



**BRIEFING PAPER**

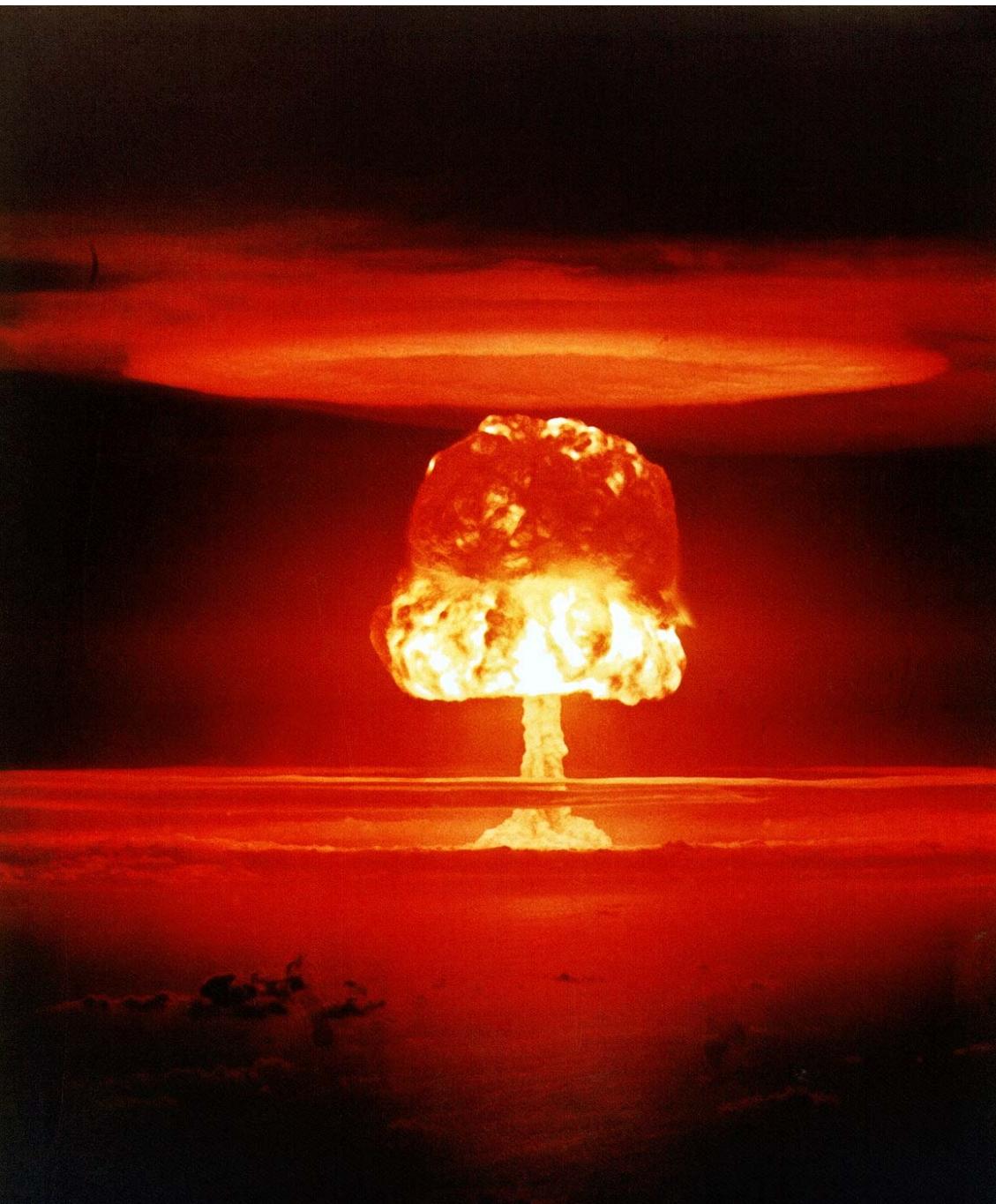
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# Nuclear Weapons - Country Comparisons

By Claire Mills

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# Summary

There are nine countries in the world that have nuclear weapons. Between them they possess an estimated 15,000 nuclear warheads. Of those, four countries: China, India, Pakistan and North Korea are actively expanding their nuclear capabilities.

Their nuclear status within the international community differs significantly however. Under the Nuclear Non-Proliferation Treaty (NPT) a nuclear weapon state is defined as one that manufactured and exploded a nuclear weapon, or other nuclear explosive device, prior to 1 January 1967. As such there are five acknowledged nuclear weapon states under the treaty: the United States, Russia, China, France and the UK. Those countries which have developed a nuclear capability outside of the NPT framework are considered *de facto* nuclear weapon states. At present there are three states that have pursued this path: India, Pakistan and Israel. Despite having conducted a series of nuclear tests and demonstrated its missile capabilities, North Korea is not recognised by the international community as a nuclear weapons state. It is considered nuclear capable, however. In addition there are a number of states that have, over the years, had nuclear aspirations, the most prominent being Iran.

This paper is intended as a brief guide to which countries possess nuclear weapons and how they are seeking to either modernise or expand those capabilities.

## United States

The United States conducted its first nuclear test in July 1945 and is the only country to have used nuclear weapons in conflict when it dropped atomic bombs on the Japanese cities of Hiroshima and Nagasaki in August 1945.

By the time the NPT was concluded in 1968 the United States had a nuclear stockpile of tens of thousands. Since the 1970s the US and Soviet Union/Russia have concluded a number of bilateral arms control agreements which have reduced the size of their respective nuclear arsenals.

Despite this progress the United States still retains an extensive nuclear force (6,800 nuclear warheads in total) and is in the process of replacing or modernising its nuclear capabilities through an extensive programme that is estimated to cost \$400 billion over the next decade and \$1 trillion in total over the next 30 years.

## Russia

The Soviet Union tested its first atomic weapon in 1949. By the time the NPT was concluded in 1968, the Soviet Union, like the US, had accumulated a nuclear stockpile of tens of thousands of warheads.

During the last two decades of the Cold War the US and the Soviet Union concluded a number of bilateral arms control agreements which reduced the size of their respective nuclear arsenals.

Following the dissolution of the Soviet Union in late 1991, Russia was formally recognised as the sole remaining nuclear weapon state under a Protocol to the US-Soviet *Strategic Arms Reduction Treaty*, which was signed in May 1992.

Russia has the largest nuclear arsenal in the world (approximately 7,000 warheads) and since 2008 has been undertaking an extensive programme of nuclear capabilities modernisation.

### China

In 1955 the Chinese leadership initiated a nuclear weapons programme, partly in response to concerns about US nuclear threats during the Korean War. Nine years later, China became the last of the five NPT recognised states to successfully test an atomic device. China then tested its first thermonuclear device in June 1967. Observers commented on the short time-span (32 months) between the two tests, which was substantially less than the other nuclear powers.

Precise information on the extent of China's nuclear arsenal is difficult to obtain, due to a lack of open source information and often contradictory or exaggerated claims.

China's nuclear stockpile is estimated at 270 warheads. Over the last two decades China has, however, been actively seeking to expand its nuclear capabilities in order to achieve a more robust and survivable nuclear force; while at the same time developing a credible second-strike capability. It is the only *acknowledged* nuclear weapon state under the NPT that is expanding its nuclear inventory.

### France

France first tested a nuclear weapon in 1960, eight years after the UK and four years before China. The last French tests took place in 1996, just prior to the conclusion of the *Comprehensive Nuclear Test Ban Treaty* (CTBT).

Since the end of the Cold War France has scaled back its nuclear arsenal by 50%, with a reduction in both its overall holdings but also the withdrawal of several weapons systems, including its land-based ballistic missile capability. It now has a nuclear stockpile of less than 300 warheads. It has also reduced its alert levels (in 1992 and 1996) in terms of both response times and the number of weapons systems on alert. All of France's nuclear forces have been de-targeted.

France does not participate in NATO's nuclear planning mechanisms and its forces are not formally assigned to NATO.

### UK

The UK first tested a nuclear explosive device in October 1952, becoming the third state to develop nuclear weapons after the United States and the Soviet Union.

Initial capability centred upon the RAF's strategic bomber force. A submarine-launched capability, based upon the Polaris submarine-launched ballistic missile (SLBM), entered service in 1968. The current Trident-based system entered service in the mid-1990s.

Since the end of the Cold War, the UK has taken a number of steps towards nuclear disarmament. It has withdrawn all nuclear weapons systems except for Trident; made changes to the operational status of the deterrent and been increasingly transparent about its nuclear inventory. At present the UK's nuclear stockpile is 225 warheads, although that will reduce to no more than 180 warheads by the mid-2020s. At this point the UK will have achieved a 65% reduction in the size of its overall nuclear stockpile since the height of the Cold War.

The UK is currently in the process of replacing its SSBN fleet, with a new class of submarine: the *Dreadnought*. The first submarine is due to enter service in the early 2030s.

## India

Successive Indian governments had maintained a policy of ambiguity on the country's nuclear status after what appeared to be a partially successful nuclear test in 1974. In May 1998, however, India conducted a series of publicised nuclear tests which established its status as a self-declared nuclear weapon state, outside of the framework of the NPT.

Public information on India's nuclear weapons programme is, however, scarce. It is estimated to have an arsenal of between 120 and 130 nuclear warheads, although there is some doubt as to how many are operational. India continues to produce fissile material for weapons purposes and is actively working to expand both its nuclear arsenal and its delivery capabilities. In August 2016 it completed the 'nuclear triad', enabling delivery of a nuclear warhead by land, sea or air.

## Pakistan

Pakistan's nuclear programme began in the early 1970s, following the 1971 war with India that led to East Pakistan becoming Bangladesh. It was spurred on by India's first nuclear test in 1974, although it was not until the late 1980s that the US concluded that Pakistan had acquired the capability to build a primitive nuclear device.

In line with India, Pakistan conducted a series of publicised nuclear tests in May 1998 which established its status as self-declared nuclear weapon state, outside of the NPT framework.

Pakistan is estimated to have a stockpile of 130-140 warheads. Like India, it continues to produce fissile material for weapons production and it is thought to be expanding its nuclear arsenal faster than any other country.

## Israel

Successive Israeli governments have maintained a policy of official ambiguity on the issue of nuclear weapons. Israel has never demonstrated its capability through a nuclear test, nor has the country ever confirmed or denied having nuclear weapons.

Despite this, it is universally acknowledged that Israel possesses a nuclear weapons capability (approximately 80-100 warheads), outside of the framework of the NPT.

## North Korea

Despite having conducted a number of nuclear tests North Korea is not recognised by the international community as a nuclear weapons state. It is, however, considered nuclear capable.

Opinions are divided on the size of its stockpile. A longstanding common estimate has been 8-10 warheads although US Defence Intelligence was reported in July 2017 to have revised that estimate significantly upwards to 60. Those recent figures have, however, been disputed by a number of independent experts.

North Korea possesses a short-to-medium range delivery capability capable of targeting locations in its immediate sphere of influence, including US forces in the Pacific. Achieving a viable long-range nuclear capability is currently its objective and in July 2017 North Korea successfully tested, for the first time, an ICBM technically capable of striking the United States. Further development to ensure reliability and accuracy is required, but experts have concluded that achieving a viable long-range capability is likely within the next 2 years, and much sooner than initial estimates had suggested. However, while North Korea is thought to have achieved miniaturisation of a nuclear warhead capable of being mounted on an ICBM, opinions still remain divided.

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It continues to test both its nuclear warheads and its ballistic missile capabilities, in defiance of UN Security Council resolutions.

### **Other suspected aspirant nations**

#### *Iran*

An extensive uranium enrichment programme was revealed in the early 00s, which many countries and other observers alleged was part of a nuclear weapons programme and not just intended for civilian energy purposes.

The International Atomic Energy Agency (IAEA) found Iran to be non-compliant with its NPT safeguards agreement in 2005 and referred the matter to the UN Security Council which passed several resolutions calling on Iran to halt its enrichment activities. However, in a report in 2011 the IAEA concluded that it was still unable to offer assurances about the purpose of Iran's nuclear programme.

Concern over Iran's potential threshold status has led to intense diplomatic efforts over the last few years to reach agreement on Iran's nuclear programme, in exchange for the lifting of international sanctions which have been imposed against the regime since 2002.

A deal on Iran's nuclear programme was eventually reached in 2015. In exchange for limitations on Iran's enrichment activities, and access to all Iranian nuclear facilities by the IAEA, the UN, US and EU agreed to suspend all nuclear related sanctions against Iran.

The future of the Iran nuclear deal is currently uncertain after US President Donald Trump threatened to withdraw from the agreement. However, top officials in the Trump administration, including the US Defense Secretary, James Mattis, have expressed the view that Iran continues to abide by the nuclear agreement and that upholding it is in the US' national security interests. Were the agreement to fall apart Iran's President has stated that the country could restart its nuclear programme.

#### *Syria*

Syria, which is also a party to the NPT, has been under investigation by the IAEA in response to concerns within the international community that it had been developing a secret nuclear weapons programme. However, verification and monitoring of suspected nuclear sites by IAEA inspectors has been complicated by the ongoing civil war.

Nevertheless, in a statement to the 2015 NPT review conference the IAEA Director General renewed his call on Syria to cooperate fully with the IAEA in connection with unresolved nuclear issues.

# 1. Background

There are nine countries in the world that have nuclear weapons. Between them they possess an estimated 15,000 nuclear warheads. Of those, four countries: China, India, Pakistan and North Korea are actively expanding their nuclear capabilities.

Their nuclear status within the international community differs significantly however. Under the Nuclear Non-Proliferation Treaty (NPT) a nuclear weapon state is defined as one that manufactured and exploded a nuclear weapon, or other nuclear explosive device, prior to 1 January 1967. As such there are five acknowledged nuclear weapon states under the treaty: the United States, Russia, China, France and the UK. The United States was the first state to demonstrate a nuclear weapons capability in 1945 and, so far, is the only state to have used such weapons in conflict. The Soviet Union tested its first atomic weapon in 1949; while the United Kingdom conducted its first nuclear weapons test in 1952, France in 1960 and China in 1964. All five of those states are in the process of either modernising or replacing their nuclear arsenals, although China is the only declared nuclear weapon state that is expanding its nuclear capabilities.

Those countries which have developed a nuclear capability outside of the NPT framework are considered *de facto* nuclear weapon states. At present there are three states that have pursued this path: India, Pakistan and Israel. India and Pakistan have continued to actively expand their nuclear arsenals. Both are continuing to produce and stockpile weapons grade fissile material; while at the same time developing new delivery systems for their respective nuclear deterrents.

Despite having conducted a series of nuclear tests, the most recent in September 2017, North Korea is not recognised by the international community as a nuclear weapons state. It is considered nuclear capable, however and continues to test both its nuclear warheads and its missile capabilities in contravention of UN resolutions. Achieving a viable long-range nuclear capability, able to target the US mainland, appears to be its objective.

In addition there are a number of states that have, over the years, had nuclear aspirations. Several of those countries, most notably South Africa, have unilaterally renounced their nuclear weapons programmes and adopted non-nuclear status under the NPT. Others have attempted to develop, or have been alleged to be developing, illicit nuclear weapons programmes in contravention of their NPT obligations. Iran is one such state, although agreement on a nuclear deal that would see Iran limit its uranium enrichment activities in exchange for the lifting of international sanctions was reached in 2015.

This paper is intended as a brief guide to which countries possess nuclear weapons and how they are seeking to either modernise or expand those capabilities.

Transparency is a major challenge however. Even in the most open of democracies nuclear weapons programmes are largely classified; information is not widely available; while for those countries motivated either by threat perception or conventional military inferiority the tendency to exaggerate the extent, or operational nature, of their nuclear arsenals is commonplace. As a consequence, there is significant disparity in the estimates of each state's active arsenal, reserve stockpiles of operational warheads and those warheads awaiting dismantlement. This lack of openness is a particular difficulty in relation to those states that operate outside of the NPT and IAEA framework, and those which are suspected of harbouring nuclear intentions.

### 1.1 Recommended sources

There are a number of sources which have been invaluable in compiling this paper, and they would be recommended for any reader wishing to undertake more detailed reading or research:

- [Federation of American Scientists](#)
- [Bulletin of the Atomic Scientists: Nuclear Notebook](#)
- [Nuclear Threat Initiative](#)
- [Arms Control Association](#)
- [SIPRI World Nuclear Forces 2017](#)

It is worth noting that data between each of these of sources can vary.

This paper is also part of a wider Library briefing series on nuclear weapons:

- CBP8010, [\*Replacing the UK's nuclear deterrent: progress of the Dreadnought class\*](#)
- CBP7990, [\*President Trump: the nuclear question\*](#)
- CBP7986, [\*A prohibition on nuclear weapons?\*](#)
- CBP7634, [\*Nuclear weapons: disarmament and non-proliferation regimes\*](#)
- CBP7353, [\*Replacing the UK's Nuclear Deterrent\*](#)
- CBP4079, [\*The French nuclear deterrent\*](#)
- CBP7542, [\*Nuclear convoys\*](#)
- SN07028, [\*Conference on the humanitarian impact of nuclear weapons\*](#), December 2014
- SN03147, [\*UK-USA Mutual Defence Agreement\*](#), October 2014

### 1.2 Glossary of acronyms

- ALCM – air-launched cruise missile
- CASD – continuous at-sea deterrence
- CTBT – Comprehensive Test Ban Treaty
- FMCT – Fissile Material Cut-Off Treaty
- HEU – highly enriched uranium
- IAEA – International Atomic Energy Agency
- ICBM – intercontinental ballistic missile

- INF – Intermediate Nuclear Forces Treaty
- LRSO – Long-range, stand-off
- MIRV – multiple independently targetable re-entry vehicle
- NPR – Nuclear Posture Review
- NPT – Nuclear Non-Proliferation Treaty
- NSG – Nuclear Suppliers Group
- SDSR – Strategic Defence and Security Review
- SLBM – submarine-launched ballistic missile
- SORT – Strategic Offensive Reductions Treaty
- SSBN – ship, submersible, ballistic, nuclear (submarine)
- START – Strategic Arms Reduction Treaty

## 2. United States

### Summary

- Nuclear stockpile is estimated at 6,800 warheads in total. 4,000 are operational (strategic and non-strategic), including 1,393 deployed strategic nuclear warheads.
- Under new START the number of deployed *strategic* warheads must not exceed 1,550 by February 2018.
- Non-strategic warheads are not currently subject to any arms control limitations.
- Forces are organised on the nuclear triad principle
- Retains first-use option
- Is undertaking an extensive modernisation programme that is estimated to cost \$400 billion over the next decade, and \$1 trillion over the next 30 years.
- In January 2017 President Trump initiated a new Nuclear Posture review, which is due to report at the end of the year.

