detonated its first atomic explosion on October 3, 1952.

Despite the enactment of the McMahon Act, there was an entrenched belief in Downing Street that an independent nuclear deterrent and a close nuclear partnership with the United States could best serve the British interest.²⁶ However, reestablishment of the intimacy of the Manhattan Project was not easy. Nuclear cooperation stood apart as the two countries continued to cooperate closely on diplomatic and military matters.

The Road to a Mutual Defence Agreement Between the US and UK

With the coming of the Eisenhower Administration in 1953, the prospects of nuclear cooperation began to improve. President Eisenhower was highly worried about the Soviet technological development and sought closer cooperation with Western allies on nuclear and military matters. He believed that "in the longer-term, Europe should become a third power bloc," closely aligned with the United States but "capable of looking after its own defense."²⁷ Thus, as part of a broader strategy to coordinate NATO policies to effectively balance perceived Soviet threats and reduce the burden on the American economy, the Administration sought closer nuclear cooperation with the British. Despite minor amendments to the Atomic Energy Act in August 1954, which allowed close nuclear association

^{25.} The McMahon Act, formally called the Atomic Energy Act of 1947, has been associated with the name of Senator Brien McMahon, who presented the Bill on the floor of the Senate.

^{26.} John Baylis, "Exchanging Nuclear Secrets: Laying the Foundations of the Anglo-American Nuclear Relationship", *Diplomatic History*, vol. 25, no. 3, 2001, p. 35.

^{27.} Ibid., p. 36.

with Western allies, congressional opposition and inter-agency disputes precluded fruitful nuclear partnership. Successive failed attempts to achieve closer nuclear cooperation with American counterparts led the British ambassador in Washington to conclude that "American acceptance of Britain as a Great Power and the possibility of exercising an influence on US policy rested on having a military nuclear program with megaton as well as The launch of the Sputnik I came as a psychological shock to the Western alliance and turned the perception about Soviet technological inferiority upside down. At the same time, fortuitous from the British perspective, it created favourable circumstances to reestablish nuclear cooperation.

kiloton weapons."²⁸ Thus, knowing that the Anglo-American nuclear cooperation agreement was not around the corner, the UK proceeded with the thermonuclear Grapple test in 1957.

On October 4, 1957, the Soviet Union launched the world's first artificial satellite demonstrating the capability to launch an intercontinental ballistic missile. The launch of the Sputnik I came as a psychological shock to the Western alliance and turned the perception about Soviet technological inferiority upside down. At the same time, fortuitous from the British perspective, it created favourable circumstances to reestablish nuclear cooperation and allowed the Eisenhower Administration to overcome congressional opposition in support of a close nuclear partnership.

On June 30, 1958, after a marathon of negotiations and diplomatic bargaining, amendments to the Atomic Energy Act 1954 were passed by the US Congress. The new Act authorised the US president to share restricted information on nuclear weapons with countries that have made "substantial progress" in the nuclear field. In 1958, only Britain met the requirements of the substantial progress clause. The "Agreement for Cooperation on the Uses of Atomic Energy for Mutual Defense Purposes" was signed between the

^{28.} Ibid., p. 38.

The 1958 Mutual Defence Agreement guided Anglo-American nuclear cooperation during the Cold War and continues to do three decades after the Cold War. United Kingdom and the United States on July 3, 1958.²⁹ The Mutual Defence Agreement between the US and UK is the foundation of the Anglo-American nuclear relationship. According to Article 2A of the agreement, the two nations agreed to exchange classified

information for "the development of defense plans, training of personnel in the employment of, and defense against, atomic weapons, the evaluation of the capabilities of potential enemies in the employment of atomic weapons, the development of delivery systems compatible with the atomic weapons, and research, development, and design of military reactors."³⁰ In addition, under Article 3, the United States agreed to transfer "one complete submarine nuclear propulsion plant," to the Government of the United Kingdom.³¹

The 1958 Mutual Defence Agreement guided Anglo-American nuclear cooperation during the Cold War and continues to do three decades after the Cold War. In December 1962, President Kennedy and Prime Minister Macmillan signed the Nassau Agreement, in which the United States agreed to supply Polaris submarine-launched ballistic missiles to the United Kingdom. The signing of the Polaris sales agreement on April 6, 1963, finalised the purchase of the missiles. In the mid-1990s, the American Trident D5 missiles replaced the Polaris missiles and continue to serve British nuclear deterrent requirements to this day. In 2006, the UK decided to participate in the USled the Trident II D5 life extension programme, which will extend the life of the Trident missiles to the early 2060s. Also, under the US W93 warhead programme, Britain is working closely with the American counterparts on the

^{29.} The full title is Agreement between the Government of the United Kingdom and Northern Ireland and the Government of the United States of America. A copy of the official treaty document is available at https://media.nti.org/pdfs/56_4.pdf. The agreement is criticised for its alleged violation of Article I and Article VI of the NPT. See Claire Mills, US-UK Mutual Defence Agreement, 3147 (London: House of Commons Library, 2014), pp. 9-11.

^{30.} Ibid., pp. 2-3.

^{31.} Ibid., p. 3.

development of its successor warhead to the Holbrook.

Strategic Interest and Reciprocity

Despite the strong perception of an extraordinary nuclear relationship between the US and UK, all the nuclear cooperation agreements resulted from dogged bargains, and mutual give and take. Given the fact that US and British defence goals were aligned during The US-UK nuclear partnership is perceived as asymmetrically favourable to the British, where Washington planted all the seeds and London has reaped the fruits. While there is some element of truth attached to that reading, it is not entirely correct.

the Trident negotiations, the US exploited British technical dependence to extract commitments to bolster its conventional security interests.³² As aptly argued by Suzanne Doyle, "Reagan officials would take a hard-nosed approach to the US-UK partnership in order to manoeuvre Britain's defence strategy in line with their own strategic vision."³³

The US-UK nuclear partnership is perceived as asymmetrically favourable to the British, where Washington planted all the seeds and London has reaped the fruits. While there is some element of truth attached to that reading, it is not entirely correct. The Anglo-American partnership was founded on reciprocity, where both parties recognised that the other had something valuable to contribute.³⁴ The nuclear partnership assumed that "the development and production of nuclear weapons remained a difficult and expensive business," and it would be wise for the two Western powers to pool resources.³⁵ Indeed, in certain aspects of nuclear technology such as thermonuclear weapon designs and civil nuclear energy, the UK was superior to its Atlantic counterpart. The American nuclear scientists recognised that "substantial progress made by the United Kingdom would be of great benefit

^{32.} Suzanne Doyle, "A Foregone Conclusion? The United States, Britain and the Trident D5 Agreement", *Journal of Strategic Studies*, vol. 40, no. 6, 2017, p. 869.

^{33.} Ibid., p. 882.

Lawrence Freedman, Britain and Nuclear Weapons (London: The Palgrave Macmillan Press Ltd., 1980), p. 6.

^{35.} Ibid.

The UK positioned its nuclear strategy to offset the Soviet Union's conventional superiority in Eastern Europe during the Cold War. Nuclear deterrence was the UK's best bet against a Soviet military invasion of Europe. to the United States."³⁶ Undoubtedly, the nuclear partnership with America saved Britain a massive amount of money and helped enormously in terms of the technical development of its nuclear force.³⁷ In the process, Britain lost a great deal of strategic independence, and America "secured a measure of control over British nuclear

policies."³⁸ Reciprocity and self-interest rather than kinship explain the US-UK nuclear partnership.

UK's NUCLEAR STRATEGY

The Era of Nuclear Stockpile Reduction (1991-2021)

The UK positioned its nuclear strategy to offset the Soviet Union's conventional superiority in Eastern Europe during the Cold War. Nuclear deterrence was the UK's best bet against a Soviet military invasion of Europe. In the final stages of the Cold War, the UK maintained an estimated stockpile of around 420 nuclear warheads, capable of launching from the air, water surface, and under water. The nuclear warheads in the British arsenal fulfilled strategic, sub-strategic and tactical roles.

