

## Non-strategic nuclear weapons

### The next step in multilateral arms control

62

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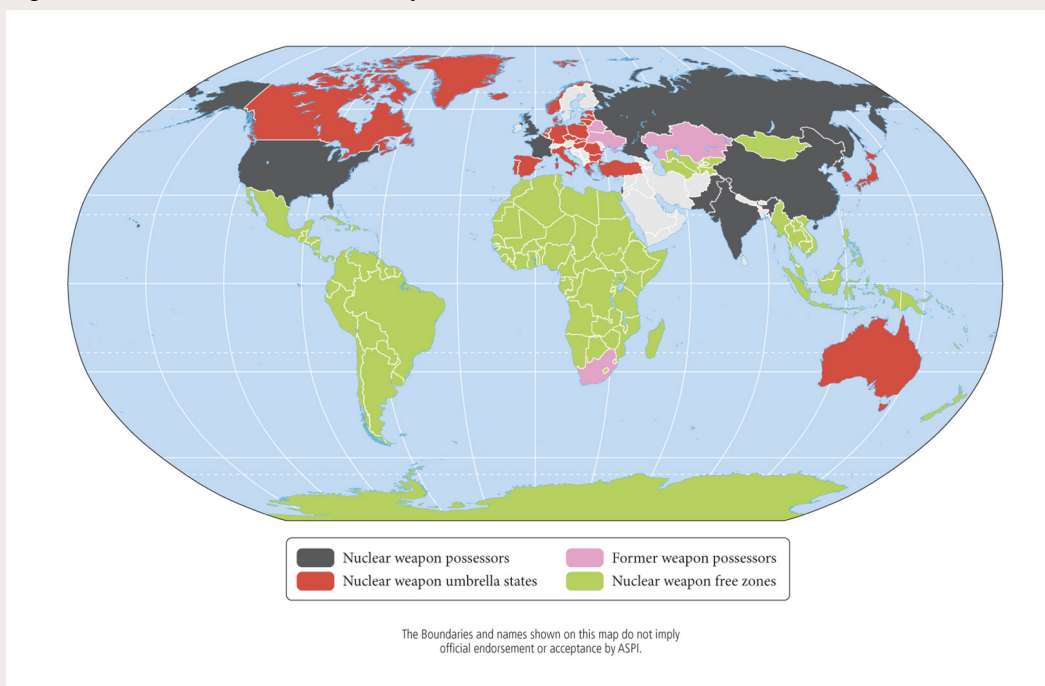
#### Introduction

Since the achievements of the 1990s and the New Strategic Arms Reduction Treaty (START), nuclear arms control has stalled. The inclusion of non-strategic nuclear weapons (NSNWs, or 'tactical' nuclear weapons) in future arms control negotiations is critical if progress on nonproliferation and disarmament is to be sustained.

As Dr Henry Kissinger testified before the US Senate Foreign Relations Committee in May 2010:

[New START is] probably the last agreement on strategic arms that can be made without taking tactical nuclear weapons into account. It is also approaching the end of what can be achieved by bilateral negotiations between the United States and Russia. Growing existing arsenals and proliferation will soon impose a multilateral context.<sup>1</sup>

**Figure: Countries with nuclear weapons**



As recently as June 2013, Russian Foreign Minister Sergei Lavrov emphatically reinforced this view, saying that future nuclear arms reductions would have to include all states that possess nuclear weapons, and be pursued in a multilateral format.<sup>2</sup>

This policy paper addresses the need to include NSNWs in international arms control negotiations and offers a strategy for the Australian Government and other like-minded governments to advance nuclear disarmament. It begins by explaining why it's been so difficult to include NSNWs in arms control negotiations and presents a new approach for regulating these weapons. It concludes that the development and retention of nuclear weapons with yields below 5 kilotons lack a convincing rationale. A treaty banning this special class of NSNW is therefore the most effective mechanism for advancing nuclear arms control, and the best option for investing political effort towards disarmament. Such a treaty would support existing disarmament initiatives and provide a new platform for future reductions in nuclear stockpiles.

This policy paper is complemented by a longer discussion paper, which includes a more thorough exploration of the technical, strategic and legal issues, as well as many references for further reading.<sup>3</sup>

## The problem

NSNWs pose particular types of risk, and reducing those risks involves problems of categorisation, yield thresholds and delivery systems.