The United States conducted its first nuclear test in July 1945 and is the only country to have used nuclear weapons in conflict when it dropped atomic bombs on the Japanese cities of Hiroshima and Nagasaki in August 1945.

By the time the NPT was concluded in 1968 both the Soviet Union and the United States had a nuclear stockpile of tens of thousands apiece. Since the 1970s the US and the Soviet Union (subsequently Russia) have concluded a number of bilateral arms control agreements which have reduced the size of their respective nuclear arsenals.

Despite this progress the United States still deploys an extensive nuclear force and is in the process of modernising and replacing its nuclear capabilities.

### Nuclear Policy

The US' current nuclear policies are set out in the 2010 [Nuclear Posture Review](#) (NPR). Published just a year after President Obama set out his disarmament agenda and vision of 'global zero', the NPR was viewed as a crucial test of the sincerity of that agenda. It also came just months after agreement was reached on the START successor treaty.

Recognising that the nuclear environment had radically altered since the end of the Cold War and that US nuclear priorities had changed thus, the NPR set out a revision of US nuclear deterrence policy, strategy and force structure for the next five to ten years.

The NPR confirmed that the fundamental role of US nuclear weapons in deterring a nuclear attack on the United States, its allies and partners, would continue as long as nuclear weapons exist. However, it also recognised that maintaining strategic deterrence and stability could be achieved at reduced force levels.

It confirmed that the US would retain the smallest possible nuclear stockpile consistent with its need to deter adversaries, reassure allies and hedge against technical or geopolitical surprise. A nuclear posture based on the nuclear triad would continue, within the context of treaty provisions, in order to “maintain strategic stability at reasonable cost, while hedging against potential technical problems or vulnerabilities”. Some ability to ‘upload’ non-deployed nuclear weapons on existing delivery vehicles would be retained, however. Preference would be given to uploading the capacity of bombers and strategic submarines. Existing ICBM would carry just a single warhead.

The current alert posture of US strategic forces (heavy bombers off full-time alert, nearly all ICBM on alert and a significant number of SSBN at sea at any given time) would also be maintained for the present. Measures to further diminish the possibility of nuclear launches resulting from accidents, unauthorised actions or misperceptions should be continued and the time available to the President to consider authorising the use of nuclear weapons should be maximised. Therefore the US would continue the practice of ‘open-ocean targeting’ of all ICBMs and submarine-launched ballistic missiles (SLBM);<sup>1</sup> strengthening the US command and control system to maximise Presidential decision making time and exploring new modes of ICBM basing that enhance survivability and further reduce any incentives for prompt launch.

The US would also retain the capability to forward deploy US nuclear weapons on US tactical fighter aircraft and heavy bombers.

In addition, the NPR confirmed that the US would pursue further disarmament measures with Russia, including initiatives to address non-strategic and non-deployed weapons as well as strategic weapons.

### **Declaratory policy**

Under the 2010 NPR the US retains the right to first use of nuclear weapons, although it has pledged not to use or threaten the use of nuclear weapons against non-nuclear weapon states that are party to the NPT and in compliance with their nuclear non-proliferation obligations.

In addition, the use of nuclear weapons against nuclear weapon states and non-compliant states will only be considered in extreme circumstances to defend the US’s vital interests, or its allies and partners. There also remains a narrow range of contingencies in which US nuclear weapons may still play a role in deterring a conventional or chemical/biological weapons attack by such states.

### **Bilateral arms control agreements**

Under various bilateral arms control agreements signed since the mid-1980s: the *Intermediate Range Nuclear Forces Treaty* (INF), the *Strategic Arms Reduction Treaty* (START) the *Strategic Offensive Reduction Treaty* (SORT), and New START, limitations on both nuclear warheads and

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<sup>1</sup> Whereby, in the unlikely event of an unauthorised or accidental launch, the missile would land in the open ocean.

delivery vehicles have been imposed on the US and Russia. In summary, those treaties committed both countries to the following:<sup>2</sup>

- **START** – Under the treaty, both sides undertook to cut their active stockpiles of strategic nuclear warheads to 6,000 each by 2001. Both sides also undertook to reduce the number of strategic nuclear delivery vehicles (ICBM, SLBM, and heavy bombers) to 1,600.<sup>3</sup> However, the provisions of START, including its inspection provisions, expired on 5 December 2009.
- **INF** – The treaty committed both parties to eliminating all nuclear-armed ground-launched ballistic and cruise missiles with ranges of between 500 and 5,500km.<sup>4</sup>
- **SORT** – The treaty would reduce nuclear arsenals to between 1,700 – 2,200 *operationally deployable* strategic warheads by 31 December 2012.<sup>5</sup> However, the treaty did not place further limitations on the number of nuclear delivery vehicles; while the verification and inspection provisions for SORT were based on those set down in the previous START I treaty. SORT expired when the START successor treaty entered into force.
- **New START** - . In March 2010 a successor to the START treaty was concluded between the US and Russia, under which both countries are committed to reducing deployed strategic warheads to 1,550 and fielded delivery platforms<sup>6</sup> to 700 by February 2018. The treaty expires in 2021 unless a five year extension is agreed by both parties.

Both the INF and New START remain in force.

### Other nuclear agreements

American nuclear assets contribute to the NATO nuclear umbrella and US tactical nuclear weapons are based in a number of European countries.<sup>7</sup>

In Asia and the Middle East the US has maintained extended deterrence through a series of bilateral arrangements, a forward military presence and security guarantees.<sup>8</sup>

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<sup>2</sup> Further detail on each of these treaties is available in Library Briefing Paper SN/IA/1404, *Arms Control and Weapons of Mass Destruction*

<sup>3</sup> Under START II, negotiated in 1993, further reductions in strategic nuclear arsenals were to occur in two phases: initially reducing to a ceiling of between 3,800 and 4,250 strategic warheads, and then down to 3,000 to 3,500. The treaty also provided for the elimination of all ICBMs capable of carrying multiple independently targetable re-entry vehicles (multiple warheads or MIRVs). In the event, START II did not enter into force, and Russia declared on 14 June 2002 that it would no longer be bound by the treaty, following the US withdrawal from the *Anti-Ballistic Missile (ABM) Treaty*. The move was seen as essentially symbolic, given that START II had been effectively superseded by the SORT treaty, which had been signed a few weeks earlier.

<sup>4</sup> Text is available at <http://www.fas.org/nuke/control/inf/text/index.html>

<sup>5</sup> Not including stored nuclear warheads in the actual nuclear stockpile. There is nothing in the treaty that would oblige the signatories to decommission those warheads withdrawn from operational service.

<sup>6</sup> ICBM, SLBM and heavy bombers

<sup>7</sup> Belgium, Germany, Italy, Netherlands and Turkey. Some commentators consider those states to be nuclear states by virtue of the fact that US nuclear weapons are based on their soil. See "US tactical nuclear weapons in Europe", *Bulletin of the Atomic Scientists*, 2011

<sup>8</sup> The concept of extended deterrence is an important one, particularly for countries such as Japan which has chosen to forego the option of developing its own nuclear

The US signed the Comprehensive Test Ban Treaty in 1996, but Congress is yet to ratify it. The Senate rejected ratification in 1999 and despite a commitment in the 2010 NPR to seek ratification of the treaty, the US administration failed to bring the matter before Congress before President Obama left office in January 2017.

The Obama administration was also supportive of a new fissile material cut-off treaty.

### **Nuclear Policy under President Trump**

Upon entering office in January 2017 one of President Trump's first actions was to sign an Executive Order on [\*Rebuilding the US Armed Forces\*](#), in which he called for a review of US nuclear capabilities and posture. The aim is:

To ensure that the United States nuclear deterrent is modern, robust, flexible, resilient, ready, and appropriately tailored to deter 21st-century threats and reassure our allies.

That review began in April 2017 and is expected to be concluded by the end of the year.

The prospects for the review are uncertain. During both the election campaign, and since his inauguration, there has been a distinct lack of clarity with regard to President Trump's views on nuclear weapons. As such, it raises interesting questions for the strategic direction of the Nuclear Posture Review. Will it build upon the vision of 'Global Zero' espoused by Obama? Or, in light of the prevailing international security situation, will President Trump seek to keep the US' nuclear options open, in particular with respect to Russia, North Korea and Iran? If so, could that open the door to a **wholesale shift toward modernisation and expansion of the US nuclear deterrent?**

### **Capabilities**

Nuclear deterrence is one of the five missions under the responsibility of US Strategic Command. Like Russia and China, the US operates a nuclear triad of sea, land and air-based systems.

### **Stockpile**

At present the United States is estimated to have a total inventory of 6,800 warheads, of which:

- 4,000 are active/operational warheads (strategic and non-strategic)
- 2,800 are retired and awaiting dismantlement

The most recent data exchanged between the US and Russia under the terms of the New START agreement showed that of those 4,000 operational US warheads 1,393 were deployed strategic nuclear

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capability in return for the protection provided by the US nuclear umbrella. A number of analysts have suggested that abandoning extended deterrence could encourage proliferation as several states could seek to develop their own nuclear weapons capability as an alternative. It is also worth noting that under the concept of extended deterrence, many of the non-nuclear weapon states are in fact indirect beneficiaries of nuclear weapons and therefore the security guarantee inferred by a nuclear capability is not concentrated solely in the hands of a few countries.

warheads (below the ceiling agreed in new START).<sup>9</sup> The US also has 500 non-strategic warheads in its inventory. Approximately 150 of those warheads are thought to be deployed in Europe.<sup>10</sup>

In 2013 President Obama called for negotiations with Russia on a further one-third cut in strategic forces, although Russia, at the time, refused to engage in discussions on this issue.

### **Fissile Material**

The US no longer produces fissile material for weapons purposes, although it does retain a stockpile of fissile material.<sup>11</sup> The latest figures from the International Panel on Fissile Materials suggests that the US has 260 metric tons of highly enriched uranium (HEU) and 38 metric tons<sup>12</sup> of plutonium for weapons purposes.<sup>13</sup>

### **US Navy**

The Navy has 14 Ohio class ballistic missile submarines (SSBN) in its inventory equipped with up to 24 Trident II D5 SLBM.<sup>14</sup> Two of those SSBN are in refit at any one time, while the remaining 12 are available for deployment. The US has operated a posture of continuous at-sea deterrence since 1960.

Those 12 operational SSBN are capable of deploying a total of 288 trident missiles, each of which can be configured with up to 12 warheads, although in practice each missile is thought to deploy with 4 or 5 warheads apiece. Under the terms of New START that is expected to be reduced to 240 missiles, and approximately 1,100 warheads by 2018.<sup>15</sup>

A service-life extension programme for the Trident II D5 missile will keep the missile in service until at least 2042.

Full scale production of approximately 1,600 upgraded W76-I warheads for the Trident II D5 missile is also underway and scheduled for completion in 2019.

A programme to replace the Ohio class SSBN is currently underway (see below).

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<sup>9</sup> [Data as of 1 October 2017](#). New START imposes a ceiling of 1,550 deployed strategic nuclear warheads, to be achieved by February 2018.

<sup>10</sup> Kristensen and Norris, "Worldwide deployments of nuclear weapons, 2017, *Bulletin of the Atomic Scientists*, 31 August 2017

<sup>11</sup> The US halted the production of HEU for weapons in 1964 and ceased plutonium processing for weapons in 1992.

<sup>12</sup> In addition to 49.3 metric tons of excess military material (*Global Fissile Materials Report 2015*)

<sup>13</sup> The amount of HEU needed to make a nuclear weapon varies with the degree of enrichment and the sophistication of the weapon design. In general, the higher the enrichment level and greater sophistication, the less HEU is needed to make a bomb. Plutonium-based nuclear weapons only work as implosion weapons, with more sophisticated weapons using less plutonium. The International Panel on Fissile materials estimates that an average of 15kg of HEU is required per warhead, or 3kg of weapons grade (or 5kg reactor grade) of plutonium is required per warhead (*Global Fissile Materials Report 2015*)

<sup>14</sup> Under New START the actual number of deployed missiles was reduced to 20 in 2016.

<sup>15</sup> *Arms Control and Proliferation Profile: the United States*, Arms Control Association, October 2015

## US Air Force – Global Strike Command

The US Air Force fields approximately 450 Minuteman III ICBM, which has a range of over 12,000km. Under the 2010 NPR the Obama administration announced plans to de-MIRV<sup>16</sup> existing missiles, with each missile now carrying a single warhead.<sup>17</sup> That process was completed in June 2014. Under New START 50 ICBM will be removed from their silos, although they are expected to be kept in reserve.<sup>18</sup>

A service-life extension programme for the Minuteman III has recently been complete which will retain the ICBM in service until 2030.

The Air Force also operates a fleet of 90 bombers, which are dual-capable and therefore able to deploy with both nuclear and conventional munitions. Of those, 20 are B2-A Spirit bombers and 70 are B-52H Stratofortress bombers. Both aircraft are capable of carrying up to 16 nuclear-armed gravity bombs, while the B-52H is also capable of carrying 20 air-launched cruise missiles. Under New START the intention is to reduce the bomber fleet to 60 aircraft by 2018.<sup>19</sup>

In addition the US also deploys several fighter aircraft in a dual-use tactical role. The F-15 and F-16, carrying the B-61 gravity bomb has been the cornerstone of this force. In the future this capability will be replaced by the Joint Strike Fighter.

## US nuclear forces in NATO countries

As outlined above, the US has tactical nuclear forces deployed at six bases in five NATO countries: Belgium, Germany, Italy, Netherlands and Turkey. All of those countries are parties to the NPT and have signed and ratified the CTBT. US nuclear weapons were removed from Greece in 2001 and from the UK in 2008.

Those nuclear forces currently comprise an estimated 150 B-61 gravity bombs<sup>20</sup> capable of being deployed on US F-15, F-16 aircraft; Belgian, Dutch and Turkish F-16 aircraft and German and Italian Tornados. The US maintains “absolute control and custody of the associated nuclear weapons”.<sup>21</sup> It has been noted that under a programme, referred to as Snowcat (support of nuclear operations with conventional air tactics), all NATO countries participate in NATO’s nuclear mission even if they do not have nuclear weapons stationed on their territory or have aircraft tasked with a nuclear role.<sup>22</sup>

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<sup>16</sup> MIRV – multiple independently targetable re-entry vehicle, meaning a missile is capable of carrying multiple warheads.

<sup>17</sup> The missiles will remain MIRV-capable and warheads are expected to remain in storage should it become necessary.

<sup>18</sup> “US nuclear forces 2015”, *Bulletin of the Atomic Scientists*, 2015

<sup>19</sup> “US nuclear forces 2015”, *Bulletin of the Atomic Scientists*, 2015

<sup>20</sup> At the height of the Cold War the US had 7,300 tactical nuclear weapons deployed in Europe. Since the 1970s that number has been steadily shrinking. In 1986 the US withdrew nearly 2,000 weapons, followed by 3,000 between 1991 and 1993. By 2001 the US is estimated to have had 480 tactical nuclear weapons in Europe, which was subsequently halved to 200 by 2007 (See Norris and Kristensen, “US tactical nuclear weapons in Europe”, *Bulletin of the Atomic Scientists*, 2011)

<sup>21</sup> NATO website: [NATO's nuclear deterrence policy and forces](#)

<sup>22</sup> Norris and Kristensen, “US tactical nuclear weapons in Europe”, *Bulletin of the Atomic Scientists*, 2011

NATO's nuclear policy is based on NATO's 2010 [Strategic Concept](#) and the 2012 [Deterrence and Defence Posture Review](#) which states that:

Nuclear weapons are a core component of NATO's overall capabilities for deterrence and defence alongside conventional and missile defence forces. The review has shown that the Alliance's nuclear force posture currently meets the criteria for an effective deterrence and defence posture [...]

As long as nuclear weapons exist, NATO will remain a nuclear alliance.

In a [speech in June 2013](#) Barack Obama stated that the US intended to work with its NATO allies "to seek bold reductions in U.S. and Russian tactical weapons in Europe". However, NATO linked such a move to reciprocal steps by Russia,<sup>23</sup> which was not forthcoming on the issue.

At the NATO Heads of State and Government Summit in Warsaw in July 2016 NATO leaders reaffirmed NATO's nuclear status, and on the subject of tactical nuclear weapons in Europe, stated:

NATO's nuclear deterrence posture also relies, in part, on United States' nuclear weapons forward-deployed in Europe and on capabilities and infrastructure provided by Allies concerned. These Allies will ensure that all components of NATO's nuclear deterrent remain safe, secure, and effective. That requires sustained leadership focus and institutional excellence for the nuclear deterrence mission and planning guidance aligned with 21st century requirements. The Alliance will ensure the broadest possible participation of Allies concerned in their agreed nuclear burden-sharing arrangements.<sup>24</sup>

That Summit Communiqué went on to state:

The circumstances in which NATO might have to use nuclear weapons are extremely remote. If the fundamental security of any of its members were to be threatened however, NATO has the capabilities and resolve to impose costs on an adversary that would be unacceptable and far outweigh the benefits that an adversary could hope to achieve.<sup>25</sup>

### Modernisation

Under the Obama administration, the US's initial approach to nuclear modernisation altered. In an effort to support the broader disarmament and non-proliferation agenda, and give credibility to US intentions to lead that initiative, modernisation of the US nuclear arsenal evolved from the development of new capabilities under the Bush administration<sup>26</sup> to an initial strategy focused largely on stockpile stewardship and the modernisation of existing capabilities through service-life extension programmes. However, that programme steadily evolved to increasingly focus on replacement programmes for existing capabilities across the nuclear triad as through-life extension programmes come to an end. As Hans Kristensen noted in an article in 2014:

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<sup>23</sup> NATO, [Deterrence and Defence Posture Review](#), 2012, para.26

<sup>24</sup> [NATO Warsaw Summit Communiqué](#), 9 July 2016, para.53

<sup>25</sup> *Ibid*, para.54

<sup>26</sup> Such as the Reliable Replacement Warhead programme

This modernization plan is broader and more expensive than the Bush administration's plan and appears to prioritize nuclear capabilities over conventional ones. The Obama administration entered office with a strong arms control and disarmament agenda, but despite efforts by some officials and agencies to reduce the number and role of nuclear weapons, the administration may ironically end up being remembered more for its commitment to prolonging and modernizing the traditional nuclear arsenal.<sup>27</sup>

Indeed, in January 2015 the US Congressional Budget Office estimated that over the next decade the US government planned to spend \$348 billion on modernising and replacing its nuclear forces, approximately \$35 billion per year.<sup>28</sup> That estimate was revised upwards in February 2017 to \$400 billion, an average of \$40 billion per year to 2026.<sup>29</sup>

In the longer term, the Congressionally-mandated *National Defense Panel Review of the 2014 Quadrennial Defense Review* estimated that the cost of maintaining, modernising and replacing the nuclear triad, over the next 30 years, could be in the region of \$600 billion to \$1 trillion.<sup>30</sup> With the effect of defence inflation it has been argued that this total could even exceed \$1.5 trillion.<sup>31</sup> A 2014 report by the Center for Nonproliferation Studies argued that such expenditure was "comparable to spending for procurement of new strategic systems in the 1980s under President Ronald Reagan".<sup>32</sup>

And based on current plans<sup>33</sup> that level of funding is set to remain on track under the Trump administration. Whether that will change as a result of the ongoing Nuclear Posture Review, however, remains to be seen.