With the end of the Cold War and improvement in the UK's strategic environment, the then Conservative government carried out a Nuclear Posture Review and withdrew the WE-177 free-fall bombs, dismantled the Royal Navy's surface ships' capability to carry nuclear warheads, and phased out tactical nuclear weapons mounted on heavy artillery.³⁹ As a

^{36.} Baylis, n. 26, p. 51.

^{37.} Ibid., p. 56.

^{38.} Ibid.

^{39.} Three significant developments improved the UK's perceptual strategic environment: dissolution of the Warsaw Pact, fall of the Soviet Union, and signing of the Strategic Arms Reduction Treaty of 1991. Taylor, et al., n. 7, p. 20.

result, when the Labour government took over in 1998, the UK's nuclear deterrent posture had been reduced to a single system—the Trident. By the mid-1990s, the nuclear stockpile had been reduced from approximately 420 nuclear weapons in the late 1980s to an estimated 300 warheads. In July 1998, the Labour administration conducted a new Strategic Defence Review (SDR) that further eased the British nuclear posture.⁴⁰ The SDR envisaged reductions in the overall nuclear arsenal and operational nuclear warheads. The number of operationally available warheads was to be decreased from a maximum of 300 under the previous administration to less than 200. It announced that the UK would deploy only one submarine for CASD. The submarine on patrol would carry a reduced load of 48 warheads compared to 96 during the Conservative government. The readiness posture of the submarines on patrol was relaxed, and the deployed missiles were de-targeted.

The subsequent notable development in the UK's nuclear posture was the 2006 nuclear White Paper titled "The Future of UK's Nuclear Deterrent."⁴¹ The White Paper further relaxed the operational stance of the UK's nuclear deterrence. It reduced the active warheads from fewer than 200 to fewer than 160. Also, the overall nuclear stockpile was reduced by 20 per cent.

On May 26, 2010, the UK publicly disclosed its total nuclear stockpile figures in a parliamentary statement issued by Foreign Secretary William Hague⁴². Hague announced that "for the first time, the government will make public the maximum number of nuclear warheads that the UK will hold in its stockpile: in future, our overall stockpile will not exceed 225

UK Ministry of Defence, *Strategic Defence Review*, July 1998. https://webarchive.nationalarchives. gov.uk/http:/www.mod.uk/NR/rdonlyres/sdr1998_complete.pdf. Accessed on July 10, 2021; Tom Dodd, *The Strategic Defence Review White Paper*, 98/91 (London: House of Commons Library, 1998).

⁴¹ UK Ministry of Defence and Foreign and Commonwealth Office, "The Future of the United Kingdom's Nuclear Deterrent", pp. 1-44, December 4, 2006. https://assets.publishing.service. gov.uk/government/uploads/system/uploads/attachment_data/file.pdf. Accessed on July 15, 2021.

^{42.} Until 2010, the UK mentioned the percentage reduction in its overall nuclear stockpile compared to a previous reference point. In 2010, for the first time, the UK released the nuclear warhead stockpile numbers explicitly. The warhead numbers for the preceding years have been retrospectively calculated.

nuclear warheads."⁴³ In July 2013, the Ministry of Defence confirmed that by May 2010, the overall nuclear stockpile had been reduced to less than 225.⁴⁴

The 2010 Strategic Defence and Security Review (SDSR) released by the Conservative government made further changes to the UK's nuclear stockpile and operational nuclear posture.⁴⁵ The SDSR reduced the operationally available warheads from "fewer than 160 to no more than 120", warheads deployed on the submarines from 48 to 40, and operational missiles on board Trident submarines from 12 under the previous government to no more than eight.⁴⁶ Besides, it announced an intention to lower the cap on the overall nuclear stockpile from a maximum of 225 warheads to not more than 180 by the mid-2020s.⁴⁷ In January 2015, former Secretary of State for Defence, Michael Fallon, clarified in a written ministerial statement that as announced by the 2010 SDSR, each Vanguard class submarine on CASD carried 40 warheads, reducing the operationally available warheads to no more than 120.⁴⁸

Subsequently, in 2015, the National Security Strategy and Strategic Defence and Security Review reaffirmed the intention made in the 2010 SDSR to reduce the overall nuclear stockpile to 180 warheads by the mid-2020s.⁴⁹ The submarines on patrol continued to carry 40 operational warheads and deploy eight operational missiles.⁵⁰ However, according to Hans Kristensen and Matt Korda, "Despite these stated intentions, it is believed that throughout

House of Commons Debates, May 26 2010, vol no. 510, column 181. https://publications. parliament.uk/pa/cmhansrd/cm100526/debtext/.htm#. Accessed on July 28 2021.

Sue Ford, email to R Edwards, July 25, 2013. https://robedwards.typepad.com/files/mod-foiresponse-on-dismantling-nuclear-weapons.pdf. Accessed on July 15, 2021.

HM Government, "Securing Britain in an Age of Uncertainty", *The Strategic Defence and Security Review*, pp. 37-39, October 2010. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/62482/strategic-defence-security-review. pdf. Accessed on July 12, 2021.

^{46.} Ibid., p. 38.

^{47.} Ibid., p. 39.

A written statement made by Michael Fallon on January 20, 2015, to the UK Parliament, Statement UIN HCWS210. https://questions-statements.parliament.uk/written-statements/ detail/2015-01-20/HCWS210. Accessed on July 28, 2021.

^{49.} n. 23.

^{50.} Ibid.

the decade, the overall size of UK nuclear stockpile remained constant, at approximately 225 nuclear weapons in total."⁵¹

INTEGRATED REVIEW: END OF A TREND?

The Integrated Review, released on March 16, 2021, represents a significant shift in the UK's nuclear posture since the 1990s and the bipartisan efforts to reduce the nuclear stockpile. Since the end of the Cold War, the UK has, for the first time, increased its overall nuclear stockpile from 225 to 260 nuclear warheads. As clarified by the British Ambassador to the Conference on Disarmament, Aidan Liddle, while the UK intended to reduce its overall nuclear stockpile to 180 by the mid-2020s, the cap on the number of nuclear warheads remained 225, as announced by the then Foreign Secretary, William Hague, in May 2010.⁵² Functionally, the UK would have reduced its overall nuclear stockpile to 180 by the mid-2020s. The new cap set by the 2021 Integrated Review is a 44 per cent increase compared to the 2010 commitment.

Nuclear Doctrine

In the Integrated Review, the UK has left untouched the proclaimed nuclear doctrine of minimum, credible, and independent nuclear deterrence. However, given the perceived potential threats such as advancements in Ballistic Missile Defence (BMD), hypersonic missiles, and cyber weapons, it does not consider the existing nuclear warheads stockpile credible enough to deter. In other words, what was deemed credible and minimum earlier is not regarded as credible in the light of the worsening security environment. Hence, for the minimum to be credible, the nuclear arsenal must be increased, according to the predominant view in the UK Administration.

^{51.} Kristensen and Korda, n. 5, p. 154.

^{52.} For example, see Aidan Liddle's comment on a twitter thread posted by Hans Kristensen, at https://twitter.com/AidanLiddle/status/. Accessed on July 15, 2021.

While the UK maintains deliberate ambiguity about the minute operational details of its nuclear posture, it used to, at least, declare figures of warheads deployed on the deterrent submarine and operational missiles on board the Trident system.

Nuclear Transparency

In its latest Integrated Review, the UK has gone back on its commitment to reduce its overall nuclear stockpile and baulked at operational transparency. While the UK maintains deliberate ambiguity about the minute operational details of its nuclear posture, it used to, at least, declare figures of warheads deployed on

the deterrent submarine and operational missiles on board the Trident system. With the 2021 Integrated Review, the UK has extended the policy of deliberate ambiguity and would no longer release public figures of its operational stockpile, deployed warheads and deployed missiles.⁵³

Negative Security Assurances

In its previous nuclear and defence White Papers, the UK had maintained that it would not use or threaten to use its nuclear weapons against Non-Nuclear Weapon States (NNWS) party to the NPT. The negative security assurances do not apply to the NNWS if they acquire and threaten to use biological or chemical weapons. The Integrated Review expands the caveats in the negative security assurance to include strategic threats emerging from novel technologies, in addition to biological and chemical threats.⁵⁴ It effectively means that the UK has reserved an option to launch nuclear weapons if novel disruptive technologies inflict a strategic attack and cause damage comparable to nuclear weapons. The Integrated Review has not defined novel disruptive technologies precisely; however, scholars and commentators have referred to hypersonic, cyber and BMD technology.