### *Categorising strategic and non-strategic nuclear weapons*

The main difference between a strategic and a non-strategic nuclear weapon is the contingency for which the weapon is deployed. Strategic nuclear weapons are primarily used for deterrence by threatening a would-be adversary with massive destruction, including of major cities. NSNWs, by contrast, are primarily designed for attacks against military targets.<sup>4</sup> Low-yield nuclear weapons are a category of NSNW designed mainly for battlefield contingencies. Nuclear arms control agreements have so far focused on higher yield strategic weapons, while NSNWs have never been addressed.

NSNWs have been defined by the US Office of the Secretary of Defense as any nuclear weapon that's not part of the 'nuclear triad' of long-range bombers, strategic nuclear submarines and intercontinental ballistic missiles (ICBMs).<sup>5</sup> This definition appears to be reflected in New START signed between the US and Russia. Since the definition of a strategic weapon in New START is focused on American and Russian delivery systems, the arsenals of many other nuclear-armed states would be considered NSNWs even though they're predominantly maintained for strategic purposes.<sup>6</sup> It's therefore unlikely that NSNWs can be included in global arms control negotiations without redefining NSNWs in a manner that's commonly accepted and applicable across all nuclear-armed states<sup>7</sup> and their delivery systems.

### *Yields*

It's possible to categorise NSNWs based on yield. The yield of a nuclear weapon is the energy released in the explosion.<sup>8</sup> The simplest nuclear weapons are pure fission devices with yields of approximately 10 to 20 kilotons.<sup>9</sup> Each state that has developed nuclear weapons has begun with these Hiroshima- or Nagasaki-style bombs.<sup>10</sup> Most nuclear-armed states have gone on to develop even more powerful thermonuclear weapons, often with smaller spatial dimensions for ease of delivery.

Advanced technical expertise makes it possible to develop nuclear weapons with significantly lower yields than a Hiroshima- or Nagasaki-style bomb. For the purposes of this paper, a *low-yield weapon* is any nuclear weapon designed to have an explosive yield of less than about 5 kilotons (the process of establishing an exact *minimum-yield threshold* is considered below under 'Minimum-yield threshold treaty').



A modern nuclear bomb explosion in the desert © solarseven via Shutterstock.

### ***Risks of low-yield nuclear weapons***

Low-yield weapons are more difficult to produce than simple fission or even thermonuclear weapons, so the decision to develop them must be for contingencies for which higher yield weapons prove unsuitable. The main reason to have low-yield weapons is to be able to credibly threaten their use on the battlefield, greatly raising the stakes for would-be adversaries and thus deterring conventional attacks.<sup>11</sup> If that approach is seen to be successful, other countries that judge their conventional arms to be inadequate for deterrence will be tempted to follow suit.<sup>12</sup> This would necessarily entail a belief in the possibility and desirability of engaging in the limited use of nuclear weapons, and require confidence that risks of escalation can be managed.

The inability of political leaders to control the outbreak of a low-yield nuclear attack, direct ongoing operations, avoid escalation or bring hostilities to a conclusion vexed NATO planners for decades. There was always an unavoidable paradox that NSNWs had to be placed at risk of conventional attack in order to deter it.<sup>13</sup> In that circumstance, if deterrence fails, relatively junior field officers facing overwhelming military aggression will have to decide between using nuclear weapons or being defeated—a decision that governments might not be able to control, given the pre-delegation of these weapons in a crisis. US doctrine during the Cold War dictated that, while battlefield nuclear weapons should only be employed in circumstances in which there was an irresistible conventional attack, the decision to use them should be made quickly, as allied forces must remain intact in order to take advantage of nuclear use.<sup>14</sup>

Strategists also concluded that, if nuclear weapons were used on a European battlefield, things would descend into chaos and anarchy in 'very short order', at which point escalation to all-out nuclear war might be 'unavoidable'.<sup>15</sup> It's hard to imagine nuclear powers in Asia today having substantially better controls over their nuclear weapons than did the superpowers during the Cold War.<sup>16</sup> Even if both sides use low-yield weapons in a major conflict without using more powerful nuclear weapons, the mutual devastation would still be unprecedented.<sup>17</sup>

The probability of low-yield weapons being used is greater than the probability for other classes of nuclear weapon because low-yield weapons are designed for battlefield contingencies. Their continued development, particularly in emerging nuclear arsenals, poses a major threat to regional and global stability. It's therefore clear that the dangers of unauthorised use, theft and miscalculation greatly outweigh any marginal benefit deployed low-yield weapons may offer.