The Pentagon's current modernisation priorities cover all three legs of the nuclear triad:

- A new class of SSBN (the *Columbia* class submarine) which will replace the current *Ohio* class from 2031. Twelve new SSBN are planned and will be equipped with 16 missiles tubes, as opposed to the current 24. The initial estimated cost of the total programme is \$139 billion.
- A new long-range strike bomber (B-21) for deployment from the mid-to late 2020s. Current expectations are for a fleet of at least 100 aircraft, some of which will be nuclear capable. Independent estimates have suggested the programme could cost at least \$110 billion.<sup>34</sup> The new bomber will be equipped with the new B61-12 guided stand-off nuclear gravity bomb, which is scheduled to be

<sup>27</sup> Hans Kristensen, "Nuclear weapons modernization: a threat to the NPT?", *Arms Control Today*, May 2014

<sup>28</sup> US Congressional Budget Office, [Projected cost of US nuclear forces 2015 to 2024](#), January 2015

<sup>29</sup> US Congressional Budget Office, [Projected costs of US nuclear forces 2017 to 2026](#), 14 February 2017

<sup>30</sup> *Ensuring a strong US defense for the future*, National Defense Panel Review of the 2014 Quadrennial Defense Review, July 2014

<sup>31</sup> "The trillion (and a half) dollar deal", *Arms Control Today*, August 2017

<sup>32</sup> [The Trillion Dollar Nuclear Triad](#), Center for Nonproliferation Studies, January 2014

<sup>33</sup> As set out in the US administration's budget request for fiscal year 2018.

<sup>34</sup> "Trump continues Obama nuclear funding", *Arms Control Today*, August 2017

completed in 2025 at a cost of \$7.6 billion; and a new long-range standoff (LRSO) cruise missile scheduled for deployment in 2026. The B61-12 will also be deployed in Europe in the mid-2020s. Initially it will be retrofitted to existing F-15, F-16 and Tornado aircraft but will eventually arm US F-35 aircraft once they are deployed.<sup>35</sup>

- A next generation ICBM (the Ground Based Strategic Deterrent programme) which will replace the Minuteman III in 2030. Under current Air Force plans replacement of the Minuteman III and rebuilding the existing infrastructure is expected to cost in the region of \$85 - \$140 billion over the next 30 years.<sup>36</sup> It will provide the US with a nuclear ICBM capability well into the 2070s. There has been some suggestion that the Air Force is currently examining options for the replacement system to also be deployed, in the longer term, on mobile launchers. An article in *Arms Control Today* in April 2016 noted that such a development would be “unprecedented” in US nuclear strategy, noting that the US examined two mobile ICBM options during the Cold War, both of which were cancelled before they became operational. The development of such a system would be expected to cost at least \$80 billion more over the next 50 years than the retention of only silo-based ICBM.<sup>37</sup>
- A number of nuclear warhead programmes to support these programmes are also underway. Including: the W76-1 life extension programme (LEP) and the W88 Alteration 370 programme, both for the Trident II D5 missile; the B61-12 LEP; the W80-4 LEP which will provide a warhead for the LRSO programme; and the IW-1 LEP which is intended to provide an interoperable warhead for various system. In the FY18 budget request warhead programmes received an additional \$1 billion, a 7.8% increase on 2017 funding levels.<sup>38</sup>

The affordability of the US nuclear modernisation programme has been questioned, however. Costs of several programmes have already been revised upwards by several billion dollars; while in the mid-2020s spending on all three legs of the nuclear triad is expected to consume between 5% and 7% of the entire US defence budget.<sup>39</sup> A number of experts have warned that the programme, as it stands, cannot be sustained without significant and sustained increases to the defence budget and/or cuts to conventional military programmes, which would undermine President Trump’s pledge following his inauguration to expand the military. The possibility of nuclear projects being re-prioritised or cut is therefore the subject of much debate.

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<sup>35</sup> Turkey, the Netherlands, Italy and possibly Belgium are also expected to buy the F-35 from the US from 2024 onwards.

<sup>36</sup> The initial cost estimate published by the US Air Force in 2015 was \$62.3 billion

<sup>37</sup> “Air Force seeks mobile ICBM option”, *Arms Control Today*, April 2016

<sup>38</sup> See “Nuclear weapons agency gets 11 percent funding increase in FY18 budget request”, *Defense News*, 24 May 2017

<sup>39</sup> See “Can the US afford to modernise its nukes?”, *Jane’s Defence Weekly*, 12 August 2015 and “The US nuclear weapons spending binge”, *Arms Control Today*, December 2015

One of the projects considered by analysts to be most at risk is the US Air Force's cruise missile programme (LRSO) which is similar to the current Joint Air-to-Surface Standoff Missile – Extended Range project which is a non-nuclear cruise missile. Several members of Congress have argued that, at an estimated cost of \$30 billion, the LRSO programme is unaffordable and unnecessary. To date, Defense Secretary Mattis has yet to endorse the programme.

An attempt to block funding for the programme was introduced in early June 2016 in an amendment to the *2017 Defense Appropriations Bill*. Despite the amendment being defeated (by 159-261 votes) the fact that more than a third of the House of Representatives voted for the amendment was regarded by commentators at the time as indicative of the vulnerability of the programme going forward.<sup>40</sup> Indeed, further legislation was introduced in the House in April 2017 which seeks to cap development funding for the missile and its warhead at existing levels until the new Nuclear Posture Review is submitted to Congress

In a report in February 2016, the Center for American Progress also called for the number of *Columbia* class SSBN to be reduced; the removal of the tactical nuclear mission in Europe and the downsizing of the ICBM force. It suggested that by doing so the US could maintain a credible deterrence structure, while at the same time more effectively managing the budget.<sup>41</sup>

US Defense Secretary, James Mattis, told the House Armed Services Committee in June 2017 that the cost to sustain and upgrade the US nuclear arsenal is affordable "if appropriately prioritized".<sup>42</sup>

### Box 1: Suggested reading

- [Statement of the Vice Chairman of the Joint Chiefs of Staff before the House Armed Services Committee on the Military Assessment of Nuclear Weapons Requirements](#), 8 March 2017
- [Statement of the Commander United States Strategic Command before the House Committee on Armed Services on the Military Assessment of Nuclear Weapons Requirements](#), 8 March 2017
- [US strategic nuclear forces: background, developments and issues](#), US Congressional Research Service, August 2017
- [Nonstrategic nuclear weapons](#), US Congressional Research Service, February 2017
- "Price tag rising for planned ICBMs", *Arms Control Today*, October 2016
- ["Examining the flawed rationale for a new nuclear air-launched cruise missile"](#), *Arms Control Today*, June 2016
- ["The problem with NATO's nukes"](#), *Foreign Affairs*, February 2016
- Todd Harrison, [Defense modernization plans through the 2020s: addressing the bow wave](#), Center for Strategic and International Studies, January 2016

<sup>40</sup> "Nuclear cruise missile survives challenge in House", *Defense News*, 16 June 2016

<sup>41</sup> [Setting priorities for nuclear modernization](#), Center for American Progress, February 2016

<sup>42</sup> "Trump continues Obama nuclear funding", *Arms Control Today*, August 2017

### 3. Russia

#### Summary

- Has the largest nuclear arsenal in the world.
- Nuclear stockpile is estimated at 7,000 warheads, of which 4,300 are operational (both strategic and non-strategic), including 1,561 that are currently deployed.
- Under the New START agreement the number of deployed *strategic* warheads must not exceed 1,550 by February 2018.
- Non-strategic warheads are not currently subject to any arms control limitations.
- Forces are organised on the nuclear triad principle
- Does not operate a continuous at-sea deterrence.
- Dropped its 'no first use' policy in 1993.
- Has been undertaking an extensive programme of capabilities modernisation since 2008.

The Soviet Union tested its first atomic weapon in 1949. By the time the NPT was concluded in 1968 both the Soviet Union and the United States had a nuclear stockpile of tens of thousands apiece. During the last two decades of the Cold War the US and the Soviet Union concluded a number of bilateral arms control agreements which reduced the size of their respective nuclear arsenals.

Following the dissolution of the Soviet Union in late 1991, Russia was formally recognised as the sole nuclear weapon state under a Protocol to the US-Soviet *Strategic Arms Reduction Treaty*, which was signed in May 1992.<sup>43</sup>

Since then the US and Russia have concluded further nuclear arms reduction treaties. Yet, despite this progress Russia still deploys an extensive nuclear force and is in the process of modernising its nuclear capabilities. As Hans Kristensen and Robert Norris note in their latest assessment of Russian nuclear forces:

These modernizations, combined with an increase in the number and size of military exercises and occasional explicit nuclear threats against other countries, contribute to growing concern abroad about Russian intentions. These concerns, in turn, drive increased defense spending, nuclear modernization programs, and political opposition to reductions in Western Europe and the United States.<sup>44</sup>

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<sup>43</sup> The dissolution of the Soviet Union left Soviet nuclear weapons stationed on the territory of four newly independent republics - Russia, Kazakhstan, Ukraine and Belarus. Under the Lisbon protocol all four states became parties to the Strategic Arms Reduction Treaty (START I) and accede to the NPT as non-nuclear weapon states.

<sup>44</sup> Hans Kristensen and Robert Norris, "Russian nuclear forces, 2017", *Nuclear Notebook*, February 2017

## Nuclear Doctrine

In contrast to the United States, Russia is far more secretive about its nuclear policies. Much of the detail is contained in a confidential report, *Foundations of State Policy in the Area of Nuclear Deterrence to 2020*. However, reference to nuclear policy is set down in Russia's Military Doctrine and its National Security Strategy, which are updated periodically.

On 25 December 2014 President Putin approved a new military doctrine for the Russian Federation, replacing the previous Military Doctrine which was published in 2010. In line with previous iterations of the doctrine, on the issue of nuclear weapons it confirms that:

27. The Russian Federation shall reserve the right to use nuclear weapons in response to the use of nuclear and other types of weapons of mass destruction against it and/or its allies, as well as in the event of aggression against the Russian Federation with the use of conventional weapons when the very existence of the state is in jeopardy.

The decision to use nuclear weapons shall be taken by the President of the Russian Federation.<sup>45</sup>

In December 2015 President Putin also approved a new National Security Strategy for Russia. Echoing the 2014 military doctrine the strategy stated:

Strategic deterrence and the prevention of armed conflicts are achieved by maintaining the capacity for nuclear deterrence at a sufficient level, and the Russian Federation Armed Forces, other troops, and military formations and bodies at the requisite level of combat readiness.<sup>46</sup>

It also went on to state that Russia "is prepared for further discussion of a reduction of nuclear potentials based on bilateral accords and in multilateral formats and also contributes to the creation of fitting conditions permitting a reduction in nuclear arms without detriment to international security and strategic stability".<sup>47</sup>

### Declaratory policy

Russia formally dropped its 'no first use' policy in 1993.

### Nuclear arms control agreements

As outlined above, Russia is subject to a number of bilateral arms control agreements concluded with the US, specifically the INF treaty and the New START treaty.

In addition:

- Russia is one of the recognised nuclear weapon states under the NPT. It has a legal obligation to pursue disarmament under Article VI of that treaty.
- Russia signed the Comprehensive Test Ban Treaty in 1996 and ratified it in 2000.

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<sup>45</sup> *The Military Doctrine of the Russian Federation*, December 2014

<sup>46</sup> *Russian National Security Strategy* (English translation), December 2015

<sup>47</sup> *ibid*

- Russia supports a verifiable ban on the production of fissile material for weapons purposes.

In 2014 the US accused Russia of being in violation of the INF, following a reported test of a new ground-launched cruise missile.<sup>48</sup> This has, however, been disputed by the Russian government. In its national report to the NPT review conference in April 2015 the Russian government stated:

The Treaty is still in force. It remains an important factor of maintaining international security and strategic stability. The Russian Federation remains committed to the Treaty and fully complies with its obligations.<sup>49</sup>

In turn, Russia has also accused the US of violating the INF Treaty with the fielding of its ballistic missile defence system in Europe which they have argued is capable of launching Tomahawk cruise missiles. Russia has also suggested that the US' deployment of unmanned combat aerial vehicles (UCAV) is a breach of the treaty's provisions. In response the US administration has stated that "all of Russia's claims past and present, are categorically unfounded. The United States has been and remains in compliance with all of its obligations under the INF Treaty. These Russian claims are meant to divert attention from its own violation".<sup>50</sup>

Russia has previously indicated that it will not negotiate further non-strategic arms reductions unless the US withdraws its non-strategic nuclear forces that are currently based in Europe. Whether progress on this issue can be made under the new Trump administration remains to be seen.

### Capabilities

Since the end of the Cold War, Russia has indicated a preference to rely on its nuclear arsenal, and ICBM capabilities specifically, as a means of power projection and, some have argued, as a means of making up for the increasing obsolescence and inferiority of its conventional arsenal.

By comparison Russia's sea and air-launched nuclear capabilities are considered less technically advanced.

In the annual update to the Russian Defence Ministry Board in December 2016, it was stated that Russia's nuclear forces were equipped with 60% modern armaments.<sup>51</sup>

Between 2012 and 2015 Russia spent approximately £401 million on the modernisation of its nuclear weapons.<sup>52</sup>

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<sup>48</sup> See "Russia breaches INF treaty, US says", *Arms Control Today*, 2014

<sup>49</sup> [National Report submitted by the Russian Federation](#), April 2015

<sup>50</sup> Richard Fieldhouse, "INF Treaty impasse: time for Russian action", *Arms Control Today*, February 2016

<sup>51</sup> [Statement to Extended Board Session of the Russian Defence Ministry](#), 22 December 2016

<sup>52</sup> "Nuclear weapons financing, and Russia's armed forces reform", BASIC Blog, 17 February 2015

## Stockpile

Russia continues to have the largest nuclear arsenal in the world, capable of being delivered from land, sea and air. At present it is estimated to have a total inventory of 7,000 warheads, of which:

- 4,300 are active/operational warheads, including non-strategic warheads.
- 2,700 are retired and awaiting dismantlement

The most recent data exchanged between the US and Russia under the terms of the New START agreement showed that of those 4,300 operational Russian warheads 1,561 were deployed strategic nuclear warheads, only slightly above the ceiling imposed by New START.<sup>53</sup> Russia also has 501 deployed delivery systems.<sup>54</sup>

Russia also possesses a non-strategic (tactical) arsenal that is thought to total approximately 2,000 warheads. Russia retains a non-strategic capability for two primary reasons: the existence of potential nuclear powers within Russia's sphere of influence and the deployment of US nuclear weapons in Europe. Such capabilities could also potentially be deployed against elements of the proposed US ballistic missile defence architecture in Eastern Europe.

## Fissile material

The extent of Russia's holdings of fissile material is uncertain. Although the country no longer produces fissile material for weapons purposes,<sup>55</sup> according to the latest figures from the International Panel on Fissile Materials, Russia has approximately 616 metric tons of HEU and 94 metric tons of plutonium<sup>56</sup> available for weapons production.<sup>57</sup>

In October 2016 Russia suspended its cooperation in a bilateral agreement signed with the US in 2000 to dispose of 68 metric tons of excess weapons-grade plutonium (34 tons each).<sup>58</sup> The Russian government justified its decision on the basis of "unfriendly actions" by the US and the inability of Washington to fulfil its own obligations under the agreement. The Russian Duma subsequently passed legislation setting out a number of conditions that would have to be met before Russia would resume cooperation under the agreement. Namely:

- The lifting of all US sanctions enacted in response to Moscow's actions in Ukraine in 2014
- Compensating Russia for the damage caused by the sanctions
- Reducing the US military presence in Eastern European NATO countries.

<sup>53</sup> [Data as of 1 October 2017](#). New START imposes a ceiling of 1,550 deployed strategic nuclear warheads, to be achieved by February 2018.

<sup>54</sup> Of a ceiling of 700 imposed under New START.

<sup>55</sup> Russia announced a halt to highly enriched uranium production in 1989 and the cessation of plutonium production for weapons in 1994.

<sup>56</sup> In addition to 34 metric tons of excess military material.

<sup>57</sup> International Panel on Fissile Materials, *Global Fissile Material Report*, 2015

<sup>58</sup> [Plutonium Management and Disposition Agreement](#), 2000.

The likelihood of the agreement being resurrected, in the current political climate, is therefore regarded as negligible.

### **Land based capabilities**

The ground-based arm of the nuclear deterrent is operated and maintained by three Rocket Armies of the Strategic Missile Force, organised into 12 divisions operating silo and mobile missile launchers.

According to the 2017 *Military Balance* the Strategic Missile Force has 324 ICBM at its disposal, capable of carrying 1,104 warheads. Just over half (174) are Soviet-era ICBM: the RS-20 with MIRV capability (up to 10 warheads apiece), the RS-12M mobile single warhead ICBM, and the RS-18 ICBM equipped with up to 6 warheads each.

The remainder are Topol-M single warhead ICBM (both silo-based and road mobile) and the RS-24 Yars ICBM which has MIRV capability.<sup>59</sup> The older Soviet-era missiles are gradually being phased out to be replaced by the Topol-M and RS-24 Yars ICBM.

Deployment of the Iskander-M short-range ballistic missile system, which is nuclear capable, has also continued. Over the last few years Iskander-M brigades have reportedly been stationed close to NATO territory, for example around St Petersburg. In October 2016 President Putin also suggested that nuclear-tipped Iskander-M missiles had been deployed to the Russian enclave of Kaliningrad, between Poland and Lithuania.