^{53.} n. 1, p. 77.

^{54.} Ibid.

Position on Non-Proliferation and Disarmament

Importantly, the Integrated Review has endorsed the ideals of multilateral disarmament, arms control, nonproliferation and a world without nuclear weapons.⁵⁵ It has endorsed The UK has reserved an option to launch nuclear weapons if novel disruptive technologies inflict a strategic attack and cause damage comparable to nuclear weapons.

the "full implementation of the NPT in all its aspects, including nuclear, non-proliferation, and the peaceful uses of nuclear energy."⁵⁶ It also refers to the United Kingdom as a responsible nuclear weapon state and reiterates its commitment towards strategic risk reduction and verifiable disarmament.

Timeline	Overall nuclear stockpile	Maximum operational nuclear warheads	Maximum nuclear warheads on board Trident submarine	Maximum operational missiles on board Trident submarine
Post-Cold War*	Approximately 420	300	96	-
1998 Strategic Defence Review	Approximately 280	200	48	-
2006 Nuclear White Paper (Future of Nuclear Deterrent)	Approximately 240-245	160	48	12

Table 1: Evolution of United Kingdom's Operational Nuclear Posture

^{55.} Ibid., p. 78.

^{56.} Ibid.

2010 Strategic Defence and Security Review	Envisioned to reduce nuclear warhead stockpile from "not more than 225 to not more than 180 by the mid-2020s."	120	40	8
2015 Strategic Defence and Strategic Review	Reaffirmed the 2010 commitment.	120	40	8
2021 Integrated Review	Increase nuclear warheads stockpile from a maximum of 225 nuclear warheads to "no more than 260 nuclear warheads."	-	-	-

Source: Compiled by the author from sources such as the House of Commons Briefing Paper, No. 9175; Hans M. Kristensen and Matt Korda, "United Kingdom Nuclear Weapons, 2021", *The Bulletin of the Atomic Scientists*, vol. 77, no. 3, 2021, pp. 153-158.

*At the peak of the Cold War, the late 1970s, the UK had around 520 nuclear warheads.

RATIONALE BEHIND THE NUCLEAR TURNAROUND

As is evident from the above two sections, the UK had moved to a relatively subdued nuclear posture after the Cold War. Since reaching its peak in the late 1970s, the UK had almost halved its nuclear capabilities by the 1990s. The incongruence between the UK's past nuclear behaviour and the one projected by Integrated Review makes one ask: what led the UK to roll back the decades-long progress on gradual nuclear reductions? There is no straightforward answer to why the UK has spiked the cap on the nuclear stockpile; multiple causations seem to be at work.⁵⁷ The Integrated Review has ambiguously mentioned the rationale behind the decision, and scholars and commentators have subsequently analysed the developments. This section expounds on the official explanation and the views and analyses of the strategic community.

Technological and Doctrinal Threats

The Integrated Review justifies the increase in nuclear warheads on the grounds of the "evolving security environment, including the developing range of technological and doctrinal threats."⁵⁸ It is not explicit about the technological and doctrinal threats; however, it hints at some states' developing novel nuclear technologies and tactical nuclear weapons and their integration into their military strategies and doctrines.⁵⁹ 'Some states' may be inferred as an indirect reference to Russia in particular and China to a lesser extent. It also identifies the evolving great-power competition and the disruptive technologies posing a threat to strategic stability.

Hypersonic Technology

In succession to the Integrated Review, Prime Minister Boris Johnson released the defence White Paper titled "Defence in a Competitive Age". While not directly related to the warhead decision, it offers some crucial indicators about the novel technologies threatening strategic stability in the UK's perception. These include advances in hypersonic technology made by a "wide range of state actors", which are increasingly challenging the UK's technological advantage, ballistic missile defences and strategic stability.⁶⁰ Manoeuvrable and speedy hypersonic gliders, capable of flying

^{57.} This section doesn't analyse which rationale explains the warhead spike better but outlines various possible motives that might have led the UK to inflate its nuclear arsenal. It might be possible that more than one motive or a combination of them has caused the UK to increase its nuclear stockpile.

^{58.} n. 1, p. 76.

^{59.} Ibid.

^{60.} Ministry of Defence, *Defence in a Competitive Age*, March 22, 2021, p. 7. https://www.gov.uk/government/publications/defence-in-a-competitive-age. Accessed on July 25, 2021.

The increase in the nuclear stockpile might be insurance against a preemptive strike targeting non-patrolling submarines or NC2, leaving the submarine at CASD with a higher retaliatory potential. at low heights over large distances, can penetrate the BMD. Their BMD penetrating capability exposes the Nuclear Command and Control (NC2) and other strategic assets that are protected by point missile defence to a strategic attack. The UK is concerned that Russian advances in hypersonic

technology can outmatch Britain's missile defences and target its strategic assets. The increase in the nuclear stockpile might be insurance against a preemptive strike targeting non-patrolling submarines or NC2, leaving the submarine at CASD with a higher retaliatory potential.

Integrated Air Defence Systems

Other variables cited in the recently released defence White Paper as possible contributors to the warhead rise are Russian and Chinese advancements in the early warning radars and integrated air defence systems.⁶¹ Mention of the air defence systems buttresses the statement made by the UK's Secretary of State for Defence Ben Wallace, in an interview with the British Broadcasting Corporation (BBC). Wallace attributed the increase in warhead numbers to the Russian advances in ballistic missile defence: "A quite clear study of effectively how warheads work and how they reenter the atmosphere means that you have to make sure they're not vulnerable to ballistic missiles defence," said Wallace.⁶² His statement indicates the UK's concern about the advances made by its adversaries in BMD technology, impeding its capability to retaliate. Thus, increasing the warheads might be an attempt to overwhelm the enemy's defences and increase the probability of missiles getting through them.

^{61.} Ibid., p. 9.

^{62. &}quot;Ben Wallace on Nuclear Weapons", Twitter video, 1: 47, March 21, 2021, BBC Politics. https://twitter.com/BBCPolitics/status. Accessed on August 26, 2021.

Nuclear War-fighting

In the 1990s, the UK had dismantled the sub-strategic and tactical nuclear warheads and, for over two decades, has not discussed the sub-strategic role of its nuclear arsenal. The last mention of the Trident's sub-strategic role and significance of limited nuclear capability to deterrence credibility was in the 1998 Strategic Defence Review. It stated that "the credibility The concern expressed in the Integrated Review about states developing warfighting nuclear systems and integrating them into their military strategy has led some scholars to speculate that the UK is seeking limited warfighting capability with an expanded nuclear arsenal.

of deterrence also depends on retaining an option for a limited strike... Unlike Polaris and Chevaline, Trident must also be capable of performing this 'sub-strategic' role."⁶³

The concern expressed in the Integrated Review about states developing war-fighting nuclear systems and integrating them into their military strategy has led some scholars to speculate that the UK is seeking limited war-fighting capability with an expanded nuclear arsenal. Professor Lawrence Freedman argues, "The implication is [*sic*] larger stockpile is to have capacity so that Trident can be counter to both Russian short-range systems for use on the European battlefield as well as longer-range missiles that threaten homelands."⁶⁴ Since the UK perceives the development of tactical nuclear weapons as a threat to strategic stability, it might be possible that with the increased nuclear stockpile, it might seek a sub-strategic or tactical role for its nuclear deterrence.⁶⁵

^{63.} UK Ministry of Defence, *Strategic Defence Review*, July 1998. https://webarchive.nationalarchives.gov.uk/http:/www.mod.uk/NR/rdonlyres/sdr1998_complete.pdf. Accessed on July 10, 2021.