### ***Delivery systems***

In the context of promoting disarmament, focusing on the triad of long-range bombers, strategic nuclear submarines and ICBMs raises insurmountable obstacles, given the geographical proximity of strategic rivals against which nuclear-armed states maintain a nuclear deterrent. For example, a treaty that places restrictions on land-based missiles with a range greater than 5,500 kilometres (by analogy with New START) is decidedly unhelpful when it comes to managing strategic risk between India and Pakistan or China and India.

Moreover, it's highly unlikely that states such as China, India and Pakistan will agree to more restrictive limitations on their own delivery systems unless the arsenals of the US and Russia are similarly circumscribed. Unlike systems designed to deliver powerful strategic warheads, non-strategic delivery vehicles can serve many conventional war-fighting purposes.<sup>18</sup> Determining whether a given short-range missile system is conventional or nuclear may prove impracticable. Tactical aircraft can also be nuclear capable (the Mirage 2000N, for example) but are to be found in almost every nation's force structure. Any treaty restricting them would disadvantage nuclear-armed states that don't have large and diverse nuclear arsenals.

### **Minimum-yield threshold treaty**

Now that the problems associated with the continued existence of low-yield weapons have been summarised, this section establishes that a multilateral treaty would be the best mechanism for achieving a prohibition and considers the possible structure and effects of such a treaty.<sup>19</sup>

#### ***The case for a multilateral arms control treaty***

For several reasons, the removal of low-yield weapons as a threat to international security would be most effectively achieved through a multilateral treaty that outlaws their development and retention. First, multilateral treaties can establish norms in a way that other mechanisms can't. For example, even though the Comprehensive Nuclear Test Ban Treaty (CTBT) hasn't yet entered into force, its existence and ratification by 159 countries has created a powerful norm against nuclear testing<sup>20</sup>, and even nuclear-armed states that haven't ratified the treaty have now declared unilateral moratoriums.<sup>21</sup> Similarly, a treaty banning low-yield weapons would create a powerful norm against their retention and use, even among states that fail to ratify it.

Second, it would prove much easier to lobby nuclear-armed states to remove their low-yield weapons once the norm against the weapons had been established. Countries without nuclear weapons would have no objection to a treaty outlawing this specific type of nuclear weapon, so the tabling at the UN General Assembly of a treaty banning low-yield weapons is likely to achieve rapid and widespread support.

Finally, given that addressing NSNWs is now crucial to negotiating future reductions in strategic weapons, and that nuclear arms control must soon proceed in a multilateral framework, it's important that whatever mechanism is used to manage NSNWs *permanently* applies to all countries and all nuclear arsenals. A universal treaty banning nuclear weapons below a designated yield is the most direct and effective means to achieve this.

### ***Establishing a minimum-yield threshold***

What should be the precise yield threshold (in kilotons) of any new treaty? For a minimum-yield threshold to be supported by all states without nuclear weapons, while still adding value to existing treaties, the threshold needs to be set below the yield of a simple fission weapon. If the threshold is set any higher, some would see it as an attempt by nuclear-armed states to entrench their nuclear superiority, which would make it impossible to achieve universality. The continued existence of higher yield strategic weapons would blunt concerns that banning low-yield weapons would undermine nuclear deterrence. To support international peace and security at all levels, it's therefore necessary to set the nuclear threshold at low yields. The limit would ideally sit above most nuclear demolitions, depth bombs and artillery, but still permit strategic weapons with yields comparable to or greater than a Hiroshima- or Nagasaki-type weapon. Thus the initial minimum threshold of low-yield weapons would sit somewhere within this range, presumably around 5 kilotons.<sup>22</sup>

A minimum-yield threshold of 5 kilotons wouldn't undermine the nuclear assurances the US extends to its allies in regions like Northeast Asia. The nuclear umbrella is provided for primarily by the legs of the American triad.<sup>23</sup> Low-yield weapons don't contribute to the US extended deterrence posture in this region, having already been removed from the Korean peninsula, Guam, Hawaii and Alaska.<sup>24</sup> Since the capabilities that provide the necessary assurances to allies are fundamentally strategic, banning nuclear weapons with a yield below 5 kilotons wouldn't affect those assurances in any way.