Russian ground forces also possess an undisclosed number of non-strategic (tactical) nuclear weapons. Estimates vary but one assessment in 2014 suggested that 170 warheads were assigned to ground-launched, short-range ballistic missiles.<sup>60</sup> As with its other nuclear forces, the Army is currently modernising its short-range ballistic missile force, to provide greater range.

### **Naval capabilities**

The Russian Navy currently has 12 operational SSBN, each equipped with 16 SLBM, at its disposal. The majority of those SSBN are Soviet-era platforms, dominated by the six vessels of the Delta IV class.

Russia does not operate a policy of continuous at-sea deterrence but patrols periodically. The adoption of this posture has been largely attributed to Russia's adoption of a nuclear triad and its focus on its extensive ground-launched ICBM capability.

Modernisation of Russia's SSBN fleet has, however, been a priority since 2008. The Delta IV SSBN have been upgraded to deploy with a modified SS-N-23 SLBM, codenamed Sineva, which carries up to four warheads. Since 2008 three new vessels of the new Borei class have also entered service. The first SSBN to be constructed since the end of the Cold War, the Borei class is equipped with 16 new Bulava SLBM, each with an

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<sup>59</sup> Deployment of the RS-24 began in 2010. The RS-24 is reportedly a modified Topol-M but was given a new designation in order to avoid potentially violating the obligations of the START treaty, or its successor, which prohibited increasing the number of warheads on existing missiles, but did not preclude building new missiles.

<sup>60</sup> [Nuclear Threat Initiative: Russia profile](#), March 2016

operational range of 8-9,000 km and capable of carrying 6 warheads apiece. A total class of between eight and ten boats is anticipated to replace the ageing Delta III SSBN.

However, a series of testing failures of the Bulava missile in 2008 and 2009 has delayed the programme which is now years behind schedule. Delays in the introduction of the Borei class has subsequently forced Moscow to extend the life of several of its ageing Delta III SSBN in order to maintain its numbers of sea-based deployed strategic warheads. The Delta IV-class SSBN which are currently in service are not expected to be decommissioned from service until well into the 2020s. As such, the delay to the Borei class is not considered detrimental to Russia's sea-based nuclear posture, although it has raised questions as to the technical capabilities and overall condition of Russia's military-industrial complex.

Approximately 700 warheads are also thought to be assigned to Russia's naval forces for delivery via cruise missiles, anti-submarine weapons, torpedoes and depth bombs.<sup>61</sup>

### **Air-launched capabilities**

Russia's air-delivered nuclear capability is operated by the Long Range Aviation Command. It consists of four squadrons operating 76 bomber aircraft. One squadron deploys 16 Tu-160 'Blackjack' aircraft equipped with up to 12 AS-15B nuclear air-launched cruise missiles (ALCM); while three squadrons operate the Tu-95MS 'Bear H', each with up to 6 AS-15A ALCM. Both platforms can also be equipped with nuclear-armed free-fall bombs.

Both aircraft are in the process of being incrementally updated to allow them to remain in service until the late 2020s-early 2030s. In 2015 10 modernised aircraft were delivered, followed by a further 4 aircraft in 2016. The number of aircraft delivered in 2016 fell significantly short of expectations however. In December 2015 the Russian Defence Ministry had identified the delivery of 9 aircraft as a priority for 2016.<sup>62</sup>

Approximately 730 non-strategic warheads are also estimated to be deployed on AS-4 air-to-surface missiles and free fall bombs assigned to tactical air forces.<sup>63</sup> The air force operates a medium-range bomber, the Tu-22M, which is capable of deploying with nuclear-armed cruise missiles; while the air force is also currently working to replace its Su-24M aircraft, which can be deployed in a tactical nuclear role, with the new Su-34. Deployment of the Su-34 has already begun. A total of 120 Su-34s are planned through to 2020.

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<sup>61</sup> [Nuclear Threat Initiative: Russia profile](#), March 2016

<sup>62</sup> [Key points of report of the Russian Defence Minister at extended session of the Russian Defence Ministry Board](#), December 2015 and [Statement to Extended Board Session of the Russian Defence Ministry](#), 22 December 2016

<sup>63</sup> [Nuclear Threat Initiative: Russia profile](#), March 2016

## Modernisation

Russia is currently in the middle of an extensive programme of modernisation of its nuclear and ballistic missile capabilities, as part of a broader modernisation effort under the State Armaments Plan.

First established in 2008 the intention of Russia's wholesale modernisation plan was to rebuild a cohesive military out of the old Soviet structures. As part of that programme the modernisation of capabilities and in particular the strategic nuclear deterrent has consistently been identified as a priority. By 2020 the objective is to replace 70% of the entire Russian arsenal, both conventional and nuclear, with modern systems.

While the broader modernisation plan has been beset with financial pressures and industrial challenges, upgrades to Russia's nuclear capabilities have largely remained unscathed. Indicative, some would argue, of the priority that the Putin administration has continued to place on nuclear weapons in terms of military power projection.<sup>64</sup>

### Land-based nuclear capabilities

In June 2015 President Putin announced that Russia would increase the size of its ICBM force by 40, in response to the deployment of ballistic missile defence systems near Russia's borders. By 2020 around 200 RS-24 Yars ICBM are expected to be procured. Estimates have put delivery of new Topol-M and RS-24 Yars ICBM systems at 40 per year.<sup>65</sup> The replacement programme is scheduled for completion by 2022.

Work is also ongoing on a new silo-based ICBM, the Sarmat, which can carry up to 10 warheads. The first prototype was due to be completed in March 2016, with entry into service expected in 2019/2020. A total complement of 46 Sarmat missiles is expected.

In 2015 the Russian Ministry of Defence also announced that a new rail-based ICBM, based on the RS-24 Yars missile, would be developed. This would not be an entirely new capability as an extensive Combat Railway Missile Complex was in place during the Cold War. Regarded as a survivable and highly evasive platform, the revival of this asset has been viewed with some concern.<sup>66</sup> Design work is already thought to have begun and operational capability was initially expected to be achieved in 2019. However, budgetary pressures have reportedly delayed the programme until at least 2020. An article in *Jane's Aerospace, Defence and Security* has suggested that a final feasibility report on the project is due to be submitted to President Putin in 2017 leading to speculation that the programme could eventually be cut if Russia's economy does not improve and further pressure is placed on the defence budget.<sup>67</sup>

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<sup>64</sup> Russia's rearmament programme and the challenges it currently faces is examined in greater detail in Library briefing paper CBP7877, [Russia's rearmament programme](#), January 2017

<sup>65</sup> In 2016 strategic ground forces received 41 new ballistic missiles ([Statement to Extended Board Session of the Russian Defence Ministry](#), 22 December 2016)

<sup>66</sup> See "Railing against the West", *RUSI Defence Systems*, 20 March 2015

<sup>67</sup> "Russian rail-mobile ICBM project set to be axed", *Jane's Aerospace, Defence & Security*, 2015

In July 2014 the US accused Russia of violating the INF treaty by testing a new ground-launched cruise missile (GLCM) with a range greater than that permitted by the treaty. The assumption is that new the GLCM would be deployed with the Army in a tactical nuclear role, although it is not believed to be so at present. Russia has, however, denied the allegations.

### **Naval nuclear capabilities**

Within the Russian Navy, further vessels of the *Borei* class SSBN, and its complement of Bulava SLBM are expected within the 2020-2030 timeframe. A total class of between eight and twelve boats is anticipated, with the boats currently under construction expected to have some modifications, thereby designated the *Borei-A*. The programme is not expected to be completed until the mid-late 2020s.

Work is also expected to begin in post-2020 on a fifth-generation SSBN, and equivalent SLBM, which will enter the production phase from 2031 onwards.

Russia's non-strategic naval capabilities have also been the focus of modernisation, with the expected introduction into service of a new class of attack submarine, the *Yasen*, equipped with a new type of long-range sea-launched cruise missile which is nuclear capable. The *Yasen* class will also be able to deliver nuclear armed anti-submarine rockets, as well as nuclear torpedoes.

### **Air-launched nuclear capabilities**

Modernisation of the Tu-160 and Tu-95 strategic bomber fleets will remain ongoing, which will allow them to remain in service until the late 2020s-early 2030s.

A new longer range air-launched cruise missile, designated the Kh-102 is also currently under development for deployment on both the Tu-160 and Tu-95MS. It has an estimated range of 5,000km, which is double that of the AS-15A.

Going forward the Russian Ministry of Defence has indicated that it has begun studying designs for a next generation strategic bomber (PAK-DA), to replace the fleet of Tu-160 and Tu-95 aircraft. A prototype is expected in the early 2020s, although some estimates have suggested that flight testing could begin in 2019 with first deliveries to the air force in 2025.<sup>68</sup>

Since March 2015, however, there has also been some discussion over the possibility of Russia re-establishing the Tu-160 production line (which had ended in 1992) after the Russian Defence Minister suggested it was under consideration as an alternative to the PAK-DA programme. A number of analysts have questioned the rationale of restarting Tu-160 production, however, suggesting that "defence ministry and industry may lack the resources to support such a project".<sup>69</sup>

<sup>68</sup> "Russian air patrols: long-range ambitions", *Strategic Comments*, June 2015

<sup>69</sup> "Russian air patrols: long range ambitions", *Strategic Comments*, June 2015

**Box 2: Suggested reading**

- Hans Kristensen and Robert Norris, "Russian nuclear forces 2017", *Nuclear Notebook*, February 2017
- House of Commons Library Briefing Paper, CBP7877, [Russia's Rearmament Programme](#), January 2017
- Elbridge Colby, [Russia's evolving nuclear doctrine and its implications](#), Fondation pour la Recherche Stratégique, January 2016
- *Russian military modernization*, NATO Parliamentary Assembly, October 2015
- Steven Pifer, ["Overblown: Russia's empty nuclear sabre-rattling"](#), *The National Interest*, March 2015

## 4. China

In 1955 the Chinese leadership initiated a nuclear weapons programme, partly in response to concerns about US nuclear threats during the Korean War. Nine years later, China became the last of the five NPT recognised states to successfully test an atomic device. China then tested its first thermonuclear device in June 1967. Observers commented on the short time-span (32 months) between the two tests, which was substantially less than the other nuclear powers.<sup>70</sup>

Precise information on the extent of China's nuclear arsenal is difficult to obtain, due to a lack of open source information and often contradictory or exaggerated claims.

Over the last two decades China has, however, been actively seeking to expand its nuclear capabilities in order to achieve a more robust and survivable nuclear force; while at the same time developing a credible second-strike capability. It is the only acknowledged nuclear weapon state under the NPT that is expanding its nuclear inventory.

### Nuclear doctrine

The Chinese government has consistently asserted that its nuclear posture is based on the concept of 'self-defence'. In its national report to the 2015 NPT Review Conference, China stated:

China's nuclear weapons are for the sole purpose of defending against possible nuclear attack and never for threatening or targeting any other country. China has never provided a nuclear umbrella for any other country or deployed nuclear weapons in any other country. China has never taken part in any form of nuclear arms race. It never competes with other countries in terms of nuclear input, quantity or scale and always keeps its nuclear arsenal at the minimum level required for its national security.<sup>71</sup>

While a firm advocate of nuclear disarmament and the conclusion of a convention on the prohibition of nuclear weapons, China has also suggested that:

Nuclear disarmament should be a just and reasonable process of gradual and balanced reduction. States with the largest nuclear arsenals bear a special responsibility for nuclear disarmament and should take the lead in reducing their nuclear arsenals drastically. When conditions are ripe, all nuclear-weapon States should join the multilateral nuclear disarmament negotiation process.<sup>72</sup>

### Declaratory policy

Chinese leaders have consistently maintained a policy of 'no first use' for China. It is the only nuclear weapon state to have consistently done

### China

Nuclear stockpile is estimated at 270. None are thought to be operationally deployed but kept in storage under central control.

Force structure is nominally based on the nuclear triad, although the credibility of China's air-launched capabilities, and until recently its naval capabilities, has been questioned.

Has a longstanding no first-use policy.

Does not operate continuous at-sea deterrence.

Actively seeking to expand its nuclear

<sup>70</sup> By point of comparison, 86 months passed between the United States' first atomic test and its first hydrogen bomb test, for the Soviet Union it was 75 months, for the UK 66 months, and for France 105 months ([Nuclear Threat Initiative China Profile: Nuclear Overview](#), September 2009)

<sup>71</sup> [National report by China to the 2015 NPT Review Conference](#), April 2015

<sup>72</sup> *ibid*

so and in 2015 it confirmed that “China has never deviated from its pledge and will never do so in the future”.<sup>73</sup>

The reasons why China may have adopted a policy of no first use was examined in a Nuclear Threat Initiative briefing in December 2005:

Beijing often points to its NFU policy as proof that China—in apparent contrast to the United States and Russia—is a “peace-loving” nation that is “pursuing a foreign policy of peace.” Affectation and propaganda aside, “no-first-use” was both conditioned by necessity—a small nuclear arsenal—and by policy, since China’s nuclear weapons were not meant to go beyond countervalue (i.e., city-busting) minimum deterrence. China’s NFU policy has therefore been governed less by altruism than by other limiting factors.<sup>74</sup>

It also considered that China would have little to gain from abandoning the policy:

The NFU policy has served China well by assuring strategic stability, assisting in a relatively more efficient allocation of limited resources, and allowing Beijing to take the high moral ground on nuclear weapons use. Despite speculation about a shift in China’s nuclear doctrine, a careful analysis of official Chinese positions and recent trends in Chinese nuclear weapons modernization would suggest Major General Zhu Chenghu’s remarks do not provide any new clues to China’s nuclear doctrine, nor do they indicate a move towards building a more offense-capable and war-fighting nuclear posture. A look at the history of China’s no-first-use policy, nuclear program, and doctrine, along with its current military planning and modernization, indicate that a move away from the NFU policy is not likely in the near-to-mid-term. Even in the long-term, China’s resources and planning will likely be considered better spent on other priorities, and not the costly expansion of its nuclear arsenal.<sup>75</sup>

In its [2017 annual report to Congress](#) on China’s military capabilities, the US Department of Defense also observed:

China has long maintained a “no first use” (NFU) policy, stating that it would use nuclear forces only in response to a nuclear strike against China. China’s NFU pledge consists of two stated commitments: China will never use nuclear weapons first at any time and under any circumstances, and it unconditionally undertakes not to use or threaten to use nuclear weapons against any non-nuclear-weapon state or in nuclear-weapon-free zones.

There is some ambiguity, however, over the conditions under which China’s NFU policy would apply. Some PLA officers have written publicly of the need to spell out conditions under which China might need to use nuclear weapons first; for example, if an enemy’s conventional attack threatened the survival of China’s nuclear force or of the regime itself. There has been no indication that national leaders are willing to attach such nuances and caveats to China’s NFU doctrine.

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<sup>73</sup> [National report by China to the 2015 NPT Review Conference](#), April 2015

<sup>74</sup> [‘Going Beyond the Stir: The Strategic Realities of China’s No-First-Use Policy’](#), *NTI Issue Brief*, December 2005

<sup>75</sup> [‘Going Beyond the Stir: The Strategic Realities of China’s No-First-Use Policy’](#), *NTI Issue Brief*, December 2005

Hans Kristensen and Robert Norris have also argued in their latest assessment that the qualitative improvements in Chinese nuclear capabilities, brought about as a result of China's modernisation programme may result, in the longer term, in changes to Chinese nuclear policy and strategy.<sup>76</sup>

### **Nuclear arms control agreements**

China ratified the NPT in 1992 after several decades outside of its architecture. Now one of the recognised nuclear weapon states under the NPT China has a legal obligation to pursue disarmament under Article VI of that treaty.

Although China has observed a nuclear testing moratorium since 1996 it has signed, but not ratified, the Comprehensive Test Ban Treaty.

China supports the early negotiation and conclusion of a fissile material cut-off treaty, although it is yet to declare an official moratorium on fissile material production.

### **Capabilities**

Although China maintains that its nuclear posture is a defensive one, it does have force projection capability, which has been greatly improved in the last few years. China is thus considered to have transitioned from possessing a small, unsophisticated and highly vulnerable nuclear force to a more modern one that has an improved strike capability and which is both more reliable and survivable.

China's deterrent is nominally based on the nuclear triad principle, although the majority of Chinese warheads are currently believed to be intended for strategic purposes and delivered by ground-based ballistic missiles. The credibility of China's air-launched, and until recently its submarine-based, nuclear capabilities has been questioned.

### **Stockpile**

The Chinese nuclear stockpile has been estimated at approximately 270 warheads, an increase of 30 warheads in the last six years.<sup>77</sup>

Previous estimates of the Chinese arsenal had placed the overall figure at around 400, but that figure has been revised downwards in recent years. In any event, China is believed to have sufficient stocks of fissile material to produce a much larger arsenal (see below). The US-China Commission in its 2015 report suggested that:

China is making significant qualitative improvements to its nuclear deterrent along with moderate quantitative increases in the course of its efforts to build a more modern nuclear force.<sup>78</sup>

An assessment by the Bulletin of the Atomic Scientists in 2015 concurred with this view:

China is the only one of the five original nuclear weapon states that is quantitatively increasing the size of its nuclear arsenal,

<sup>76</sup> Kristensen and Norris, *Chinese nuclear forces 2016*

<sup>77</sup> *Arms Control and Proliferation Profile: China*, Arms Control Association, July 2017

<sup>78</sup> [US-China Commission 2015 Annual Report](#)

although the pace is slow. The arsenal's capabilities are also increasing as older missiles are replaced with newer and more capable ones.<sup>79</sup>

None of those warheads are thought to be operationally deployed but kept in storage under central control.

#### **Fissile material**

Although China has not publicly declared a halt to the production of fissile material, it is widely believed to have done so.

China has not declared its fissile material production and there are varying estimates as to its holdings. According to one assessment published by the International Institute for Strategic Studies in 2014:

The current best estimate of the total stockpile of plutonium and HEU, including material in current warheads is 1.9 tonnes of plutonium and 19 tonnes of HEU [...] the total stockpile is sufficient for a few hundred such warheads – and no more than several hundred at most [...]

This is broadly consistent with...estimates that China's stockpile of fissile material was sufficient for planned modernisation.<sup>80</sup>

The International Panel on Fissile Materials broadly concurs with this view, estimating that China currently has 16 metric tons of HEU and 1.8 metric tons of plutonium.<sup>81</sup>

#### **Land-based capabilities**

The primary nuclear mission is the responsibility of the People's Liberation Army Rocket Force.<sup>82</sup> Ground-launched capabilities comprise approximately 150 land-based missiles, including 50-60 ICBM (specifically the DF-31, DF-31A, DF-4 and DF-5A) and the DF-21A and DF-26 intermediate range ballistic missile (IRBM).