^{64.} For example, see a thread on Nuclear Weapons Policy posted on Twitter by Lawrence Freedman. https://twitter.com/LawDavF/status/1371837330378661893. Accessed on July 15, 2021.

^{65.} One of the enduring principles of the UK's nuclear strategy, mentioned in its 2006 nuclear White Paper, is that "nuclear weapons are not meant for military use during the conflict but instead to deter and prevent aggression against our vital interests that cannot be countered by other means." Thus, any future British attempt to seek a sub-strategic role for its nuclear force would go against the UK's declaratory nuclear strategy.

Political Rationale

Some observers have argued that the changes announced in the Integrated Review would not cause any physical change in the UK's nuclear arsenal and have dismissed the security and technological rationales for increasing the nuclear stockpile.⁶⁶ According to them, the real motivations are political, not strategic. Robert Peston, the political editor of ITV News, cites a former government official arguing that the UK is trying to become unpredictable by sowing strategic ambiguity.⁶⁷ Similarly, Senior Research Fellow at the Royal United Services Institute (RUSI), Matthew Harries, in a hypothetical sketch, argues, "Even if you don't actually build the things … raising the cap will make the UK look tough in the eyes of the Russians."⁶⁸ Also, Peston argues that the increase in the nuclear stockpile is an attempt to showcase post-Brexit toughness.

Heather Williams, senior lecturer at King's College, London, presents a compelling argument against those dismissing the technological and strategic justification for the warhead spike. According to her, it makes perfect sense for the UK, which has minimal nuclear warheads, to increase its nuclear stockpile to balance against the technological advances made by Russia and China in cyber, hypersonic and missile defence technologies.⁶⁹ The very essence of nuclear deterrence lies in mutual vulnerability. If strategic missiles fail to penetrate the adversary's missile defences or NC2 and strategic weapon system are susceptible to a disarming first strike [which has become an attractive option with manoeuvrable and undetectable hypersonic guide vehicles (HGVs)], nuclear deterrence is not at all credible. Aiming more nuclear warheads towards the adversary is directly proportional to the

Robert Peston, "Why the UK Lifting its Nuclear Weapon Stockpile Cap is Not What it Seems", ITV News, March 17, 2021. https://www.itv.com/news/2021-03-16/why-the-uk-lifting-itsnuclear-weapon-stockpile-cap-is-not-what-it-seems-writes-robert-peston. Accessed on August 4, 2021.

^{67.} Ibid.

^{68.} Matthew Harries, "Why is the United Kingdom Raising its Nuclear Stockpile Limits?", *The Bulletin of the Atomic Scientists*, April 2, 2021. https://thebulletin.org/2021/04/why-is-the-united-kingdom-raising-its-nuclear-stockpile-limits/. Accessed on August 4, 2021.

Heather Williams, "UK Nuclear Weapons: Beyond the Numbers", War on the Rocks. https:// warontherocks.com/2021/04/u-k-nuclear-weapons-beyond-the-numbers/. Accessed on July 26, 2021.

probability of some strategic missiles penetrating its ballistic missile defences, argues Williams.⁷⁰

Replacement Warhead

Other analysts have suggested that by showcasing a robust nuclear commitment, the UK is signalling to the United States that it is serious about the replacement warhead and thereby help persuade the Biden Administration to "appropriate US taxpayer funds for a newly designed Submarine-Launched Ballistic Missile (SLBM) warhead, dubbed the W93."71 As inadvertently revealed by the Commander of the United States Strategic Command, Charles Richard, and later confirmed by Ben Wallace in February 2020, the UK's successor warhead to the Holbrook is intricately tied to the US' W93 warhead programme.⁷² In August 2020, The Guardian revealed that Wallace wrote a letter in April 2020, lobbying the US Congress to fund the W93 warhead. Wallace wrote, "Congressional funding in [2021] for the W93 programme will ensure that we continue to deepen the unique nuclear relationship between our two countries, enabling the UK to provide safe and assured continuous-at-sea deterrence for decades to come."73 The US programme to develop its third submarinelaunched warhead was given congressional approval in December 2020; however, there are concerns that in its upcoming Nuclear Posture Review, the Biden Administration may not go ahead with the unnecessary, costly and controversial warhead.

^{70.} Ibid.

Dan Sabbagh, "Trident Nuclear Warhead Numbers Set to Increase for First Time Since Cold War", *The Guardian*, March 12, 2021. https://www.theguardian.com/uk-news/2021/mar/12/ trident-nuclear-warhead-numbers-set-to-increase-for-first-time-since-cold-war. Accessed on July 6, 2021; Kimball, n. 4, p. 3.

^{72.} US Senate Committee on Armed Services, "Statement of Charles A. Richard, Commander United States Strategic Command, before the Senate Committee on Armed Services", p. 13. https://www.armed-services.senate.gov/download/richard-testimony-042021. Accessed on July 18, 2021.

Julian Borger, "UK Lobbies US to Support Controversial New Nuclear Warheads", *The Guardian*, August 1, 2020. https://www.theguardian.com/world/2020/aug/01/uk-trident-missile-warhead-w93-us-lobby. Accessed on July 18, 2021.

The UK is particularly worried about China's military modernisation and growing military assertiveness.

Strategic Relevance

There has been an entrenched belief amongst the British political and strategic community that nuclear weapons are necessary for maintaining its great power status, in addition to catering for its security. One of

the reasons the UK went nuclear in 1952 was to revive its pre-War prestige and great power status.⁷⁴ Therefore, increasing the nuclear warheads might signal to the international community that the United Kingdom is still a major global power and, if required, capable of expanding its nuclear arsenal. It also indicates that the UK is no longer interested in remaining part of the disarmament discussions. It is willing to let go of its exemplary record in stockpile reduction to remain relevant to the geopolitical competition. If the increase in its nuclear stockpile makes a country relevant to the global order, it signifies the centrality of nuclear weapons in the great power competition.

The China Factor

China is another factor all over the Integrated Review but has not been flagged by any commentator except for being touched upon briefly by Heather Williams. While technological, transnational and systemic challenges from Russia, Iran and North Korea have remained part of the UK's strategic calculus for decades, the inclusion of China as a strategic competitor⁷⁵ and "biggest state-based threat to the UK's economic security"⁷⁶ is the most significant change in the UK's threat perception as compared to previous strategic White Papers. Never before, except in the Integrated Review published in March 2021, has China been projected in a negative light from the security and strategic standpoint. The UK is particularly worried about China's military modernisation and growing military assertiveness. The change in threat perception is evident in the UK banning the Chinese technology giant—Huawei—from its network market

^{74.} Freedman, n. 34, p. 5.

^{75.} n. 1, p. 26.

^{76.} Ibid., p. 62.

for cybersecurity concerns.⁷⁷ Other than that, the UK's concerns about China's increasing involvement in its nuclear energy projects are evident in ongoing tensions between the British government and the China General Nuclear Power Group.⁷⁸ China's advances in hypersonic missiles have The increasing dependence of states on cyber space for supporting the Critical National Infrastructure (CNI) and military operations has created new potential vulnerabilities.

also raised eyebrows in London, a concern highlighted by the 2021 defence White Paper. Also, the synergy between Russia and China is a threat to the United Kingdom and its European allies.

TECHNOLOGICAL AND THEORETICAL ISSUES

This essay outlined the Integrated Review's significant developments and rationale for the UK's warhead decision in the previous two sections. Several of the events discussed in it, as well as the reported reasons for the warhead rise, present some compelling theoretical issues.⁷⁹ Can nuclear weapons effectively deter an asymmetric cyber attack? Do hypersonic weapons comprise a missile defence panacea? Does BMD compromise mutual vulnerability? Thus, in this section, the essay has attempted to analyse aspects of the Integrated Review and stated rationales that raise questions of theoretical salience.