Finally, setting the minimum-yield threshold at 5 kilotons has the additional advantage of already having precedents in the US legislature. In 1994, the US prohibited research and development on new 'low-yield nuclear weapons', defined as weapons with design yields below 5 kilotons.<sup>25</sup> Although the ban was later rescinded by the Bush administration in 2004<sup>26</sup>, 5 kilotons remains the most commonly accepted yield limit defining a low-yield weapon.

### ***Treaty provisions***

The fundamental obligation in this treaty will be an undertaking never to develop, produce, stockpile or otherwise acquire or retain nuclear weapons designed to have a yield below the minimum-yield threshold or reasonably likely to have a yield below the threshold. There would be parallel obligations in relation to nuclear testing<sup>27</sup>, use and threat of use. There would also be parallel obligations not to assist any entity with any of these activities.

A legal mechanism would be available to any state party to bring a complaint before the UN in cases of alleged acquisition, testing or use.<sup>28</sup> A state that's harmed by the use or threat of use of a low-yield weapon might view this legal mechanism as an alternative to military escalation if it believes that the international community would be prepared to intervene after an illegal nuclear attack. However, resorting to the legal mechanism wouldn't be a legal obligation where it could interfere with the victim state's right to self-defence. This alternative step entrenches the nuclear taboo in international law while maintaining strategic deterrence as the ultimate guarantor of security.

### ***The impact of a treaty***

The treaty would require little behavioural modification by most states. Even if a nuclear-armed state tries to cheat by using or threatening to use a low-yield weapon against another nuclear-armed state, it would be faced with the prospect of retaliation with more destructive strategic weapons.<sup>29</sup> This would also be true if a nuclear-armed state that isn't a party to the treaty contemplates the use of low-yield weapons against a nuclear-armed state that is a party. The risks of continued development of low-yield weapons spurring new nuclear arms races greatly outweigh the risk of accepting a treaty with minimal intrusive verification.<sup>30</sup>

The failure of a few nuclear-armed states (Israel, Pakistan and North Korea) to ratify the treaty wouldn't inhibit the effectiveness of a treaty banning low-yield weapons that had achieved near universality. Indeed, any potential user of low-yield weapons would be forced to consider that nuclear retaliation against such use would be more likely to be seen

as justified once low-yield weapons had become uniquely taboo. The treaty's existence would therefore further restrain nuclear use by those states that remain non-parties. Nuclear-armed states that comply with the treaty wouldn't be disadvantaged because the deterrent effect of their nuclear arsenals would be strengthened against non-parties. In fact, this constitutes an added incentive to ratify.<sup>31</sup>

### ***Contribution to nonproliferation and disarmament***

A treaty banning low-yield weapons would have a constructive relationship with existing arms control agreements, such as the Nuclear Non-Proliferation Treaty (NPT) and the CTBT. The proposed treaty may also play into future nuclear arms reductions negotiated between nuclear-armed states.

The NPT is recognised as the most effective legal mechanism for reducing the motivation to acquire nuclear weapons.<sup>32</sup> Since no new nuclear breakout is likely to occur with low-yield weapons<sup>33</sup>, a treaty banning such weapons doesn't subsume or replace the role of the NPT, which has near universality. However, the NPT doesn't cover any specific type of nuclear weapon or place definitions on the yields of such weapons. Thus, the NPT doesn't address the increasing variance of nuclear weapons and missions, except implicitly through the obligation to negotiate in good faith towards disarmament.

A treaty that creates a minimum-yield threshold would be the first multilateral arms control agreement banning a particular type of nuclear weapon. Once the threshold is in place, a new benchmark would be set for nuclear-armed states seeking reductions in NSNWs through bilateral negotiation. In the future, this may effectively raise the minimum-yield threshold, further separating conventional and nuclear warfare.

A state needn't be a party to the NPT or CTBT in order to be party to a treaty banning low-yield weapons, but the treaty would add value to its two predecessors.<sup>34</sup> A minimum-yield threshold treaty would also provide a norm-setting platform by creating a threshold against which future reductions in NSNWs may be benchmarked.