The solid-fuelled, road-mobile, DF-31 and DF-31A were considered to be a major technological advancement on previous generations of liquid-fuelled, silo-based, ICBM and as such has provided the PLA with a credible, survivable nuclear strike capability. The DF-31A ICBM, which has been deployed in the last couple of years, in particular, has provided China with the ability to deploy multiple warheads aboard its ICBM, and also ensures coverage of most of the continental US. China remains in the process of replacing its older DF-4 and DF-5A ICBM with the new DF-31A.

According to the US Department of Defense, China continues to field new and more advanced systems, with improved range, mobility, accuracy and destructive capability, including the new DF-26 IRBM and a third version of the DF-21.<sup>83</sup>

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<sup>79</sup> Hans Kristensen and Robert Norris, *Chinese nuclear forces 2015*

<sup>80</sup> Jeffrey Lewis, *Paper tigers: China's nuclear posture*, IISS, 2014

<sup>81</sup> International Panel on Fissile Materials, *Global Fissile Material Report*, 2015

<sup>82</sup> A reorganisation of nuclear structures was completed in December 2015. The PLA Rocket Force replaced the Second Artillery Force in a move which has elevated the nuclear forces to a full service, equivalent to that of the army, navy and air force.

<sup>83</sup> US Department of Defense, [Annual report to Congress: Military and Security Developments Involving the People's Republic of China 2016](#), April 2016

At present China is also reported to be testing a new road-mobile ICBM thought to be capable of carrying up to 10 warheads: the DF-41.

### Naval capabilities

China established a submarine-launched nuclear capability in the mid-1980s with the development of a single Xia class SSBN equipped with 12 JL-1 SLBM.

However, its operational status has long been open to question, thereby raising doubts over the credibility of the submarine-based deterrent. The Federation of American Scientists asserted that the Xia class SSBN has never conducted a deterrent patrol outside of Chinese territorial waters; while others have argued that no nuclear-armed JL-1 ballistic missiles were ever deployed aboard the Xia class. However, an assessment published by IISS in 2014, suggested that:

It is possible that the best description of the submarine is a prolonged form of 'trial operational deployment' similar to the early deployments of the DF-4 and DF-5. The Xia class submarine may not be operational, but it is presumably available in extremis for limited missions.<sup>84</sup>

It is only in the last few years, with the development of four Jin class SSBN, each equipped with 12 JL-2 SLBM, that China is considered to have established a credible sea-based element of its nuclear triad. A fifth boat is thought to be under construction.

The Jin class constitutes major technological advancement over the Xia class submarine, particularly in relation to stealth, sonar, propulsion, command and control systems and overall survivability of the sea-based deterrent. The JL-2 SLBM, which was successfully flight tested in 2013 and 2014, also provides greater range<sup>85</sup> and accuracy. Importantly the Jin class, provides China with a potential second-strike capability if it is operationally deployed.

Yet, questions still remain about its operational status. The IISS *Military Balance 2017* denotes its status as "unknown"; while Kristensen and Norris observe that "confusion continues about whether the Jin submarines have sailed on deterrent patrols with nuclear weapons on board".<sup>86</sup>

The Pentagon's 2016 assessment of China's military capabilities states:

China continues to produce the JIN-class SSBN (Type 094) with associated CSS-N-14 (JL-2) submarine-launched ballistic missiles (SLBM) that has an estimated range of 7,200 km. This platform represents China's first credible, sea-based nuclear deterrent. China will probably conduct its first SSBN nuclear deterrence patrol sometime in 2016. Four JIN SSBNs are operational, and up to five may enter service before China begins developing and fielding its next-generation SSBN, the Type 096, over the coming

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<sup>84</sup> Jeffrey Lewis, *Paper tigers: China's nuclear posture*, IISS, 2014

<sup>85</sup> The previous JL-1 has a range of approximately 1,700km; while the JL-2 has a range in excess of 7,000km

<sup>86</sup> Kristensen and Norris, *Chinese nuclear forces 2016*

decade. The Type 096 will reportedly be armed with a successor to the JL-2, the JL-3 SLBM.<sup>87</sup>

Even with an operationally available SSBN fleet, it is unclear whether China will adopt a posture of continuous at-sea deterrence, akin to that operated by the US, UK and France. Jeffrey Lewis has argued that “technical considerations, such as the range of the JL-2 and China’s apparently limited infrastructure for communicating with its ballistic missile submarines, raises a number of questions about possible operational patterns”. He goes on to argue that:

It is unclear whether China will maintain a continuous at-sea deterrent through constant patrolling... or whether China will conduct patrols on a more episodic basis, as Russia does. If China’s naval posture mirrors the land-based force, one might expect that China’s submarines would be put to sea with nuclear weapons infrequently, with China perhaps flushing them out to sea in a crisis.<sup>88</sup>

A posture of CASD would also require a change to China’s policy of keeping nuclear warheads stored separately from its ICBM/SLBM and raises questions about the command and control processes required for a larger, and more dispersed force.<sup>89</sup>

As Kristensen and Norris also point out in their assessment for the Bulletin of the Atomic Scientists:

But even if China deployed warheads on the SSBNs and sent them to sea in a crisis, where would they sail? For a JL-2 to reach the continental United States, for example, a Jin SSBN would have sail through the East China Sea and well into the Pacific Ocean, through dangerous choke points where it would be vulnerable to hostile antisubmarine warfare.<sup>90</sup>

### **Air-launched capabilities**

China’s air force is not thought to have a primary strategic nuclear role, but a small number of warheads are assigned for delivery by the H-6 bomber in a secondary nuclear role. The Chinese Air Force is thought to have three regiments of H-6 bombers each capable of deploying 1-3 free-fall nuclear bombs, if necessary.

However China’s development of an air-launched land-attack cruise missile has been long been considered. Such a development would be a major advancement of China’s aerial strategic nuclear deterrent.

One potentially nuclear-capable cruise missile is the DH-10 (CJ-10) land-attack cruise missile, which the US has listed as dual-capable. China is also thought to be developing the CJ-20, for delivery by a modified H-6 bomber.

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<sup>87</sup> US Department of Defense, [Annual report to Congress: Military and Security Developments Involving the People’s Republic of China 2016](#), April 2016

<sup>88</sup> Jeffrey Lewis, *Paper tigers: China’s nuclear posture*, IISS, 2014

<sup>89</sup> Hans Kristensen and Robert Norris, *Chinese nuclear forces 2015*

<sup>90</sup> Hans Kristensen and Robert Norris, *Chinese nuclear forces 2016*

## Modernisation

In its national report to the 2015 NPT review conference China asserted that:

China exercises utmost restraint in the development of its nuclear weapons, which is consistent with its quest for their complete prohibition and thorough destruction, its no-first-use of nuclear weapons policy and its self-defence-oriented nuclear strategy.<sup>91</sup>

However, as outlined above, China has been diversifying its nuclear force over the last few years with the specific intent of developing a more robust and survivable capability. Efforts to deploy a credible sea-based deterrent have also been viewed as a serious attempt to provide a credible second-strike capability.

That programme of modernisation is continuing. The land-based ICBM force is being incrementally replaced with the DF-31A which will make a greater proportion of China's future land-based force more manoeuvrable, flexible and have greater range. A further ICBM variant, the DF-41, which will be road-mobile and capable of carrying up to 10 warheads, is undergoing testing, the most recent of which was in January 2017. The introduction of the DF-26 IRBM in the last year has also given China "precision strike capability against theatre targets".<sup>92</sup>

A fifth vessel of the Jin class SSBN is thought to be under construction; while a next-generation SSBN, equipped with a new missile, the JL-3, is also expected within the next decade.

China has also begun to update its H-6 bomber fleet and, as outlined above, is thought to be developing the CJ-20 nuclear armed air-launched cruise missile.

### Box 3: Suggested reading

- [\*China's evolving nuclear deterrent\*, RAND Corporation, March 2017](#)
- US Department of Defense, [\*Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2017\*](#), May 2017
- Jeffrey Lewis, Paper Tigers: China's Nuclear Future, IISS, November 2014

<sup>91</sup> [\*National report by China to the 2015 NPT Review Conference\*](#), April 2015

<sup>92</sup> US Department of Defense, *China's Military Power 2016*, p.25

## 5. France

France first tested a nuclear weapon in 1960, eight years after the UK and four years before China. The last French tests took place in 1996, just prior to the conclusion of the *Comprehensive Nuclear Test Ban Treaty* (CTBT), which it signed and ratified in 1998.

Since the end of the Cold War France has scaled back its nuclear arsenal by 50%, with a reduction in both its overall holdings but also the withdrawal of several weapons systems, including its land-based ballistic missile capability.<sup>93</sup> It has also reduced its alert levels (in 1992 and 1996) in terms of both response times and the number of weapons systems on alert. All of France's nuclear forces have been de-targeted.

The current French nuclear capability retains both submarine-launched and air-launched components, which have been modernised over the last decade.<sup>94</sup>

France does not participate in NATO's nuclear planning mechanisms and its forces are not formally assigned to NATO.

### Nuclear Policy

France maintains a policy of "strict sufficiency" whereby France maintains its nuclear arsenal at the lowest possible level compatible with the strategic context.

At the same time France is committed, in the longer term, to a nuclear disarmament action plan, including universal ratification of the CTBT, an immediate moratorium on the production of fissile materials by all states, and immediate negotiation of a *Fissile Material Cut-off Treaty* (FMCT). In February 2015 former President Francois Hollande confirmed that France would submit a draft treaty text to the disarmament community and called for negotiations on that instrument to begin without further delay. That [text](#) was subsequently presented to the NPT Review Conference in April 2015.

He also ruled out any further reductions in France's nuclear stockpile outside of any drastic reductions in other countries' nuclear arsenals that would dramatically improve the global security environment. He also committed France to not building any new types of weapon but stated that it would modernise its existing forces, while remaining within the boundaries of existing agreements.

Little in that policy is expected to change under new President Emmanuel Macron, who stated his commitment to retaining, and modernising, France's nuclear capabilities in a speech in March 2017.<sup>95</sup>

### France

Nuclear stockpile – fewer than 300 warheads

Air-launched and submarine-launched components

Operates a continuous at-sea deterrent

Retains a first-use policy

<sup>93</sup> In 1996 a review of France's nuclear posture was conducted as part of a wider defence review which called for French nuclear forces to be consolidated on fewer platforms and for a new generation of nuclear weapons to be developed. France's land-based ballistic missiles were subsequently withdrawn from service in 1996-1997. France is the only nuclear weapon state to have dismantled, in its entirety, a ground-launched nuclear capability.

<sup>94</sup> France's land-based ballistic missile capabilities were withdrawn in 1996.

<sup>95</sup> "Macron pledged to restore military service for French youth", *Bloomberg*, 18 March 2017

Indeed, in July 2017 President Macron called the French nuclear deterrent the "keystone of security".<sup>96</sup>

### **Declaratory Policy**

In 2015 France confirmed that:

In general, the role of nuclear weapons in France's doctrine of defence and national security is strictly limited to the defence of its vital interests, in extreme circumstances of self-defence.<sup>97</sup>

However, France reserves the right to use nuclear weapons first in a conflict. It has also pledged not to use nuclear weapons against non-nuclear weapon states party to the NPT and abiding by their non-proliferation commitments.

### **Nuclear arms control agreements**

France is one of the recognised nuclear weapon states under the NPT and as such has a legal obligation to pursue disarmament under Article VI of that treaty.

France signed the Comprehensive Test Ban Treaty in 1996 and ratified it in 1998.

France also advocates the immediate conclusion of a fissile material cut-off treaty.

## **Capabilities**

### **Stockpile**

France currently has "fewer than 300 nuclear warheads", all of which are deployed and operational.<sup>98</sup>

### **Fissile material**

In February 1996 France announced that it had halted the production of fissile material for weapons purposes and that it would dismantle the production facilities dedicated to its weapons programme. Like the other nuclear weapon states, France retains a stockpile of fissile material, estimated to be approximately 26 metric tons of HEU and 6 metric tons of plutonium.<sup>99</sup>

### **French Navy**

The bulk of the French deterrent is maritime-based, with the Navy having responsibility for around 80% of the arsenal.

The majority of that capability is delivered through its fleet of four *Triomphant* class ballistic missile submarines which are capable of carrying up to 16 M-51 SLBM.<sup>100</sup> The Navy retains a total of 48 SLBM in its inventory.<sup>101</sup> The new M-51 came into service in 2010 and provides

<sup>96</sup> "Emmanuel Macron aboard France's Le Terrible nuclear submarine", *BBC News Online*, 4 July 2017

<sup>97</sup> Report submitted by France to the NPT Review Conference, 2015 ([NPT/CONF.2015/10](#))

<sup>98</sup> Report submitted by France to the NPT Review Conference, 2015 ([NPT/CONF.2015/10](#))

<sup>99</sup> International Panel on Fissile Materials, *Global Fissile Material Report*, 2015

<sup>100</sup> The first of class entered service in 1997, the second in 1999, the third in 2005, and the final vessel of class entered service in mid-2010.

<sup>101</sup> [Speech by President Hollande](#), 19 February 2015

greater range,<sup>102</sup> accuracy and operational flexibility than its predecessor, the M-45.<sup>103</sup> At present three of the SSBN fleet carry the M-51 SLBM although France is currently in the process of replacing all of its M-45 SLBM with the M51 during the refit periods of the SSBN. That process is set to be complete by the end of 2017.

France's SSBN maintain a continuous at-sea deterrent posture.

The French Navy also operates a single squadron of 20 Rafale MF3<sup>104</sup> aircraft equipped with nuclear-armed ASMP-A cruise missiles, capable of being deployed aboard its aircraft carrier the *Charles de Gaulle*. The ASMP-A entered serviced in 2009 and has improved manoeuvrability, enhanced accuracy and an increased range of 600km.

### **Air Force**

The French Air Force also has two squadrons assigned to the nuclear role, comprising approximately 20 Mirage 2000N/ Rafale F3 aircraft apiece, equipped with 54<sup>105</sup> nuclear-armed ASMP and the newer ASMP-A cruise missiles, respectively.<sup>106</sup> The ASMP-A is steadily replacing the ASMP and until their withdrawal from service, the remaining Mirage 2000N will also be equipped with the ASMP-A.

### **Modernisation**

Over the last decade, France has been modernising its nuclear arsenal, through the deployment of a new class of SSBN and the upgrade of its nuclear-armed missile capabilities.

### **Naval capabilities**

The fourth and final SSBN of the *Triomphant* class entered operational service in 2010, deployed with the new M-51 SLBM. The M-51 has incrementally replaced its predecessor, the M-45, and is now deployed across the majority of the SSBN fleet.

Currently the majority of the M-51 SLBM has the same payload as the M-45, in the form of the TN75 warhead. However, France has also been in the process of developing a new, more robust,<sup>107</sup> nuclear warhead, the Tête Nucléaire Oceanique (TNO) which is replacing the TN75 warhead on upgraded M-51.2 missiles from 2016.<sup>108</sup>

The Rafale Mk3 aircraft has also recently replaced the carrier-based Super Étendard aircraft. That aircraft is also equipped with the ASMP-A.

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<sup>102</sup> The M51 has an approximate range of around 6,000 km when carrying a full payload of up to 6 warheads of variable yields and penetration aids, although that range would reportedly increase to 8,000km if only a single warhead is carried

<sup>103</sup> The M-51 is reported, for example, to be capable of deploying up to six warheads of variable yields; while it will also be possible to detonate the warheads at high altitude, generating an electro-magnetic pulse.

<sup>104</sup> The Rafale MF3 replaced the Super-Etendard in 2015

<sup>105</sup> Report submitted by France to the NPT Review Conference, 2015 ([NPT/CONF.2015/10](#))

<sup>106</sup> The Rafale F3 began taking over the nuclear strike mission from the Mirage 2000N in 2009, a process that is ongoing

<sup>107</sup> Robust warheads are less sensitive, for example, to the ageing of components.

<sup>108</sup> [Speech by President Hollande](#), 19 February 2015. The concept for the TNO (and its airborne equivalent: the TNA) was tested during France's 1995-1996 final nuclear testing campaign and as such represents the new generation of French nuclear weapons in a test-ban context.

The ASMP-A has improved manoeuvrability, enhanced accuracy and an increased range of 500km. It is also equipped with the new Tête Nucléaire Aero-Portée (TNA) warhead.<sup>109</sup>

### **Air Force capabilities**

From 2009 the Rafale F3 began taking over the airborne nuclear strike mission from the Mirage 2000N, a process that is ongoing. The Rafale F3 is equipped with the new ASMP-A cruise missile, which will also be deployed on the Mirage 2000N until its withdrawal from service.

The extent of French nuclear modernisation over the last few years prompted US Senator Saxby Chambliss, a member of the Senate Armed Services Committee, to argue in April 2010 that both France and the UK surpassed the United States in terms of nuclear modernisation and that consequently the US had “a lot of catching up to do”.<sup>110</sup>

#### **Box 4: Suggested reading**

- House of Commons Library Briefing Paper, CBP4079, [The French nuclear deterrent](#)
- “France’s nuclear conservatism”, *Strategic Comments*, February 2015

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<sup>109</sup> The air-launched equivalent of the TNO.

<sup>110</sup> “Senator says France, UK surpass Us in nuke modernization”, *Global Security Newswire*, 16 April 2010

## 6. United Kingdom

The UK first tested a nuclear explosive device in October 1952, becoming the third state to develop nuclear weapons after the United States and the Soviet Union.

Initial capability centred upon the RAF's strategic bomber force. A submarine-launched capability, based upon the Polaris SLBM, entered service in 1968. The current Trident-based system entered service in the mid-1990s.

Since the end of the Cold War, the UK has taken a number of steps towards nuclear disarmament. It has withdrawn all other nuclear weapons systems except for Trident; made changes to the operational status of the deterrent and been increasingly transparent about its nuclear inventory. By the mid-2020s the UK will have achieved a 65% reduction in the size of its overall nuclear stockpile since the height of the Cold War.

### Nuclear Policy

The UK adopts a posture of minimal nuclear deterrence, assigned to the defence of NATO.

Successive governments have insisted that the UK's nuclear deterrent is fully consistent with all of the UK's international legal obligations.