Cyber Deterrence

The increasing dependence of states on cyber space for supporting the Critical National Infrastructure (CNI) and military operations has created

^{77.} Thomas Seal, "UK Bans Installation of Huawei 5G Gear from September", Bloomberg, November 30, 2020. https://www.bloomberg.com/news/articles/2020-11-30/u-k-unveils-5g-plan-banning-huawei-installations-from-september. Accessed on August 4, 2021.

Joe Mayes, Tim Ross and Rachel Morison, "ÚK to Move Ahead on Nuclear Project Without China Support", Bloomberg, July 26, 2021. https://www.bloomberg.com/news/articles/2021-07-25/u-k-eyes-removing-china-s-cgn-in-energy-plans-as-ties-fray. Accessed on September 3, 2021.

⁷⁹ Not all the developments or stated rationales are of theoretical salience. In the author's view there are three such fundamental issues: cyber deterrence, hypersonic weapons, and ballistic missile defence.

new potential vulnerabilities. The opponent might use cyber weapons to compromise the defenders' information system infrastructure, manipulate data, deny data to decision-makers or feed false information. These new potential vulnerabilities have created concerns amongst the policy-makers and strategic community about deterring cyber attacks. However, the possibility of deterring cyber attacks is not straightforward and is fraught with uncertainty and indecision.

IS IT POSSIBLE TO DETER CYBER ATTACKS?

The UK's attempt to deter a non-nuclear strategic attack with the threat of nuclear retaliation (which follows the US doctrine announced during the Trump Administration, which reserves the option to launch nuclear weapons in response to a significant cyber attack) is an example of deterrence by punishment and inter-domain deterrence.⁸⁰ Assuming a cyber attack to be the imminent emerging threat, an article published in *The Guardian* reported that "Britain is prepared to launch nuclear weapons if the country is faced with an exceptionally destructive attack using cyber or other emerging technologies."⁸¹ The credibility and effectiveness of intra-domain deterrence in cyber space, that is, deterring a cyber attack with cyber retaliation, is itself questionable.⁸² The proposition to deter cyber attacks with the threat of a retaliatory nuclear strike is far-fetched and illusionary. As aptly argued by Richard Clark and Robert Knake, "Of all the nuclear strategy concepts, deterrence theory is probably the least transferable to cyber war."⁸³

^{80.} Inter-domain deterrence is a case of nuclear deterrence when the means of attack and means of retaliation belong to disparate theatres of offence. For example, deterring a cyber attack with the threat of nuclear retaliation.

Dan Sabbagh, Jessica Elgot, and Patrick Wintour, "Defence Review: UK Could Use Trident to Counter Cyber-Attack", *The Guardian*, March 16, 2021. https://www.theguardian. com/politics/2021/mar/16/defence-review-uk-could-use-trident-to-counter-cyber-attack. Accessed on July 6, 2021.

^{82.} Amir Lupovici, "Cyber Warfare and Deterrence: Trends and Challenges in Research", *Military and Strategic Affairs*, vol. 3, no. 3, 2011, p. 49.

^{83.} Quoted in Joseph S. Nye Jr., "Deterrence and Dissuasion in Cyberspace", *International Security*, vol. 41, no. 3, 2017, p. 45.

ATTRIBUTION DILEMMA

For deterrence to be credible, the defender must successfully identify the enemy beforehand. The credibility of the threat should be known to the potential adversary before he contemplates an attack.⁸⁴ However, cyber space offers great obfuscation potential, and hackers could easily mask their identity and actual points of origin. To be sure, attribution is not easy even in other forms of attacks but it is murkier in cyber space. Even if the defender can identify the origin of a cyber attack, the attack may be misattributed.⁸⁵ The attribution problem is best summed up in the words of former US Deputy Secretary of Defence William Lynn, "Whereas a missile comes with a return address, a computer virus does not. The forensic work necessary to identify an attacker may take months, if identification is possible at all."⁸⁶

ABSENCE OF VALUABLE INFRASTRUCTURE

Another critical requirement for deterrence to be credible is that the challenger must own something of greater value that it is unwilling to risk losing.⁸⁷ The lack of valuable infrastructure at the aggressor's end, reduces its vulnerability and boosts its will to mount an offensive. On the other hand, developed states own sophisticated information systems linked to their CNI and military infrastructure and, thus, are more vulnerable to attacks, limiting their willingness to retaliate.⁸⁸

INADVERTENT ESCALATION

The proposition of deterring a cyber attack with nuclear retaliation is challenging to execute and could lead to inadvertent escalation. Even if the

Patrick M. Morgan, "Applicability of Traditional Deterrence Concepts and Theory to the Cyber Realm", in John D. Steinbruner, et al. ed., *Proceedings of a Workshop on Deterring Cyberspace* (Washington: National Academies Press, 2010), p. 64; Lupovici, n. 82, p. 51.

^{85.} Gina Chon, Kadhim Shubber and Ben McLannahan, "Three Charged in 'Sprawling' JPMorgan Hack," *Financial Times*, November 10, 2015. https://www.ft.com/content/5862d350-87c1-11e5-90de. Accessed on July 26, 2021.

^{86.} Nye, n. 83, p. 54.

^{87.} Emilio Iasiello, "Is Cyber Deterrence an Illusory Course of Action", *Journal of Strategic Security*, vol. 1, no. 1, 2014, p. 64.

^{88.} Lupovici, n.82, p. 52.

intentions of the aggressor are not escalatory, the infiltrated bug does not understand boundaries. A malware intended to target a non-nuclear system may accidentally proliferate into strategic infrastructure, which it was not intended to do in the first place. Accidental malware proliferation could lead to inadvertent escalation.⁸⁹ Entanglement between the nuclear and conventional military Command, Control, Communication, Intelligence (C3I) assets further amplifies the risk of inadvertent escalation.⁹⁰

PROPORTIONALITY

According to the 1949 Geneva Conventions on the Law of Armed Conflict, punishment must be proportionate to the offence, in terms of both damage and civilian casualties.⁹¹ Using nuclear weapons against a cyber attack goes against all established principles of proportionality. Moreover, waging a nuclear attack against a nuclear-armed adversary involves the risk of counter retaliation.

For the various reasons mentioned above, the threat of nuclear retaliation is not effective in the cyber domain. In the realm of cyber space, deterrence by denial has a better chance of succeeding as compared to deterrence by punishment.⁹² Most importantly, deterrence through denial frees the defender from the attribution problem.⁹³ Strengthening defensive capabilities makes the challenger's adventure costly and enhances the defender's capability to attribute the cyber attacks. However, defence is not a panacea for deterring cyber offences since "perfect network security is impossible."⁹⁴ Cyber defences must evolve with the global hacking community to remain relevant, adopting best practices, technologies and tactics.

James M. Acton, "Cyber Warfare and Inadvertent Escalation", *Daedalus*, vol. 149, no. 2, 2020. https://direct.mit.edu/daed/article/149/2/133/27317/Cyber-Warfare-amp-Inadvertent-Escalation. Accessed on July 24, 2021.

James M. Acton, "Escalation through Entanglement", International Security, vol. 43, no. 1, 2018, pp. 56-99.

^{91.} Iasiello, n. 87, p. 59.

^{92.} Nye, n. 83, pp. 55-56.

^{93.} Morgan, n. 84, p. 59.

^{94.} Acton, n. 89, p. 134.

HYPERSONIC WEAPONS: A MISSILE DEFENCE PANACEA?