### **Role for Australia**

For the past four decades, Australia's been a global leader in nuclear nonproliferation and disarmament efforts. Successive Australian governments have sponsored a number of initiatives to promote nuclear disarmament, such as the Canberra Commission, the International Commission for Nuclear Non-Proliferation and Disarmament<sup>35</sup>, and the Centre for Nuclear Non-Proliferation and Disarmament. Australia is a member of multilateral and regional forums such as the East Asia Summit and the ASEAN Regional Forum, and an active contributor to nuclear bodies, including the Nuclear Suppliers Group and the Asia-Pacific Safeguards Network. Australia's non-permanent seat on the UN Security Council presents a unique opportunity to advance multilateral arms control and, having chaired the 2012 NPT PrepCom in Vienna, Australia is well positioned to promote a treaty prohibiting low-yield weapons.

Leadership by a coalition of non-nuclear-armed states is the most likely method to achieve widespread support for the treaty. For this purpose, Australia should capitalise on its membership of the ministerial-level group, the Non-Proliferation and Disarmament Initiative (NPDI), to build consensus on the need for a treaty and to develop a draft text. It's promising to note that the NPDI has already identified NSNWs as a significant impediment to nonproliferation and ongoing nuclear arms reductions, and has submitted a joint working paper on NSNWs to the 2013 NPT PrepCom in Geneva.<sup>36</sup>



## Conclusion

Low-yield weapons are a special kind of NSNW with a range of strategic drawbacks, including the reality that their possession by some states makes their acquisition by others more likely and increases the overall probability of nuclear use. Efforts to develop low-yield weapons signal to the world the contemplation of new nuclear missions and, potentially, nuclear testing. Reliance on these weapons for use on the battlefield harms prospects for global cooperation towards nonproliferation and disarmament objectives.<sup>37</sup> The contention that nuclear weapons are militarily useful encourages the proliferation of those weapons.

Outlawing nuclear weapons below a minimum yield threshold of 5 kilotons would remove several paths to nuclear conflict. A multilateral treaty is the best mechanism for marginalising low-yield weapons, decreasing the probability of their use, either through accident or design, and controlling escalation in the event of a violation. Regardless of its nuclear status, each state would receive a net benefit to its national security by ratifying the treaty outlawing low-yield weapons. This would be accomplished by reducing the chances of nuclear conflict and by giving decision-makers legal recourse to the international community in a crisis of this type.

The removal of low-yield weapons raises the nuclear threshold, helps avoid escalation, and reduces the risk of all-out nuclear war. Diplomatic coalitions such as the NPDI are well placed to build an international norm against low-yield weapons and to bring a treaty before the UN for signature and ratification.

## Notes

- 1 Henry A Kissinger, *Statement of Dr Henry Kissinger before the Senate Foreign Relations Committee on the New START Treaty*, US Senate Foreign Relations Committee, 25 May 2010, [www.foreign.senate.gov/imo/media/doc/KissingerTestimony100525a.pdf](http://www.foreign.senate.gov/imo/media/doc/KissingerTestimony100525a.pdf).
- 2 Sergei Lavrov, quoted in Sergei Guneev, 'Nuclear arms reduction deals to become multilateral', *RIA Novosti*, 22 June 2013, <http://en.rian.ru/world/20130622/181811968/Nuclear-Arms-Reduction-Deals-to-Become-Multilateral-Lavrov.html>; See also Sergei Ryabkov, quoted in Andrei Stenin, 'Russia calls for multilateral nuclear cuts', *RIA Novosti*, 28 May 2013, <http://en.ria.ru/world/20130528/181378655.html>.
- 3 See the longer paper, *A strategy for non-strategic disarmament: the multilateral prohibition of low-yield nuclear weapons*, available on the ASPI website, [http://www.aspi.org.au/admin/publicationFiles/Further\\_reading\\_Sl62.pdf](http://www.aspi.org.au/admin/publicationFiles/Further_reading_Sl62.pdf).
- 4 Even Australia once considered that '[t]he availability of low-yield nuclear weapons would be of considerable importance to the Australian Services should a situation develop which posed a direct threat to Australia'; see Australian Department of Defence, *Strategic basis of Australian defence policy, 1959*, para. 54, reproduced in Stephan Frühling (ed.), *A history of Australian strategic policy since 1945*, Defence Publishing Service, Canberra, 2009, p. 264.
- 5 US Department of Defense, *Office of the Secretary of Defense: the nuclear matters (expanded edition)*, 2011, para. 3.2, [www.acq.osd.mil/ncbdp/nm/nm\\_book\\_5\\_11/index.htm](http://www.acq.osd.mil/ncbdp/nm/nm_book_5_11/index.htm), reprinted in Hans M Kristensen and Robert S Norris, 'Nonstrategic nuclear weapons', *Bulletin of the Atomic Scientists*, September/October 2012, 68(5):96–104.
- 6 Kristensen and Norris, 'Nonstrategic nuclear weapons', p. 97; see also Bruno Tertrais, 'French perspectives on nuclear weapons and nuclear disarmament', in Barry Blechman (ed.), *France and the United Kingdom*, Henry L Stimson Center, Washington DC, February 2009, pp. 1–22, 12.
- 7 A nuclear-armed state is a state that possesses nuclear weapons, whether its arsenal is emerging or developed. In 2013, this includes the US, Russia, the United Kingdom, France, China, Israel, India, Pakistan and North Korea. Any state that doesn't possess nuclear weapons is a non-nuclear-armed state. For a comprehensive analysis of the perceived war-fighting and deterrence utility of low-yield weapons, see sections 5 and 6 of the longer paper.