In January 2013 the then Government suggested that sustainable nuclear disarmament in the future could only be achieved through a multilateral process. In answer to a Parliamentary Question an FCO Minister commented:

In order for the UK to offer to include its small number of nuclear weapons in multilateral disarmament negotiations there would first need to be further reductions in the much larger nuclear weapons stockpiles held by other states and greater assurances that no new major threats will emerge that could threaten the UK or its vital interests. The UK is focused on building the international environment that will make this possible.<sup>111</sup>

At the conclusion of the 2015 NPT Review Conference the UK Ambassador to the Conference on Disarmament, Dr Matthew Rowland, reiterated the UK's "undiminished" commitment to the NPT, and the UK's obligations under it, including with respect to Article VI.<sup>112</sup> However he also went on to state:

We continue to believe that an incremental, step-by-step approach is the only practical option for making progress towards nuclear disarmament [...]

We stress that addressing further prospects for nuclear disarmament would require taking into account all factors that could affect global strategic stability. We also stress the

### UK

Nuclear stockpile – currently 225 warheads, no more than 120 operationally available.

A stockpile of no more than 180 warheads will be achieved by the mid-2020s.

The UK is the only nuclear weapon state that has reduced to a single deterrent system: the submarine-launched Trident system.

Operates continuous at-sea deterrence.

Forces are assigned to NATO

Retains a first use policy

<sup>111</sup> HC Deb 18 January 2013, c998W

<sup>112</sup> Statement by Ambassador Matthew Rowland, UK Permanent Representative to the Conference on Disarmament in Geneva, at the UN 2015 Review Conference of the Treaty on Non-Proliferation of Nuclear Weapons, 22 May 2015

importance of engaging in frank and constructive dialogue to that end, and confirm our readiness to do so.

### **Declaratory Policy**

The UK does not have a policy of 'no-first use', deeming such a posture to be incompatible with NATO's doctrine of deterrence.

The 2015 Strategic Defence and Security Review (SDSR 15) confirmed that the "UK will not use, or threaten to use, nuclear weapons against any non-nuclear weapon state party to the NPT". This assurance does not apply, however, to any state in material breach of the NPT. The UK also maintains a position of ambiguity on the precise details of when, how and at what scale the UK may consider the use of its nuclear weapons capability, although the Government has stated that nuclear weapons would only be used in extreme circumstances of self-defence.

### **Nuclear arms control agreements**

The UK is one of the recognised nuclear weapon states under the NPT. Therefore it has a legal obligation to pursue disarmament under Article VI of that treaty.

The UK signed the Comprehensive Test Ban Treaty in 1996 and ratified it in 1998. The UK also supports negotiation of a fissile material cut-off treaty.

### **Capabilities**

The 2015 SDSR confirmed that the UK's nuclear stockpile will remain as previously set out: no more than 120 operationally available warheads and an overall stockpile of no more than 180 by the mid-2020s. At present the UK stockpile is 225 warheads, making the UK the smallest of the recognised nuclear weapon states.

Since 1998 the UK's nuclear deterrent has been based solely on the Trident weapons system, which is deployed aboard the Vanguard class submarine operating a continuous at-sea deterrent. Submarines on patrol deploy with eight operational Trident missiles and carry no more than 40 nuclear warheads.

The UK is the only recognised nuclear weapon state that has reduced to a single deterrent system.

### **Fissile material**

The UK ceased production of fissile material for weapons production in 1995. According to the International Panel on Fissile Materials it does, however, retain a fissile material stockpile of 3.2 metric tons of plutonium and 11.7 metric tons of HEU for weapons purposes.<sup>113</sup>

### **Modernisation**

The Labour Government's 2006 White Paper, [\*The Future of the United Kingdom's Nuclear Deterrent\*](#) concluded that the international security environment does not justify complete UK nuclear disarmament and

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<sup>113</sup> International Panel on Fissile Materials, *Global Fissile Material Report*, 2015

that, in terms of both cost and capability, retaining the submarine-based Trident system would provide the most effective deterrent.

The decision was therefore taken to maintain the UK's existing nuclear capability by replacing the existing *Vanguard* class submarines and to participate in the current US service-life extension programme for the Trident II D5 missile.

Although commonly referred to as "the renewal or replacement of Trident", the 'Dreadnought' programme<sup>114</sup> is about the design, development and manufacture of that new class of four submarines. A Common Missile Compartment for the SSBN, which will house the current Trident strategic weapons system, is being developed in conjunction with the United States. Replacement of the Trident II D5 missile itself is not part of the Dreadnought programme.

In July 2016 the House of Commons approved the decision to maintain the UK's nuclear deterrent beyond the early 2030s. That vote has enabled the programme to move forward into its manufacturing phase, which will see the construction of the four new *Dreadnought* class ballistic missile submarines over the next 15-20 years.

At £31 billion (with a £10 billion contingency) it will be one of those most expensive acquisition programmes in the MOD's equipment plan.

Decisions on a replacement warhead have been deferred until 2019/2020.

Successive governments have expressed the belief that the current programme to replace the nuclear deterrent is compatible with the UK's obligations under the NPT, arguing that the treaty contains no prohibition on updating existing weapons systems and gives no explicit timeframe for nuclear disarmament.

The Successor programme is examined in more detail in Library briefing papers:

- CBP8010, [\*Replacing the UK's nuclear deterrent: progress of the Dreadnought class\*](#)
- CBP7353, [\*Replacing the UK's 'Trident' Nuclear Deterrent\*](#), June 2016

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<sup>114</sup> Also referred to as the Successor programme

## 7. *De facto* nuclear weapon states

The NPT defines a nuclear weapon state as one that manufactured and exploded a nuclear weapon, or other nuclear explosive device, prior to 1 January 1967. Those countries which have developed a nuclear capability since then are therefore considered *de facto* nuclear weapon states.

India, Pakistan and Israel have all acquired a nuclear weapons capability outside the framework of the NPT and are therefore considered *de facto* nuclear weapon states.

India and Pakistan are actively expanding their nuclear arsenals. Both are continuing to produce and stockpile weapons-grade fissile material; while at the same time developing new delivery systems for their respective nuclear deterrents.

### 7.1 India

Successive Indian governments had maintained a policy of ambiguity on the country's nuclear status after what appeared to be a partially successful nuclear test in 1974. In May 1998, however, India conducted a series of publicised nuclear tests which established its status as a self-declared nuclear weapon state.

Public information on India's nuclear weapons programme is, however, scarce.

#### Nuclear Policy

India's nuclear policies are motivated by regional threats, notably Pakistan but also increasingly China.

India has consistently stated that it maintains a credible minimum deterrent for self-defence, although in its Draft Nuclear Doctrine, published in 1999, that concept was considered "dynamic" and "related to the strategic environment, technological imperatives and the needs of national security". That document also established "global, verifiable, and non-discriminatory nuclear disarmament" as a national security objective.

However, as outlined below, India is one of only a few states that is actively increasing its nuclear arsenal which has led many analysts to question this position.

#### Declaratory Policy

In 2003 the Indian government announced that it would not use nuclear weapons against states that do not possess such capability, although it has reserved the right to use nuclear weapons in response to any WMD attack, including a biological or chemical weapons attack.<sup>115</sup> In early 2010 India joined calls for the establishment of a global 'no first use' policy as part of its overall support for global nuclear disarmament,

#### India

Estimated to have an arsenal of between 120 and 130 nuclear warheads, although there is some doubt as to how many are operational.

Not a party to the Nuclear Non-Proliferation Treaty.

Continues to produce weapons-grade fissile material.

Is actively expanding its nuclear arsenal and delivery capabilities. In August 2016 it completed the 'nuclear triad'.

Maintains a policy of credible minimum deterrence.

Maintains a no first use policy

<sup>115</sup> "Arms Control and proliferation Profile: India", *Arms Control Association*

an initiative described by the government as one which “harmonizes with our long-held positions”.<sup>116</sup>

### **Nuclear arms control agreements**

India is not party to the NPT and has not signed the Comprehensive Test Ban Treaty. In conjunction with Pakistan, India has consistently declined to join the NPT as a non-nuclear weapon state, arguing that it cements in place an unfair distinction between the five recognised nuclear weapon states and the remainder that have to forego such a capability.

India also only supports the CTBT within the context of general nuclear disarmament. India did, however, declare a moratorium on nuclear testing in 1998 which it has since maintained.

India supports the conclusion of a Fissile Material Cut-off Treaty but does not want the treaty to cover existing stockpiles.

In 2008 the US and India concluded a civil nuclear trade cooperation deal that would allow India to import key nuclear technologies, including reactors and nuclear fuel, from the countries of the Nuclear Suppliers Group (NSG), in return for concluding a Comprehensive Safeguards Agreement with the IAEA which would subject its civilian nuclear facilities to IAEA inspection.<sup>117</sup> It also committed to continuing its moratorium on nuclear testing, instituting effective export control systems consistent with the NSG and refraining from transferring enrichment and reprocessing technologies to states that do not already have them.<sup>118</sup>

That agreement ultimately transformed into a parallel agreement of the Nuclear Suppliers Group in September 2008 which exempted India from some of its nuclear export rules. India has since negotiated nuclear cooperation agreements with a number of countries including the UK, Russia, France, South Korea, Canada and Australia.

All of these agreements have been reached despite the fact that India is not party to the NPT, a move several analysts have regarded as undermining a fundamental principle of the treaty, which is to deny nuclear technologies to countries that have not signed up to the treaty, and instead placed the diplomatic and commercial interests of NSG countries ahead of their nonproliferation responsibilities. Mark Hibbs of the Carnegie Endowment for International Peace argued in 2008 that the US and NSG deals had “damaged the nonproliferation regime and has exacerbated nuclear tensions in South Asia”.<sup>119</sup> George Perkovich also labelled the deals “selective non-enforcement” of the international non-proliferation rules.<sup>120</sup> More recently John Carlson of the Nuclear

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<sup>116</sup> “India calls for global “no first use” nuke policy”, *Global Security Newswire*, 24 February 2010

<sup>117</sup> India’s military nuclear facilities are however, excluded from the safeguards agreement and therefore the inspections regime.

<sup>118</sup> Further detail on the US-India deal, and associated issues, is available in a report from the Congressional research Service entitled [US Nuclear Cooperation with India: Issues for Congress](#) (RL 33016)

<sup>119</sup> Mark Hibbs, “Moving forward on the US-India nuclear deal”, *Carnegie Endowment for International Peace*, 5 April 2010

<sup>120</sup> George Perkovich, “Global implications of the US-India deal”, *Daedalus*, Winter 2010

Threat Initiative suggested that “as a result of the US initiative, India is now receiving the benefits of the nuclear nonproliferation treaty without assuming any of the NPT’s obligations, a situation widely seen as damaging the NPT”.<sup>121</sup>

A number of analysts have also expressed concern that allowing India to secure foreign nuclear fuel shipments for its civilian nuclear energy programme, by default, frees up domestic resources, such as uranium, to be diverted solely into India’s nuclear weapons programme.<sup>122</sup>

## Capabilities

### Stockpile

India is currently estimated to have an arsenal of between 120 and 130 warheads, although there is some debate as to how many of those warheads are fully assembled, and how many are fully operational.

Indian government sources claim the country has developed a range of fission warheads and more powerful, two-stage thermonuclear devices, although some observers have expressed doubts about the reliability of the latter claim.<sup>123</sup>

### Fissile material

All of India’s nuclear warheads are currently believed to be plutonium based.

Although the US had originally called for a halt to the production of fissile material for weapons production as part of the civil nuclear cooperation deal in 2008, the Indian government refused to link the two issues together.

Production of weapons grade fissile material continues in India and the International Panel on Fissile Materials estimated in 2015 that India currently holds approximately 4 metric tons of plutonium for weapons production.<sup>124</sup> India has also been producing highly enriched uranium for naval propulsion purposes.<sup>125</sup>

India is, however, in the process of constructing a fast breeder reactor which will significantly increase its capacity to produce plutonium once it becomes operational in 2018. It is also thought to be close to completing a second uranium enrichment facility which, it has been suggested, could:

Generate approximately twice the necessary enriched uranium for India’s future fleet of submarines, [and] also has the potential to accumulate a stockpile of weapons-grade HEU in addition to the current stockpile of weapons-grade plutonium.<sup>126</sup>

<sup>121</sup> “Nonproliferation benefits of India deal remain elusive”, *Arms Control Today*, June 2015

<sup>122</sup> “Indian Nuclear Forces 2015”, *Bulletin of the Atomic Scientists: Nuclear Notebook*, 2015 and “Nonproliferation benefits of India deal remain elusive”, *Arms Control Today*, June 2015

<sup>123</sup> Nuclear Threat Initiative, *Nuclear Disarmament: India*, August 2015

<sup>124</sup> International Panel on Fissile Materials, *Global Fissile Material Report*, 2015

<sup>125</sup> That HEU is thought to be enriched to 30-45%, much less than weapons grade HEU (90%)

<sup>126</sup> Nuclear Threat Initiative, *Nuclear Disarmament: India*, August 2015

Expansion of India's thermonuclear weapons programme is thought to be a likely consequence of expanded HEU production which would substantially increase the explosive yield of India's current nuclear arsenal.

As outlined above, critics of the US-India civil nuclear deal have long argued that foreign imports of nuclear fuel to the civilian sector has assisted India in expanding its fissile material production for weapons purposes.

### **Delivery systems**

At present India relies primarily upon its Mirage 2000 and Jaguar combat aircraft, equipped with nuclear-armed free-fall bombs for the delivery of its nuclear capability.

India also has an extensive ballistic missile programme, although to date its nuclear-capable ballistic missile inventory is limited to short and intermediate-range missiles (the Prithvi I and II, Agni-I, II and III). With a range of approximately 3,000-3,500km, the Agni III provides India with the ability to strike targets as far off as Shanghai.

The Indian Navy launched its first indigenous *Arihant* class nuclear-powered ballistic missile submarine in 2014. The submarine completed its sea trials in early 2016 and was reported to have been commissioned into service in August 2016. It will initially be equipped with K-15 short-range SLBM, although the longer term aim is to additionally equip the SSBN with K-4 ballistic missiles with a range of up to 3,500km. The latter would put Pakistan and most of China within range if launched from the northern Indian Ocean. The K-4 is still undergoing testing and it is unclear when it will be ready for deployment.<sup>127</sup> Nevertheless the launch of the *Arihant* class, equipped with the K-15 represents a moderate sea-based deterrent and completes India's nuclear triad.

### **Expansion of India's nuclear arsenal**

While the initial development of a nuclear capability was undertaken with neighbouring Pakistan in mind, the development of a nuclear capability based upon the triad principle is part of India's long-standing goal to establish a credible deterrent against regional rival China.

India has thus made significant progress toward developing both a submarine-based deterrent capability and a more credible long-range ballistic missile programme, beyond its current inventory of short to medium-range missiles.

### **Land-based capabilities**

India has been developing a further intermediate-range ballistic missile, the Agni-IV, which has a range of 4,000km. It is currently undergoing testing, the most recent of which was in January 2017.

India's first intercontinental ballistic missile (the Agni V), which is reported to be road and rail-mobile and has a reported range of over 5,000km, is also in development. It was tested for the first time in 2012

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<sup>127</sup> "India stays silent on first nuclear sub", *Arms Control Today*, December 2016

and in 2013 the Indian government suggested that the Agni-V was being modified to deploy with MIRV capability. However, some analysts questioned India's ability to develop such a capability given its technological complexity and expense. Loading multiple warheads on the Agni-V would also reduce its extra range which was arguably the reason for developing it in the first place. It has also been argued that introducing a MIRV capability into its nuclear arsenal would raise questions over the credibility of India's doctrine of minimum deterrence, given that the whole purpose of multiple warheads is to quickly strike numerous targets.<sup>128</sup> A fourth, successful, test of the Agni-V was conducted in December 2016.

A second ICBM, the Agni-VI, with a range of 8-10,000km, is also rumoured to be in development.

### **Submarine-launched capabilities**

A further 3 SSBN of the *Arihant* class are expected over the next few years in line with the expansion of HEU production for India's naval propulsion programme. Indeed a second SSBN is thought to be near completion, for delivery in 2018; while a third is under construction. A base for the SSBN is also believed to be under construction on India's east coast.<sup>129</sup>

### **Air-launched**

While India relies primarily on its air force for its nuclear mission, its original combat aircraft are ageing. A replacement for its Mirage and Jaguar aircraft, in the nuclear role, is therefore considered by many analysts to be on the cards. In 2016 India and France agreed the sale of 36 Rafale aircraft, which is already used in a nuclear role in the French air force. Conversion to a similar role within the Indian Air Force has been highlighted as one possible scenario.

India's first intermediate-range land-attack cruise missile (the Nirbhay), which could be deployable from land, sea and air, is also in development. India tested the missile several times in 2013 and 2014, although the success of those tests was questionable. It is currently unclear whether the missile is nuclear-capable.

#### **Box 5: Suggested reading**

- "Delhi's nuclear ambitions", *The World Today*, June/July 2016
- ["What lurks beneath: a nuclear arms race at sea"](#), *The Economist*, 6 February 2016
- "Nuclear doctrines and stable nuclear relationships: the case of South Asia", *International Affairs*, January 2016
- "The inconsequential gains and lasting insecurities of India's nuclear weaponization", *International Affairs*, September 2014

<sup>128</sup> "Indian Nuclear Forces 2015", *Bulletin of the Atomic Scientists: Nuclear Notebook*, 2015

<sup>129</sup> "Indian Nuclear Forces 2015", *Bulletin of the Atomic Scientists: Nuclear Notebook*, 2015

## 7.2 Pakistan

Pakistan's nuclear programme began in the early 1970s, following the 1971 war with India that led to East Pakistan becoming Bangladesh. It was spurred on by India's first nuclear test in 1974, although it was not until the late 1980s that the US concluded that Pakistan had acquired the capability to build a primitive nuclear device.<sup>130</sup>

US officials believe the Pakistani nuclear programme originally received material and technical assistance from China, although key information on uranium enrichment was also illegally obtained during the mid-1970s by Abdul Qadeer Khan, a Pakistani scientist who became a leading figure in Pakistan's illicit nuclear weapons establishment.<sup>131</sup>

In line with India, Pakistan conducted a series of publicised nuclear tests in May 1998 which established its status as self-declared nuclear weapon state.

### Nuclear Policy

Pakistan's strategic nuclear doctrine remains officially undeclared, although the guiding principle appears to be that of minimum credible deterrence, intended to primarily offset the conventional superiority of India and its own nuclear assets.