Technology warriors have presented hypersonic missiles as a panacea for missile defence systems.⁹⁵ The argument is that fast, manoeuvrable, and low flying hypersonic weapons could penetrate the enemy's missile defences. The perceived vulnerability from a disarming first strike could reduce the states' ability to Technology warriors have presented hypersonic missiles as a panacea for missile defence systems. The argument is that fast, manoeuvrable, and low flying hypersonic weapons could penetrate the enemy's missile defences.

cause unacceptable damage in retaliation, which has made them insecure about their nuclear deterrence. Thus, states like the US, Russia, China and Japan have jumped into a hypersonic arms race to counter advances made by their adversaries.⁹⁶ The United Kingdom is in the development and experimentation stage with regard to hypersonic weapons.⁹⁷ In July 2019, it had awarded a £12 million contract to Rolls-Royce and its industrial partners to build hypersonic aircraft propulsion systems.⁹⁸ Also, the Integrated

^{95.} Steven Simon, "Hypersonic Missiles Are a Game Changer", *The New York Times*, January 2, 2020. https://www.nytimes.com/2020/01/02/opinion/hypersonic-missiles.html. Accessed on July 27, 2021; R. Jeffrey Smith, "Hypersonic Missiles Are Unstoppable. And They're Starting a New Global Arms Race", *The New York Times Magazine*, June 19, 2021. https://www.nytimes.com/2019/06/19/magazine/hypersonic-missiles.html. Accessed on July 28, 2021.

^{96.} Congressional Research Service, *Hypersonic Weapons: Background and Issues for Congress*, Kelley M. Sayler, R45811 (Washington, DC: Congressional Research Service, 2021); "First Regiment of Avangard Hypersonic Missile Systems Goes on Combat Duty in Russia", *TASS*, December 27, 2019. https://tass.com/defence/1104297. Accessed on August 1, 2021; "China Displays New Hypersonic Nuclear Missile on 70th Anniversary", Reuters, October 1, 2019. https://www.aljazeera.com/news/2019/10/1/china-displays-new-hypersonic-nuclear-missile-on-70th-anniversary. Accessed on August 2, 2021; "Japan To Guard Disputed Islands with Hypersonic Missiles That Can 'Decimate' Chinese Warships", *The EurAsian Times*, August 30, 2021. https://eurasiantimes.com/japan-to-guard-disputed-islands-with-hypersonic-missiles-that-can-decimate-chinese-warships/. Accessed on September 2, 2021.

^{97.} The development of hypersonic weapons might provide the UK with a way around the Russian BMDs. However, as argued in the section below, hypersonic weapons' advantages are minimal. Also, even in the absence of hypersonic missiles, the UK already has the capability to get past Russian BMDs.

Andew Chuter, "British Military Scrambles to Speed Up Work on Hypersonic Engines, Weapons," Defense News, July 18, 2019. https://www.defensenews.com/global/europe/2019/07/18/ british-military-scrambles-to-speed-up-work-on-hypersonic-engines-weapons/. Accessed on October 26, 2021.

The UK's deterrent capability is submarine-based, with at least one Vanguard class submarine always on a CASD since April 1969. Even if the enemy's hypersonic missiles inflict a damaging strike, the UK's capability to inflict a retaliatory strike remains unscathed. Review has allocated £6.6 billion for novel military research, including hypersonic and laser weapons.⁹⁹ It is evident from the 2021 defence White Paper that Britain is concerned about the advances in hypersonics made by Russia and China.¹⁰⁰ The underlying concern is that hypersonic missiles could penetrate the UK's BMD and target its CNI, military installations, and nuclear command and control.

The British reservations about the unsettling hypersonic technology are valid. However, the concerns are assuaged for reasons specific to the UK's deterrent capability and the technological limitations of hypersonic missiles.

The UK's deterrent capability is submarine-based, with at least one Vanguard class submarine always on a CASD since April 1969. Even if the enemy's hypersonic missiles inflict a damaging strike, the UK's capability to inflict a retaliatory strike remains unscathed. The capability of the nucleararmed ballistic submarine at CASD to traverse undetected near an enemy's territory and attack swiftly would prevent an adversary from launching the first strike.

Limitations of Hypersonic Systems

Speed and manoeuvrability are the two characteristic qualities of hypersonic missiles that contribute, or are believed to contribute, to their BMD penetrating capability. However, as they approach the target, the reentry vehicle's speed decreases to that of short-range ballistic missile due to atmospheric and aerodynamic resistance and energy lost due to high-speed

Dominic Nicholas, "Britain Pours Billions into Race to Develop World's Fastest Missile," *The Telegraph*, March 17, 2021. https://www.telegraph.co.uk/news/2021/03/17/exclusivebritain-pours-billions-race-develop-worlds-fastest/. Accessed on October 26, 2021.

^{100.} Ministry of Defence, "Defence in a Competitive Age", p. 7, March 22, 2021. https://www.gov. uk/government/publications/defence-in-a-competitive-age. Accessed on July 25, 2021.

manoeuvring.¹⁰¹ Thus, it is very likely that glide vehicles are vulnerable to the sophisticated missile defences deployed by the UK.

While hypersonic missiles can fly at low altitudes, they cannot travel low enough to evade terrestrial radar systems when flying over long distances. Due to "aerodynamic load and pressure limitations," hypersonic missiles cannot fly at lower altitudes where radar-evading cruise missiles fly.¹⁰² As pointed out by Colonel Stephen Reny of the US Air Force Academy, "Lower altitudes are problematic for hypersonic flight because the lower altitudes overpressure hypersonic engines, and prolonged flight creates extreme thermal management issues."¹⁰³ Thus, hypersonic missiles have to fly at an altitude higher than 70,000 ft, making them vulnerable to radar detection.

It could be critically argued that hypersonic weapons can carry inflight terminal manoeuvres and, thus, evade missile defences. However, manoeuvrability at hypersonic speeds is not all that easy. "One potential challenge for boost-glide weapons is that the high acceleration required for evasive manoeuvring could complicate the reception of GPS signals, potentially undermining accuracy," argues James Acton.¹⁰⁴ Also, even a slight deflection at hypersonic speed could generate such large radii having the potential "to throw these swift vehicles miles off course in a fraction of second."¹⁰⁵ Another limitation of manoeuvring at high speed is that it reduces the speed of the glide vehicle, adversely affecting the range and survivability of the vehicle.

Colonel Reny argues, "The speed, range, and manoeuvrability of hypersonics are all attributes that will make them preeminent weapons, but that capability will likely not culminate in the penetrating defence panacea some literature speculates."¹⁰⁶ Moreover, the destabilising concerns about

105. Reny, n. 102, p. 58.

James M. Acton, "Hypersonic Boost-Glide Weapons", Science and Global Security, vol. 23, no. 3, 2015, p. 134.

Stephen Reny, "Nuclear-Armed Hypersonic Weapons and Nuclear Deterrence", Strategic Studies Quarterly, vol. 14, no. 4, 2020, p. 56.

^{103.} Ibid., p. 57.

^{104.} Acton, n. 101, p. 213.

^{106.} Ibid., pp. 59-60.

MIRVs—multiple warheads packed on a single missile—were developed to counter the defensive advantage provided by the missile defence technology and reestablish strategic vulnerability. Their capability to confuse BMDs and penetrate BMDs is well recognised. hypersonic missiles, in the context of the UK are, to a large extent, assuaged by its submarine-based nuclear deterrence.

Ballistic Missile Defence and Assured Vulnerability

The UK has cited Russian advances in BMD technology as one reason for expanding its nuclear arsenal. The Russian BMDs have threatened the assured retaliation capacity of the UK, argues Ben Wallace. However, the UK's deterrence posture and the limitations of the adversary point

BMDs, allow the UK to penetrate its defences and attack value targets.

SUBMARINE-BASED DETERRENCE

The United Kingdom maintains a submarine-based deterrence, capable of reaching deep inside the enemy's waters undetected. SLBMs launched from such close ranges reduce the reaction time for missile defences and have a fair chance of penetrating the adversary's defences. Moreover, swarms of missiles launched from longer distances could overwhelm the enemy's missile defence systems, with only a few reaching the target and a few sufficient to create mutual vulnerability.

MIRVED TRIDENT

Trident missiles, which the UK operates in a communal pool with the US, are endowed with the capability to launch Multiple Independently Targetable Reentry Vehicles (MIRVs), demonstrating limited manoeuvrability.¹⁰⁷ MIRVs—multiple warheads packed on a single missile—were developed to counter the defensive advantage provided by the missile defence technology

^{107.} Taylor et. al., n. 7, p. 15.

and reestablish strategic vulnerability. Their capability to confuse BMDs and penetrate BMDs is well recognised.