- 8 The explosive yield of a (metric) ton of trinitrotoluene is defined as precisely 4.184 gigajoules (metric units are used throughout this paper). See National Institute of Standards and Technology, *The NIST reference on constants, units and uncertainty*, 2000, <http://physics.nist.gov/cuu/Units/>.
- 9 See Robert Harney, Gerald Brown, Matthew Carlyle, Eric Skroch and Kevin Wood, 'Anatomy of a project to produce a first nuclear weapon', *Science & Global Security*, 2006, 14:163–182.
- 10 See, for example, Joel Ullom, 'Enriched uranium versus plutonium: proliferant preferences in the choice of fissile material', *Nonproliferation Review*, 1994, 2(1):1–15; Harney et al, 'Anatomy of a project to produce a first nuclear weapon'.
- 11 See Elli Louka, *Nuclear weapons, justice and the law*, Edward Elgar Publishing, Cheltenham, 2011, pp. 19–20.
- 12 Wade L Huntley, 'Threats all the way down: US strategic initiatives in a unipolar world', *Review of International Studies*, 2006, 32:49–67, 52.
- 13 Shashank Joshi, 'New year, new problem? Pakistan's tactical nukes', *The Diplomat*, 2 January 2013, p. 3, <http://thediplomat.com/2013/01/02/pakistans-new-nuclear-problem/3/>.
- 14 See Andrew Butfoy, 'The nuclear–conventional nexus in Western military planning for European contingencies', PhD dissertation, Strategic and Defence Studies Centre, Australian National University, Canberra, 1988, p. 249.
- 15 Robert S McNamara, 'Memorandum to the President: the role of tactical nuclear forces in NATO strategy', 15 January 1965, in *US nuclear history*, National Security Archive, Washington DC, item number NH01000, p. 14, [http://gateway.proquest.com/openurl?url\\_ver=Z39.88-2004&res\\_dat=xri:dnsa&rft\\_dat=xri:dnsa:article:CNH01000](http://gateway.proquest.com/openurl?url_ver=Z39.88-2004&res_dat=xri:dnsa&rft_dat=xri:dnsa:article:CNH01000).
- 16 On the risk of unauthorised use, see Paul K Kerr and Mary B Nikitin, 'Pakistan's nuclear weapons: proliferation and security issues', CRS Report for Congress, doc RL34248, 10 May 2012, pp.12–13, [www.fas.org/sgp/crs/nuke/RL34248.pdf](http://www.fas.org/sgp/crs/nuke/RL34248.pdf).
- 17 See simulation described in United Nations, *General and complete disarmament: a comprehensive study on nuclear weapons: report of the Secretary-General*, F Pinter, London, 1981.
- 18 Thomas F Ramos, 'The future of theater nuclear weapons', *Strategic Review*, Fall 1991, 19(4):41–47.
- 19 For an evaluation of the possible alternatives to a multilateral treaty for including NSNWs in arms control, see sections 8 and 9 of the longer paper.
- 20 See Sergio Duarte, 'The future of the Comprehensive Nuclear-Test-Ban Treaty', *UN Chronicle*, March 2009, 46(1 & 2):30–35, 33.
- 21 Excepting Israel and North Korea.
- 22 While the increasing accuracy and reliability of delivery systems have reduced the yields of strategic warheads over time, it's highly unlikely that counter-value weapons will ever be reduced below 5 kilotons.
- 23 Jeffrey Lewis, 'Extended nuclear deterrence in Northeast Asia', *The Nautilus Institute*, 1 August 2012, <http://nautilus.org/napsnet/napsnet-special-reports/extended-nuclear-deterrence-in-northeast-asia/>.
- 24 Hans M Kristensen, 'New article: where the bombs are', Federation of American Scientists, *FAS strategic security blog*, 9 November 2006, comment on 14 November 2006, [www.fas.org/blog/ssp/2006/11/new\\_article\\_where\\_the\\_bombs\\_ar.php](http://www.fas.org/blog/ssp/2006/11/new_article_where_the_bombs_ar.php); Hans M Kristensen and Robert S Norris, 'US Nuclear Forces, 2013', *Bulletin of the Atomic Scientists*, 69(2):77–86.