#### Declaratory policy

Pakistan has pledged to retain a general position of 'no first use' against non-nuclear weapon states. However, it retains a position of first-use against a nuclear-armed aggressor, such as India. In July 2016 the Pakistani Defence Minister also suggested that it would use nuclear weapons for defensive purposes in any armed conflict with India.<sup>132</sup>

#### Nuclear arms control agreements

Pakistan is not a party to the NPT arguing, in a similar vein to India, that its principles are discriminatory. It has also stated that it will not sign the NPT while India has nuclear weapons. In February 2010 the Pakistani government used its concerns over the US-India civil nuclear deal to reiterate that the country would not join the NPT, even if India agreed to do so. Foreign Ministry Spokesman, Abdul Basit, reportedly commented at the time:

We cannot sign the treaty. We cannot give up nuclear weapons. If you have a conventional imbalance between Pakistan and India, then obviously our reliance on nuclear deterrence increases correspondingly. At one point in time we were ready to sign the treaty, provided it was also done by India. That is the position that we took, but it has become outdated.<sup>133</sup>

### Pakistan

Is estimated to have a stockpile of 130 - 140 warheads.

Not a party to the NPT or the Comprehensive Test Ban Treaty.

Continues to produce weapons-grade fissile material.

Thought to be expanding its nuclear arsenal faster than any other country.

Retains a policy of first-use against nuclear armed states, such as India.

<sup>130</sup> [Pakistan's nuclear weapons](#), US Congressional Research Service, February 2016

<sup>131</sup> A Q Khan was also accused of trading nuclear technology and expertise with Iran, Libya and North Korea.

<sup>132</sup> "Is India shifting nuclear doctrine?", *Arms Control Today*, May 2017

<sup>133</sup> "Pakistan rules out joining non-proliferation treaty", *Global Security Newswire*, 23 February 2010

Pakistan has not signed the Comprehensive Test Ban Treaty, although it has maintained a moratorium on testing since 1998. It has linked its signature of the CTBT to that of India.

Pakistan supports the negotiation of a non-discriminatory fissile materials treaty, although in contrast to the majority of other states, only if it covers existing stockpiles. Pakistan has maintained that it will be at a disadvantage, with respect to India, if existing stockpiles are not included due to India's larger stockpile, production capabilities and the effect of the 2008 US and NSG agreements with India on the foreign import of nuclear materials. Due to the need for consensus within the Conference on Disarmament<sup>134</sup> Pakistan has effectively used this issue to block the start of negotiations on a fissile material cut-off treaty, and has stated that it will continue to do so until an agreement on existing stockpiles is added to the treaty text.

The Pakistani government has urged the US to establish a similar agreement with Pakistan, to the civilian nuclear cooperation deal concluded with India. The Obama administration was noncommittal on the issue, citing concerns over Pakistan's proliferation legacy, the safety of Pakistan's nuclear assets and the ability of those weapons to fall into the hands of terrorists or other non-governmental actors. As a report from the US Congressional Research Service in February 2016 noted "the main security challenges for Pakistan's nuclear arsenal are keeping the integrity of the command structure, ensuring physical security and preventing illicit proliferation from insiders".<sup>135</sup> It remains to be seen whether the Trump administration will adopt a different approach.

## Capabilities

### Stockpile

Pakistan is generally thought to have a nuclear weapons inventory of approximately 130-140 nuclear warheads.

### Fissile material

Pakistan continues its production of fissile material for weapons and is in the process of augmenting its weapons production facilities,<sup>136</sup> which has led many analysts to conclude that both quantitative and qualitative improvements in Islamabad's nuclear arsenal are inevitable. Expressing concern that any US-India nuclear cooperation agreement could tilt the strategic balance between India and Pakistan in favour of the former, in May 2009 a Foreign Ministry spokesman also suggested that despite the government's continued opposition to an arms race in South Asia, Pakistan may need to increase its nuclear arsenal in response to expansion by India.<sup>137</sup>

Pakistan's nuclear arsenal is thought to be largely HEU based, although plutonium production is on the increase. At present Pakistan's stockpile

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<sup>134</sup> The body tasked with beginning negotiations on this issue.

<sup>135</sup> [Pakistan's nuclear weapons](#), US Congressional Research Service, February 2016

<sup>136</sup> Pakistan has recently finished constructing a fourth heavy water reactor at its plutonium production complex at Khushab.

<sup>137</sup> Paul Kerr, *Pakistan's Nuclear Weapons: Proliferation and Security Issues*, 9 December 2009

of HEU is estimated to be in the region of 3.1 metric tons; while its stockpile of plutonium is 0.17 metric tons.<sup>138</sup> On the basis of its current annual production rates, it has been estimated that Pakistan could be producing 12 to 21 new nuclear warheads each year.<sup>139</sup>

Indeed the Arms Control Association has suggested that Pakistan is currently expanding its arsenal faster than any other country.<sup>140</sup> A 2015 assessment by the Bulletin of the Atomic Scientists suggested that:

Based on Pakistan's performance over the past 20 years and its current and anticipated weapons deployments, the authors estimate that its stockpile could potentially grow to 220 to 250 warheads by 2025, making it the world's fifth largest nuclear weapon state.<sup>141</sup>

However, that assessment also goes on to note:

Unless India significantly expands its arsenal or further builds up its conventional forces, it seems reasonable to expect that Pakistan's nuclear arsenal will not continue to grow indefinitely but might begin to level off as its current weapons programs are completed.<sup>142</sup>

### Delivery Systems

Pakistan's ability to deliver a nuclear weapon is largely focused on its short to medium-range ballistic missile and cruise missile capabilities. Notably, the short-range Abdali, Ghaznavi and Shaheen-I ballistic missile; the medium-range Gauri and Shaheen-II; the ground launched cruise missile Babur and the air-launched Ra'ad cruise missile. Three of those missiles have been deployed since 2011.

Pakistan is also considered among some observers to have "dangerously lowered the threshold for nuclear weapons" by developing very short-range tactical nuclear weapon capabilities to counter India's conventional superiority on the battlefield.<sup>143</sup> The Nasr ballistic missile has a range of only 60km and is thought to have been deployed in 2014 after a series of successful tests.

Pakistan's ballistic missile programme is thought to have had considerable assistance from China and North Korea over the years.

Pakistan's fleet of, US purchased, F-16 combat aircraft are also thought to have been modified to a dual-use role and are, therefore, nuclear capable. Some Mirage III and V combat aircraft may also have a nuclear mission.<sup>144</sup>

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<sup>138</sup> International Panel on Fissile Materials, *Pakistan country profile*, August 2016

<sup>139</sup> "Nuclear disarmament: Pakistan", *Nuclear Threat Initiative*, September 2015

<sup>140</sup> "Arms Control and Proliferation Profile: Pakistan", *Arms Control Association*, October 2015

<sup>141</sup> "Pakistani nuclear forces 2016", *Bulletin of the Atomic Scientists: Nuclear Notebook*, October 2016

<sup>142</sup> Ibid

<sup>143</sup> "Nuclear weapons: who has what at a glance", *Arms Control Association*, October 2015

<sup>144</sup> The Mirage was used to test launch the nuclear-capable Ra'ad cruise missile in 2008 and 2011.

## Expansion of Pakistan's nuclear capabilities

The modernisation of Pakistan's nuclear arsenal has been, and continues to be, driven by the nuclear expansion of India. Following the example of other nations, Pakistan is seeking to improve its weapon designs, moving beyond first-generation capabilities reliant on HEU to plutonium-based designs. Central to that effort has been the construction of the Khushab plutonium production reactor which was completed in 1998 and the ongoing expansion of that site, which will more than triple Pakistan's plutonium production. In anticipation of increased capacity, Pakistan has also been expanding its reprocessing capabilities, which analysts have argued suggests Pakistan is preparing to increase and enhance its nuclear forces. As the *Bulletin of the Atomic Scientists* noted in 2009:

Absent a full-scale thermonuclear test, it is premature to suggest that Pakistan is producing two-stage thermonuclear weapons, but the types of facilities under construction suggest that Pakistan has decided to supplement and perhaps replace its heavy uranium-based weapons with smaller, lighter plutonium-based designs that could be delivered further by ballistic missiles than its current warheads and that could be used in cruise missiles.<sup>145</sup>

Since 1998 Pakistan and India have embarked upon a tit-for-tat testing programme of their ballistic missile capabilities. In an effort to keep technological pace with India, Pakistan is also therefore actively pursuing programmes to increase the effectiveness of its current ballistic missile inventory, while at the same time developing longer range ballistic missiles than its current possesses. Investment in the Nasr missile programme continues; while a new intermediate range ballistic missile (the Shaheen III) is under development. Once that missile becomes operational it will give Pakistan the capability to reach targets throughout India for the first time. The missile was successfully tested in December 2015. It has also been speculated that the Taimur ballistic missile, with a range of 7,000km, is an ICBM under development. However, many analysts have refuted this suggesting that it would be contrary to the regional focus of Pakistan's nuclear doctrine.<sup>146</sup>

Pakistan is also thought to be seeking to complete the nuclear triad by developing sea-launched capabilities. After India announced its intention to develop an SSBN capability in 2009, Pakistan followed suit and in 2012 the Pakistani Navy established Headquarters Naval Strategic Forces for the development and deployment of that sea-based strategic nuclear force. The Pakistani government said that it would provide the nation's "second strike capability" and would "strengthen Pakistan's policy of credible minimum deterrence and ensure regional stability".<sup>147</sup>

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<sup>145</sup> "Nuclear Notebook: Pakistani Nuclear Forces 2009", *Bulletin of the Atomic Scientists*, September/October 2009

<sup>146</sup> [Pakistan's nuclear weapons](#), US Congressional Research Service, February 2016

<sup>147</sup> "Pakistani nuclear forces 2015", *Bulletin of the Atomic Scientists: Nuclear Notebook*, 2015

**Box 6: Suggested reading**

- [Pakistan's nuclear weapons](#), US Congressional Research Service, August 2016
- "Nuclear fears, hopes and realities in Pakistan", *International Affairs*, September 2014

## 7.3 Israel

Successive Israeli governments have maintained a policy of official ambiguity on the issue of nuclear weapons. Israel has never demonstrated its capability through a nuclear test,<sup>148</sup> nor has the country ever confirmed or denied having nuclear weapons.

Despite this, it is universally acknowledged that Israel possesses a nuclear weapons capability, outside of the framework of the NPT.

### Nuclear Policy

Clarification of Israel's nuclear policies and capabilities is difficult due to its policy of ambiguity. Since 1963 its official declaratory policy has stated that "Israel will not be the first country to introduce nuclear weapons in the Middle East";<sup>149</sup> which has been broadly interpreted to mean that Israel will not test or publicly declare the existence of its nuclear weapons.<sup>150</sup>

In April 2010, and just prior to the NPT review conference to which Israel is not a party, the country reaffirmed its policy of deliberate ambiguity regarding its nuclear operations with the Israeli Deputy Foreign Minister, Danny Ayalon, stating that "this policy will continue and no pressure from any country will make it change".<sup>151</sup>

### Nuclear arms control agreements

Israel is not a State Party to the NPT. In April 2010 the then Israeli Defence Minister, Ehud Barak, indicated that the international community should not expect Israel to join the NPT anytime soon.<sup>152</sup>

Israel signed the CTBT in 1996 but has not ratified the treaty.

Israel opposes a fissile material cut-off treaty on the basis that it would undermine Israel's official position of ambiguity on nuclear weapons.

### Capabilities

#### Stockpile

It is generally assumed that Israel possesses a highly developed nuclear arsenal of between 80 and 100 nuclear warheads.

### Israel

Has an official policy of ambiguity with respect to nuclear weapons.

Clarification of Israel's nuclear policies and capabilities is therefore difficult.

Not a party to the NPT.

Is estimated to have a nuclear stockpile of between 80 and 100 warheads.

Production of plutonium for weapons purposes is thought to be continuing.

<sup>148</sup> Although some believe that Israel conducted secret atmospheric nuclear tests in the late 1970s (ibid)

<sup>149</sup> *Arms control and proliferation profile: Israel*, Arms Control Association, July 2013

<sup>150</sup> *Nuclear Disarmament: Israel*, Nuclear Threat Initiative, September 2015

<sup>151</sup> "Israel to keep nuclear policy of deliberate ambiguity", *Global Security Newswire*, 7 April 2010

<sup>152</sup> "Israel still not prepared to join NPT", *Global Security Newswire*, 15 April 2010

## Fissile Material

How much fissile material Israel has produced is also unknown. As the Arms Control Association has noted "it is assumed by some analysts that Israel has a uranium-enrichment program, although there is not enough evidence to support a credible estimate of how much highly enriched uranium Israel might have produced".<sup>153</sup> In its *Global Fissile Material Report 2009* the International Panel on Fissile Materials concluded:

We continue to assign to Israel an inventory of 100kg of HEU, which may have been acquired covertly from the United States before 1966. Israel may also have produced enriched uranium with laser or centrifuge technology, but information on this program is very limited and it may have ended.<sup>154</sup>

In its 2015 Global Fissile Material Report, the IPFM estimated that Israel had 0.3 metric tons of HEU stockpiled for weapons production. That report also suggested that Israel is continuing to produce plutonium and currently has 0.86 metric tons of plutonium for weapons production.<sup>155</sup>

Overall it is estimated that Israel has enough stockpiled fissile material for the production of up to 200 warheads.

## Delivery Systems

Over the last few decades Israel has acquired several aircraft types capable of delivering a nuclear weapon, including US-sourced F-16 and F-15 fast jet aircraft. The F-16 will be replaced by the F-35 Joint Strike Fighter from 2017 onwards.

Israel has also pursued the indigenous development of the Jericho family of ground-launched ballistic missiles.<sup>156</sup> The Jericho 1 was deployed in the 1970s and has a range of 1,200km. The Jericho 2 is believed, after a series of improvements, to have a range of 1,400-1,800km. The Jericho 3, which was first tested in 2008, is thought to have a range of up to 6,500km. That missile would enable Israel to target all of Iran, Pakistan and Russia west of the Urals.<sup>157</sup> The current deployment status of these missiles is, however, unknown.

In 1999 Israel also took receipt of the first of several diesel-powered submarines from Germany (the Dolphin class)<sup>158</sup> which in 2002 former Pentagon officials reportedly suggested were being armed with modified Harpoon cruise missiles capable of carrying nuclear warheads.<sup>159</sup>

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<sup>153</sup> *Arms control and Proliferation Profile: Israel*, Arms Control Association

<sup>154</sup> International Panel on Fissile Materials, *Global Fissile Material Report 2009*, p.14

<sup>155</sup> International Panel on Fissile Materials, *Global Fissile Material Report*, 2015

<sup>156</sup> The Jericho missile was originally obtained from France in the early 1960s until France imposed an embargo on new military equipment exports to Israel after which time it began producing the missile independently.

<sup>157</sup> "Israeli nuclear weapons 2014", *Bulletin of the Atomic Scientists: Nuclear Notebook*, 2014

<sup>158</sup> The Dolphin class is expected to comprise six vessels in total.

<sup>159</sup> "Nuclear notebook: Israeli nuclear forces, 2002", *Bulletin of the Atomic Scientists*, September/October 2002

**Box 7: Suggested reading**

- Julian Borger, [“The truth about Israel’s secret nuclear arsenal”](#), *The guardian*, 15 January 2014
- Avner Cohen and Marvin Miller, [“Bringing Israel’s bomb out of basement”](#), *Foreign Affairs*, September 2010

## 8. Nuclear capable states

In addition to those *de facto* nuclear weapon states, over the years various states have been identified as 'nuclear capable', either by default due to the sophistication of their civilian nuclear programmes,<sup>160</sup> or because of their nuclear weapon aspirations. There are also a number of states who have given up their nuclear weapons programmes and adopted non-nuclear status under the NPT.

At present this paper does not examine those states with a threshold/latent nuclear capability.<sup>161</sup> Nor does it examine those states which have either renounced their nuclear weapons (the former Soviet states);<sup>162</sup> renounced their nuclear weapons programmes, most notably: South Africa, Brazil, Argentina and Taiwan;<sup>163</sup> or abandoned their attempts at an illicit nuclear weapons programme, notably Iraq and Libya.<sup>164</sup>

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<sup>160</sup> Such states, are recognised, by default, as having the technical capacity and the nuclear fuel cycle technology to develop a nuclear weapon programme within a comparatively short space of time if it chose to do so.

<sup>161</sup> Japan is often cited as an example of a threshold/latent nuclear state due to its advanced civilian nuclear programme.

<sup>162</sup> The dissolution of the Soviet Union in late 1991 left Soviet nuclear weapons stationed on the territory of four newly independent republics - Russia, Kazakhstan, Ukraine and Belarus. In May 1992 the Lisbon protocol was signed under which all four states became parties to the Strategic Arms Reduction Treaty (START I), with Russia as the sole recognised nuclear weapon state. The protocol required Kazakhstan, Ukraine and Belarus to accede to the NPT as non-nuclear weapon states.

<sup>163</sup> South Africa, Brazil and Argentina gave up advanced programmes during the 1990s and entered into the NPT regime as non-nuclear weapon states. Of the three, South Africa had made the greater progress, having successfully produced a small arsenal of around six weapons by the late 1980s. Taiwan had pursued a covert nuclear weapons programme during the 1960s and 1970s, but halted its efforts under international pressure.

<sup>164</sup> Following Iraq's defeat in the 1991 Gulf War, Iraq was forced to verifiably dismantle it under the supervision of UN inspectors. In December 2003 Libya revealed it had been running an illicit nuclear weapons programme but would henceforth renounce all weapons of mass destruction. It said it had acquired nuclear warhead plans and equipment for uranium enrichment from an international black market network run by AQ Khan in violation of its NPT obligations. The IAEA was invited to verify the elimination of Libya's nuclear capability, concluding that advanced technology had been obtained, but that the lack of an effective scientific base meant the programme had been in its very initial stages.

## 8.1 North Korea

Despite having conducted a number of nuclear tests, and demonstrated its missile capabilities, North Korea is not recognised by the international community as a nuclear weapons state.

It is, however, regarded as nuclear capable and in the last few years, under leader Kim Jong-un, North Korea's nuclear programme has been significantly accelerated. The regime has conducted three nuclear tests in the last two years alone (out of six in total); estimates of its stockpile have been revised, by some analysts, significantly upwards; while significant achievements have been made in advancing North Korea's ballistic missile capabilities beyond its inventory of regionally-focused short-to-medium range missiles. In summer 2017 the regime successfully tested, for the first time and to the surprise of many observers, an ICBM technically capable of striking the mainland of the United States. Opinions remain divided, however, as to whether North Korea has yet successfully achieved "miniaturisation" of a nuclear warhead for delivery on an ICBM.