POINT DEFENCES

The BMDs employed by the UK's adversaries are point missile defences, securing a defined theatre.¹⁰⁸ Unless they can employ national missile defence systems, which is both technologically challenging and economically draining, the UK could target high-value targets unprotected by the BMDs. Moreover, none of the missile defences is fully secure. Even a slight chance of a few nuclear warheads getting through will deter the enemy from launching a first strike.

FUTURE OF UK'S NUCLEAR DETERRENCE

Possible Deterrent Options: An Assessment¹⁰⁹

The UK carried out an extensive study over the possible range of deterrent options to replace the Vanguard class submarines. A thorough examination of a variety of options resulted in the identification of four generic options: a long-range aircraft equipped with cruise missiles, a silo-based system with ballistic missiles, a large surface ship equipped with ballistic missiles, and a submarine equipped with ballistic missiles. The report concluded that from a capability, operational posture and cost perspective, a "submarine-based system offers the most practical and effective means of meeting our future nuclear deterrence requirements."

The study offered the following reasons for selecting submarines over other delivery platforms. A long-range aircraft armed with cruise missiles

^{108. &}quot;Chinese and Russian Missile Defence: Strategies and Capabilities", DOD News, July 28, 2020. https://media.defense.gov/2020/Jul/28/CHINESE_RUSSIAN_MISSILE_DEFENSE_FACT_ SHEET.PDF. Accessed on August 5, 2021.

^{109.} This section draws from the Annexure B: Options Assessment Process, mentioned in the UK Ministry of Defence and Foreign and Commonwealth Office, "The Future of the United Kingdom's Nuclear Deterrent", pp. 34-39, December 4, 2006. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file.pdf. Accessed on July 15, 2021.

Silo-based systems are "immobile and impossible to conceal" and, thus, vulnerable to preemptive strikes. Even hardened silos with a high degree of protection are vulnerable to well-targeted precision strikes. is vulnerable to preemptive strikes and interception: "whilst on the ground, to conventional and nuclear missile threats, and to terrorist attacks, and once airborne, to surface-to-air and airto-air missiles." Moreover, measures to increase the readiness posture of the aircraft are visible from satellite-based systems and, therefore, escalatory in a crisis.

Silo-based systems are "immobile and impossible to conceal" and, thus, vulnerable to preemptive strikes. Even hardened silos with a high degree of protection are vulnerable to well-targeted precision strikes. Although it is possible to extend the endurance of ground-based missiles by distributing them over large distances, the UK is an island nation with a small geographical area. "Clustering silos in a small area would leave them vulnerable to being destroyed by a single incoming nuclear-armed missile." In another option, the undispersed ground-based missiles could be positioned on the launch on warning posture and, thus, freed from the concern of preemptive strikes. However, holding nuclear forces "at such high readiness could be highly destabilising in a crisis."

As compared to submarines, surface ships "provide less capability with greater vulnerability." They could be easily detected and tracked from space-based systems, making them highly vulnerable to preemptive strikes. Submarines are the most survivable or least vulnerable of all the delivery platforms. They could be easily concealed underwater and provide a deterrent effect anywhere in the world. Moreover, in terms of cost, "maintaining a submarine-based deterrent has a significant advantage over the large aircraft and silo-based approaches and is broadly similar to the surface ship option."

In addition to the stated reasons, having a survivable delivery platform allows the UK to maintain a lower warhead stockpile in concordance with its declared nuclear doctrine of a credible and minimal nuclear deterrent. Also, maintaining a less vulnerable delivery system has enabled the United Kingdom to reduce its warhead stockpile gradually. Most importantly, the submarine's invulnerability and retaliation assuredness contribute to the credibility of the nuclear deterrent, disincentivising predilection to pre-emptive strikes, thus, enhancing nuclear stability. The first of the four submarines, the *Dreadnought*, is expected to enter service in the early 2030s and cater to the UK's nuclear deterrence requirements until the early 2060s.

Dreadnought Class Ballistic Missile Submarine

The 2006 nuclear White Paper made the in-principle decision to extend the UK's existing nuclear deterrent capability by replacing the Vanguard class submarines with a new class.¹¹⁰ A year later, on March 14, 2007, the House of Commons approved the decision to "retain a strategic nuclear deterrent beyond the life of the current system."¹¹¹ Thenceforth, a five-year assessment programme finalised the design of the successor submarine. On July 18, 2016, with bipartisan support, the British Parliament once again approved extending the UK's submarine-based nuclear deterrent.¹¹² It also flagged off the manufacturing phase of the successor submarine programme. Under the programme, the UK is building four new Dreadnought class ballistic missile submarines.¹¹³

The first of the four submarines, the *Dreadnought*, is expected to enter service in the early 2030s and cater to the UK's nuclear deterrence requirements until the early 2060s. The Dreadnought class submarines, when deployed, would be equipped with Trident II D5 missiles. The United Kingdom is participating in the US Service Life Extension Programme (SLEP)

^{110.} Ibid., p. 25.

^{111.} Mills, n. 19, p. 6.

^{112.} Griff White, "British Parliament Votes to Renew Nuclear Weapons Program for 3 More Decades", *The Washington Post*, July 18, 2016. https://www.washingtonpost.com/world/britishparliament-set-to-renew-nuclear-weapons-program-for-three-more-decades/2016/07/18/_ story.html. Accessed on August 5, 2021.

^{113.} The successor class submarine was named Dreadnought by the UK's Ministry of Defence on October 21, 2016.

for the Trident II D5 missiles,¹¹⁴ which will extend the life of Trident missiles to 2039, catering to the initial operational requirements of the Dreadnought submarines.¹¹⁵ Also, the UK, in conjunction with the United States, is developing a new replacement warhead programme named W93.¹¹⁶ With the development of the Dreadnought class submarine in the pipeline, which is expected to join the Royal Navy in the early 2030s, SLEP for the Trident II D5 missile underway and the development of a new replacement warhead in place, the UK's nuclear deterrence is assured for the next three decades, beyond the early 2030s.

How will the UK realise its plan to increase its overall nuclear warheads? In a 2013 response to the Request for Information under the Freedom of Information Act (FOI), the Ministry of Defence (MoD) revealed that, since 2002, the Atomic Weapons Establishment (AWE) has been running a Stockpile Reduction Programme at its Burghfield, Berkshire facilities to disassemble the nuclear warheads phased out under various nuclear, strategic and defence White Papers.¹¹⁷ While describing the disarmament process, the MoD disclosed, "A number of warheads identified in the programme for reduction have been modified to render them unusable whilst others identified as no longer being required for service are currently stored and have not yet been disabled or modified."¹¹⁸ Since the UK lacks the capability to quickly manufacture 50-60 new warheads to meet its inflated stockpile cap, it is highly likely, argues Hans Kristensen, that the UK will reintroduce retirement warheads that have not been "rendered unusable" and are awaiting dismantlement and disposition.¹¹⁹

^{114.} In the 2006 Nuclear White Paper, *The Future of the United Kingdom's Nuclear Deterrent*, the UK decided to participate in the US-led Trident II D5 life extension programme.

^{115.} US Navy's Strategic Systems Programme Office is planning to begin a second life extension program for the Trident II missiles, which will extend the service-life of Trident missiles to the early 2080s.

^{116.} n. 72, p. 13.

^{117.} Ford, email to Edwards, n. 44, p. 3.

^{118.} Ibid.

^{119.} Kristensen, , n. 3.