- 25 *Defense Authorization Act*, Pub L No 103–160, § 3136(d) 107 Stat 1946 (1994) (42 USC 2121 note). See *Congressional Record: National Defense Authorization Act for Fiscal Year 1994*, 103rd Cong., 1st sess., House of Representatives, 16 November 1993, p. HR2401 ('Spratt–Furse provision'), [www.gpo.gov/fdsys/pkg/BILLS-103hr2401enr/pdf/BILLS-103hr2401enr.pdf](http://www.gpo.gov/fdsys/pkg/BILLS-103hr2401enr/pdf/BILLS-103hr2401enr.pdf).
- 26 *Congressional Record: National Defense Authorization Act for Fiscal Year 2004*, pp. S6668–6670; *Defense Authorization Act*, Pub L No 108–136, §§ 3136(c), 3111, 117 Stat 1746 (2003) (50 USC 2529 note). The repeal does not authorise acquisition of low-yield weapons: 'The Secretary of Energy may not commence the engineering development phase, or any subsequent phase, of a low-yield nuclear weapon unless specifically authorized by Congress.'
- 27 This would include deliberately testing strategic weapons at low yield.
- 28 See *Charter of the United Nations*, article 102.
- 29 On the sensitivity of the military significance of noncompliance to residual force levels, see Lewis A Dunn, 'Arms control verification: living with uncertainty', *International Security*, Spring 1990, 14(4):165–175, 172.
- 30 For details of the verification requirements of the treaty, see Section 10 of the longer paper.
- 31 For an evaluation of the practical effect of the treaty in the event that some nuclear-armed states are parties and others are not, see the appendix of the longer paper.
- 32 Matthew Lund, 'The eighty percent and twenty percent solutions to nuclear proliferation', *Brigham Young University Law Review*, 2009, 3:741–782, 781.
- 33 Due to the technical constraints discussed in Section 6 of the longer paper.
- 34 On the relationship between the proposed treaty and the CTBT, see Section 11 of the longer paper.
- 35 A joint initiative of the Australian and Japanese governments.
- 36 NPDI, 'Non-strategic nuclear weapons', working paper no. NPT/CONF.2015/PC.II/WP.3, Preparatory Committee for the 2015 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, 6 March 2013.
- 37 See, generally, Kingston Reif, 'When less is not more', *Bulletin of the Atomic Scientists*, 12 March 2012, [www.thebulletin.org/web-edition/columnists/kingston-reif/when-less-not-more](http://www.thebulletin.org/web-edition/columnists/kingston-reif/when-less-not-more).

## Acronyms and abbreviations

CTBT	Comprehensive Nuclear Test Ban Treaty
ICBM	intercontinental ballistic missile
NATO	North Atlantic Treaty Organization
New START	New Strategic Arms Reduction Treaty
NPDI	Non-Proliferation and Disarmament Initiative
NPT	Nuclear Non-Proliferation Treaty
NSNW	non-strategic nuclear weapon
PrepComs	NPT review preparatory committees
UN	United Nations

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