Political Position on Nuclear Deterrent

While keeping in mind the mention in the Integrated Review that the UK will continue to keep its nuclear posture under review "in the light of the international security environment and the actions of potential adversaries",¹²⁰ it will be interesting to see whether the future UK government will stick to the decision to increase nuclear warheads. Some have been critical of the Labour Party's plan to increase the nuclear warhead cap. Lisa Nandy, the UK's While keeping in mind the mention in the Integrated Review that the UK will continue to keep its nuclear posture under review "in the light of the international security environment and the actions of potential adversaries", it will be interesting to see whether the future UK government will stick to the decision to increase nuclear warheads.

shadow secretary of state, told the BBC, "We are absolutely baffled" by the government's decision to increase the number of nuclear warheads.¹²¹ When pressed to state the Labour Party's position on the warhead decision, she answered, "Until they give an explanation to the House of Commons, we won't support them."¹²² Even those like Kier Starmer, leader of the opposition, who supported the decision to renew the Trident in 2016, posed tough questions to British Prime Minister Boris Johnson: "The Labour Party's support for nuclear deterrence is non-negotiable, but this review breaks the goal of successive prime ministers and cross-party efforts to reduce our nuclear stockpile."¹²³

The Labour Party is generally divided on the question of retaining nuclear weapons. In the vote to renew the British nuclear deterrent in July

^{120.} n. 1, p. 76.

^{121.} Richard Wheeler, "Labour Will Not Back Government on Boosting Nuclear Stockpile, Says Nandy", *Evening Standard*, March 21, 2021. https://www.standard.co.uk/news/uk/ government-labour-lisa-nandy-ben-wallace-politics-b925370.html. Accessed on September 2, 2021.

^{122.} Ibid.

^{123.} House of Commons Debates March 16, 2021, Volume 691, Column 164. https://hansard. parliament.uk/commons/2021-03-16/debates/IntegratedReview#contribution. Accessed on September 4, 2021.

2016, 140 Labour Members of Parliament (MPs) voted in favour, while 47 voted against it.¹²⁴ Recently, in a speech to the RUSI, the UK's Shadow Defence Secretary, John Healey, said that "Labour's support for the UK's nuclear deterrent is non-negotiable."¹²⁵ Moreover, maintaining nuclear weapons remained a part of the Labour Party's 2019 election manifesto. In contrast to the Labour Party's controversial stance on nuclear weapons, the Conservatives are more supportive of nuclear weapons in general, and specifically of warhead expansion. Only one Conservative MP, Crispin Blunt, voted against the renewal of the Trident in 2016, whereas 322 Tories voted in favour. Although the Labour camp has expressed discontent with the increase in nuclear warheads, given the bipartisan commitment to retain nuclear weapons and worsening threat perception, it is more likely than not that the decision to increase the warhead cap is here to stay and will probably be retained in the future.

IMPLICATIONS FOR INDIA

Although the UK's decision to increase its nuclear warheads does not directly impact India's security or strategic interest, it may have an indirect effect on the global non-proliferation regime, and increase the salience of nuclear weapons in general and for great power competition in particular, indirectly affecting Indian security interests and complicating the Indian strategic calculus amidst the great power competition.

Since the primary purpose of the British nuclear weapons is to deter threats from the Russian Federation, with the recent security and defence White Papers raising concerns regarding Russia's development of hypersonic systems, tactical nuclear weapons and integrated missile defence, the UK's attempts to bolster its nuclear capabilities might worsen the Russian threat security calculations. Moscow has expressed discomfort with NATO's

^{124.} Julia Rampen, "How Labour MPs Voted on Trident", *New Statesman*, July 19, 2021. https://www.newstatesman.com/politics/staggers/2016/07/how-labour-mps-voted-trident. Accessed on September 4, 2021.

^{125. &}quot;Labour Renews Vow to Keep Nuclear Weapons", BBC, February 26, 2021. https://www.bbc. com/news/uk-politics-56198972. Accessed on September 4, 2021.

expansion and deployment of NATO forces beyond its traditional sphere of influence. British deployment of strategic forces in Russian waters and increase in its nuclear stockpile might exacerbate Russian security concerns of Western intervention in the former Soviet republics. Tensions between Russia on one side, and Britain, the British deployment of strategic forces in Russian waters and increase in its nuclear stockpile might exacerbate Russian security concerns of Western intervention in the former Soviet republics.

European Union (EU), NATO and the West, on the other, are not in India's interest. India is trying to balance its historical strategic relationship with the Russian Federation and its emerging ties with the United States and its allies. Thus, an amicable relationship between Russia and the Western nations is in India's interest.

Since the inception of nuclear weapons, India has been an activist for nuclear disarmament and a nuclear testing ban. Even after becoming a nuclear-armed state in 1998, some scholars would argue, India's engagement with the non-proliferation regime and activism for nuclear disarmament has continued.¹²⁶ The UK's decision to boost its nuclear arsenal, inadvertently increases the salience of nuclear weapons. It reinforces the impression that having more nuclear weapons may assure greater deterrence. Meanwhile, nuclear disarmament will remain a distant goal as long as countries continue to acquire nuclear weapons and collective declarations on preventing nuclear war have an impact on the nuclear policies and doctrines of major powers.

CONCLUSION

The UK's decision to substantially strengthen its nuclear deterrence reverts decades of progress on nuclear warheads' reduction, nuclear diplomacy and multilateral disarmament. It has lost credibility "to generate international condemnation of China's nuclear build-up and China's lack of nuclear

^{126.} Manjari Chatterjee Miller and Kate Sullivan de Estrada, "Continuity and Change in Indian Grand Strategy: The Cases of Nuclear Non-Proliferation and Climate Change", *India Review*, vol. 17, no. 1, 2018, pp. 33-54.

transparency", argue Tom Plant and Matthew Harries of RUSI.¹²⁷ Also, it has made life more challenging for the Biden Administration to pursue further arms control and reduction measures with Russia, which has requested that future deals take into consideration the nuclear arsenals of the NWS, especially the UK and France.¹²⁸ Next year, the UK will likely incur strong criticism for increasing its nuclear warheads and backpeddling operational transparency at the NPT review meeting. It will be interesting to watch how the UK will defend its decision to spike nuclear warheads while continuing to commit itself to multilateral disarmament, arms control, non-proliferation, and a world without nuclear weapons.

Strategic and policy decisions do not have to be consistent with theoretical concepts. The fact that nuclear warheads do not enhance deterrence after all did not stop the Americans and Soviets from diving into an expensive arms race and building thousands of nuclear weapons. What matters is not how things actually are, but how the state actors perceive them. It is the perception or misperception that shapes the decision-making process. With all these caveats in place, it is safe to argue that the United Kingdom's decision to increase its nuclear warheads is incongruous with the deterrence theory requirements and literature on novel technologies. "For deterrence, one asks, how much is enough, and enough is having a second-strike capability," argues Kenneth Waltz.¹²⁹ With one of its nuclear-armed Vanguard class submarines always on a sea deterrent and a new Dreadnought class submarine under production to replace the Vanguard class in the early 2030s, the UK has an assured second-strike capability.¹³⁰ It is not clear whether an expansion of its nuclear arsenal enhances the credibility of the UK's nuclear deterrence; however, it does hurt its disarmament interests, casts a shadow on its

^{127.} Tom Plant and Matthew Harries, "Going Ballistic: The UK's Proposed Nuclear Build-up", Royal United Services Institute, March 16, 2021. https://rusi.org/explore-our-research/ publications/commentary/going-ballistic-uks-proposed-nuclear-build. Accessed on July 4, 2021.

^{128.} Kimball, n. 4, p. 3.

^{129.} Kenneth N. Waltz, "Nuclear Myths and Political Realities", *The American Political Science Review*, vol. 84, no. 3, 1990, p. 738.

^{130.} Mills, n. 19, pp. 7-8.

commitment to Article VI of the NPT, and might lead to regional instability. It will also contribute to the overall salience of nuclear weapons, indirectly affecting the non-proliferation regime. A nation with a counter-value nuclear force and minimum, credible deterrence objectives need not worry about the technological developments of its adversaries. The UK needs to remind itself of its own nuclear deterrence strategy: nuclear deterrence "does not depend on the size of other nations' arsenals but on the minimum necessary to deter any threat to our vital interest."¹³¹

^{131.} UK Ministry of Defence, "Strategic Defence Review", July 1998. https://webarchive. nationalarchives.gov.uk/http://www.mod.uk/NR/rdonlyres/sdr1998_complete.pdf. Accessed on July 10, 2021.