The regime continues to test both its nuclear warheads and its ballistic missile capabilities, in defiance of UN Security Council resolutions.

### Nuclear doctrine

Given the opaque nature of the North Korean regime, piecing together its 'nuclear doctrine' is anything but straight-forward and requires careful reading of official statements and documents.

Alexandre Mansourov has summed up the principle of North Korea's nuclear weapons programme as:

to ensure the favourable environment for regime survival and national development by deterring external threats against the country's sovereignty and leadership and by freeing internal resources for economic growth and individual consumption.<sup>165</sup>

Other analysts would place less emphasis on the economy than Mansourov and focus more exclusively on the rationale of regime survival. There have also been occasional official references made to using nuclear weapons offensively to achieve strategic objectives, including Korean reunification.

The self-declared status of North Korea as a "nuclear state" was underscored in 2012 when this phrase was added to the preamble of the country's Constitution.<sup>166</sup>

### Declaratory policy

North Korea asserts its right to first use of nuclear weapons. The regime has said on numerous occasions that it will not hesitate to launch nuclear weapons pre-emptively if it believes that the survival of regime is under threat.

### North Korea

Not recognised by the international community as a nuclear weapon state, although it is regarded as nuclear capable.

Opinions are divided on the size of its stockpile. A longstanding common estimate has been 8-10 warheads although US Defence Intelligence was reported in July 2017 to have revised that estimate significantly upwards to 60. Those recent figures have, however, been disputed by a number of independent experts.

In July 2017 North Korea successfully tested, for the first time, an ICBM technically capable of striking the United States.

North Korea is thought to have achieved miniaturisation of a nuclear warhead, although opinions still remain divided.

Has a first use policy.

<sup>165</sup> A. Mansourov, "[Kim Jong Un's nuclear doctrine and strategy: what everybody needs to know](#)", Nautilus Institute, 16 December 2014

<sup>166</sup> A. Mansourov, "[Kim Jong Un's nuclear doctrine and strategy: what everybody needs to know](#)", Nautilus Institute, 16 December 2014

## Nuclear arms control agreements

North Korea acceded to the NPT in 1985 but withdrew from it in 2003. There is still some debate about its status under the treaty, however, with a number of countries arguing that the correct withdrawal procedures were not followed<sup>167</sup> and that the country is therefore still bound by the provisions of the NPT and needs to be brought back into compliance.<sup>168</sup>

Between 2003 and 2009 North Korea took part in the Six-Party Talks with South Korea, China, Russia and Japan with a view to ending its nuclear weapons programme. Since 2009 those talks have been suspended. A 2005 agreement between the parties to the talks involved agreement by North Korea to dismantle its nuclear weapons programme but the agreement was still-born. A 2012 agreement to freeze the programme in return for US food aid also fell apart within months.

In 1992 North and South Korea signed the 'Joint Declaration on the Denuclearization of the Korean Peninsula', in which both sides agreed not to manufacture, test, deploy or use nuclear weapons. North Korea formally withdrew from the Declaration in 2013.<sup>169</sup>

North Korea is subject to UN sanctions for multiple breaches of a series of Security Council resolutions in connection with its nuclear weapons programme.<sup>170</sup> At the end of April 2017 the UN Security Council issued a [statement](#) condemning North Korea's missile tests, calling its actions "highly destabilizing" and a "flagrant and provocative defiance of the Security Council" which is "greatly increasing tensions in the region and beyond". The statement demanded no further nuclear tests by North Korea and suggested that further "significant measures", including sanctions, could be imposed.

Indeed in June 2017 and again in August and September 2017 respectively the UNSCR adopted further resolutions ([2356](#), [2371](#) and [2375](#)) extending the scope of sanctions and reaffirmed its position that North Korea "must abandon all nuclear weapons and existing nuclear programmes in a complete, verifiable and irreversible manner, and immediately cease all related activities".

## Capabilities

### Nuclear testing programme

North Korea has conducted six underground nuclear weapons tests, four of which have been authorised under current leader Kim Jong-un:

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<sup>167</sup> In announcing its intention to withdraw from the NPT in 2003, North Korea backdated its mandatory three month withdrawal notification to 1993 when it first threatened to withdraw from the treaty.

<sup>168</sup> The British Government in its document *the Road to 2010*, for example, discussed North Korea obligations as a State Party to the NPT, while the [Final Report of the Preparatory Committee for the 2010 Review Conference](#) acknowledged the uncertainty over North Korea's status (p.48).

<sup>169</sup> "[Nuclear disarmament: North Korea](#)", Nuclear Threat Initiative, 23 September 2015

<sup>170</sup> United Nations Security Council resolutions 1718 (2006), 1874 (2009), 2087 (2013), 2094 (2013), 2270 (2016) and 2321 (2016).

2006, 2009, 2013, January 2016, September 2016, and most recently on 2 September 2017.

North Korea's nuclear weapons tests in 2006 and 2009 are believed to have involved the use of plutonium and produced estimated yields of 1 kiloton and approximately 4 kilotons respectively.

The 2013 test is estimated to have produced a yield of approximately 10 kilotons. There had been speculation that the device may have involved the use of HEU, but this could not be independently verified.

The North Korean regime has issued statements suggesting that the January 2016 test involved its first thermonuclear/hydrogen bomb.<sup>171</sup> But many experts were doubtful, arguing that the yield produced – estimated at 6-8 kilotons – was far too small for such a bomb. But some argued that the test may have been of a “boosted fission device” using hydrogen isotopes to improve the fission reaction. If true, in future North Korea might require less fissile material for each weapon, which would make it easier to develop miniaturised warheads for its intercontinental ballistic missile programme.<sup>172</sup>

Assessments of the September 2016 test suggested that the device had an approximate yield of 20 kilotons. North Korean state media suggested that it had demonstrated significant advances in “standardisation” which many experts interpreted as technological advancements in miniaturisation. However, those claims could not be independently verified and experts remained sceptical of North Korea's claims.

Initial assessments of the most recent test on 2 September 2017 suggested that the nuclear device was potentially a hydrogen bomb with a yield of approximately 100 kilotons, North Korea's most powerful nuclear explosion yet. Some analysts have since revised that estimate to up to 250 kilotons.<sup>173</sup>

### **Nuclear stockpile**

The exact size of North Korea's nuclear stockpile is unclear but 8-10 plutonium-based nuclear weapons has long been a common estimate. Some analysts had also suggested that it may also have a small number of Highly Enriched Uranium (HEU)-based weapons.<sup>174</sup>

However, in July 2017 the US Defence Intelligence Agency was reported by *The Washington Post* to have significantly raised its official estimate of the number of nuclear warheads that North Korea possesses, to 60.<sup>175</sup> That figure has been questioned by a number of independent experts who have continued to suggest that North Korea's stockpile remains much lower. Siegfried Hecker, Director Emeritus of the Los

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<sup>171</sup> “North Korea claims hydrogen bomb test”, *Arms Control Today*, January/February 2016

<sup>172</sup> “[North Korea's nuclear threat: how to halt its slow but steady advance](#)”, Arms Control Association Threat Assessment Brief, 19 February 2016

<sup>173</sup> As reported in [The Washington Post](#), 14 September 2017

<sup>174</sup> “Recalibrating US policy towards North Korea”, *Arms Control Association*, February 2017

<sup>175</sup> “North Korea now making missile-ready nuclear weapons, US analysts say”, *The Washington Post*, August 2017

Alamos National Laboratory and one of the last known officials to have inspected North Korea's nuclear facilities in 2010, has argued that the size of North Korea's stockpile is no more than 20-25 warheads; while warning of the potential risks of overselling the North Korean threat.<sup>176</sup> Jonathan Pollack of the Brookings Institution has also argued that "there's a troubled history with such intelligence shifts in the past. That should inject caution, if not outright scepticism, in evaluating these new assessments".

Indeed, many prominent commentators such as the Stockholm International Peace Research Institute (SIPRI) and the Arms Control Association have retained a much more conservative estimate of 10-20 warheads in the North Korean stockpile.<sup>177</sup>

However, North Korea is continuing to produce fissile material and is estimated by the International Panel on Fissile Material to have at least 0.03 metric tons of plutonium stockpiled for weapons purposes,<sup>178</sup> which is widely considered to be enough material to produce an additional 6-8 warheads.

### **Has miniaturisation been achieved?**

Achieving miniaturisation of a nuclear warhead so that it is capable of being deployed on a ballistic missile is considered to be a key threshold in becoming a viable nuclear weapons state.

In its September 2016 nuclear test the regime claimed that it had made advances in miniaturisation, although this was greeted, at the time, with some scepticism.

In August 2017 the US Defence Intelligence Agency was reported to have concluded that North Korea had successfully produced a miniaturised nuclear warhead capable of being fitted on a ballistic missile.<sup>179</sup> This is a view shared by Japan's Ministry of Defence in its most recent White Paper:

In general, miniaturizing a nuclear weapon small enough to be mounted on a ballistic missile requires a considerably high degree of technological capacity. However, considering that the United States, the Soviet Union, the United Kingdom, France, and China succeeded in acquiring such technology by as early as the 1960s, as well as the technological maturity reached through North Korea's previous four nuclear tests, among other factors, it is possible that North Korea has achieved the miniaturization of nuclear weapons and has developed nuclear warheads.<sup>180</sup>

However, in line with the DIA's recent assessment of the size of North Korea's nuclear stockpile, a number of independent analysts have argued that there is still a degree of uncertainty around this claim.

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<sup>176</sup> "North Korea now making missile-ready nuclear weapons, US analysts say", *The Washington Post*, August 2017

<sup>177</sup> SIPRI Yearbook 2017 and

<sup>178</sup> International Panel on Fissile Materials, [Global Fissile Material Report 2015](#)

<sup>179</sup> "North Korea now making missile-ready nuclear weapons, US analysts say", *The Washington Post*, August 2017

<sup>180</sup> [Defense of Japan 2016](#), p.23

### Ballistic missile programme

North Korea has a long-standing land-based ballistic missile programme<sup>181</sup> which, in concert with the nuclear testing programme, has been accelerated significantly in the last few years under leader Kim Jong-un.

#### *Short to medium range missiles*<sup>182</sup>

North Korea's operational ballistic missile inventory is currently centred round its short to medium-range ballistic missiles. The *Hwasong* has a range of 500–1,000 km, and is widely believed to be capable of carrying nuclear warheads. Some believe that North Korea's medium-range *Nodong* ballistic missiles (estimated range 900-1300 km) are also nuclear capable. Between them, both missiles would put all of South Korea, and most of Japan, in range.

In February 2017 North Korea also claimed to have successfully tested a solid-fuelled, medium-range, *Pukguksong-2* missile, with a range of 2,000km.<sup>183</sup> That missile was tested again on 21 May 2017 after which leader Kim Jong-un declared it capable of being deployed, in mass numbers,

#### *Intermediate range missiles*<sup>184</sup>

In April 2016 North Korea tested its road-mobile *Musudan* intermediate-range missile for the first time which has a range of up to 4,000km. Although not yet thought to be nuclear capable, and achieving mixed results in missile tests,<sup>185</sup> the missile was considered by many analysts to represent an incremental improvement to North Korea's ballistic missile capabilities.

Indeed in May 2017 the regime tested a brand new intermediate-range missile with a range of 4,500km: the *Hwasong-12*. Fired at a lofted trajectory it reached approximately 2,000km, far greater than that achieved in previous missile tests. Had it been fired on a standard trajectory experts conclude that it would have achieved a range of at least 4,000km. Achieving such an altitude would also have allowed the regime to test the ability of the missile to exit, and re-enter the atmosphere, which is crucial to developing an ICBM capability.

The missile was tested again at the end of August and again in mid-September 2017, both times on a standard trajectory overflying Japan, before landing in the Pacific Ocean. The second test flight reached a range of 3,700km, the furthest a North Korean ballistic missile has ever flown, putting the US base of Guam in the Pacific well within range.

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<sup>181</sup> "[North Korea's missile programme](#)", *BBC News Online*, 7 February 2016

<sup>182</sup> Short-range missiles have a range of less than 1,000km; while medium-range missiles have a range of between 1,000 and 3,000km

<sup>183</sup> Solid-fuelled ballistic missiles are more stable and easily deployable at short notice than liquid-fuelled variants. The development of solid-fuelled missiles is therefore considered a major technological step forward.

<sup>184</sup> Intermediate-range missiles have a range of 3,000 to 5,500km

<sup>185</sup> After 8 tests of the missile, only one in June 2016 is considered to have been a success.

## North Korean missile range estimates



### Tested/operational

- ① Hwasong: 1,000km    ② Nodong: 1,300km    ③ Musudan: 3,500km  
 ④ Hwasong-14: 6,700 km

### Untested

- ⑤ KN-08: 11,500km

Source: James Martin Center for Nonproliferation Studies / NTI



While short of the range that would designate the Hwasong-12 as an ICBM it is widely viewed by experts as a key stepping stone in North Korea's ICBM development programme. As the Nuclear Threat Initiative has observed:

The Hwasong-12 is not itself an intercontinental ballistic missile (ICBM), but it displayed all the technologies necessary to build a missile that can strike the United States [...] When North Korea tested an ICBM a few weeks later on July 4th, it used the same engine and underlying technologies first seen in the Hwasong-12. If we wish to understand North Korea's ICBM program, we must start with the Hwasong-12.<sup>186</sup>

### *ICBM development*<sup>187</sup>

Development of a reliable intercontinental (ICBM) capability, which would provide the ability to strike the continental United States, is the main focus of North Korea's current ballistic missile programme.

Achieving a viable ICBM capability had been believed to still be several years away. In February 2017 Jeffrey Lewis of the Center for Nonproliferation Studies had suggested that North Korea may attain a

<sup>186</sup> ["North Korea's Hwasong-12 missile"](#), Nuclear Threat Initiative 20 July 2017

<sup>187</sup> An ICBM has a range of more than 5,500km

missile capable of targeting the US mainland in about five years. Other analysts had predicted a much longer timeframe.<sup>188</sup>

However, on two separate occasions in July 2017<sup>189</sup> North Korea took its first steps to achieving a viable ICBM capability after successfully testing its Hwasong-14 ICBM.<sup>190</sup> Both were conducted at a lofted trajectory, although experts concluded that on a standard trajectory they would have achieved ranges of 6,700km and 10,400km respectively, putting Hawaii, Alaska and subsequently the majority of the US mainland in range. At 8,657km from Pyongyang, London would also be in range of the Hwasong-14. However, some concluded that the second test had only been partially successful because the missile's re-entry vehicle had "disintegrated prematurely". Michael Elleman of the International Institute for Strategic Studies, said:

A reasonable conclusion based on the video evidence is that the Hwasong-14's re-entry vehicle did not survive during its second test. If this assessment accurately reflects reality, North Korea's engineers have yet to master re-entry technologies and more work remains before [North Korean leader] Kim Jong Un has an ICBM capable of striking the American mainland.<sup>191</sup>

Such significant advances in its ballistic missile programme in a relatively short space of time has led many to conclude that achieving a *reliable* ICBM capability could, however, now be possible within the next 2 years. It has also led a number of commentators to question whether North Korea has attained illicit missile technologies and knowledge from overseas.<sup>192</sup> Opinion is, however, divided on the whether this is indeed the case.

As outlined above, questions also still remain over whether North Korea has successfully achieved miniaturisation of its nuclear warheads, thereby making its ICBM nuclear capable.

#### *Submarine-launched ballistic missiles*

In May 2015, North Korea announced that it had successfully flight-tested a submarine-launched ballistic missile. However, it was widely agreed that the missile was launched from a submerged barge rather than a submarine. There were further SLBM tests in November 2015 and throughout 016, with varying degrees of success. Experts believe that the country is still a long way from having a meaningful submarine-based nuclear weapons capability.<sup>193</sup>

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<sup>188</sup> See "Recalibrating US policy towards North Korea", *Arms Control Association*, February 2017

<sup>189</sup> 4<sup>th</sup> and 28<sup>th</sup> July

<sup>190</sup> The relationship between the Hwasong-14 and two ICBM (the KN-08 and KN-14) which North Korea has displayed at military parades since 2012 but never tested, is unclear.

<sup>191</sup> "Video Shows Possible Failure of North Korean ICBM Test", IISS Commentary, 31 July 2017

<sup>192</sup> See for example Michael Elleman, "[The secret to North Korea's ICBM success](#)". IISS Voices, 14 August 2017 and [The Diplomat](#), 16 August 2017

<sup>193</sup> "North Korea's nuclear threat: how to halt its slow but steady advance", Arms Control Association Threat Assessment Brief, 19 February 2016

**Box 8: Suggested reading**

Defence Select Committee, [North Korea: Oral evidence session](#), 13 September 2017

## 8.2 Other aspirant nations

While not considered nuclear capable there are a number of countries which have, at various times, been considered as aspirant nuclear powers, the most notable being Iran.

### Iran

Iran's nuclear programme began in 1967 under the Shah with the US-funded Tehran Research Reactor (TRR) and the establishment of the Atomic Energy Organization of Iran in 1974. Following the 1979 Revolution, the new Islamic Republic paid little attention to nuclear development but kick-started the programme in the late 1980s.

An extensive uranium enrichment programme was revealed in the early 00s, which many countries and other observers, alleged was part of a nuclear weapons programme and not just intended for civilian energy purposes. Pursuit of a nuclear weapons capability would be a contravention of Iran's NPT obligations, which it signed in 1970.

The IAEA found Iran to be non-compliant with its NPT safeguards agreement in 2005 and referred the matter to the UN Security Council which passed several resolutions calling on Iran to halt its enrichment activities. However, in a report in 2011 the IAEA concluded that it was still unable to offer assurances about the purpose of Iran's nuclear programme. While it listed a number of activities that would indicate a possible military dimension to the nuclear programme it could not provide firm evidence that Iran was in fact working towards nuclear weapons.<sup>194</sup>

In 2012 the US Director of National Intelligence suggested before the Senate Intelligence Committee that:

We assess that Iran is keeping open the option to develop nuclear weapons, in part by developing various nuclear capabilities that better position it to produce such weapons, should it choose to do so. We do not know, however, if Iran will eventually decide to build nuclear weapons.<sup>195</sup>

He went on to say that, should it make that decision, Iran has the technical capacity to achieve a nuclear weapons capability:

Iran's technical advancement, particularly in uranium enrichment, strengthens our assessment that Iran has the scientific, technical,

<sup>194</sup> *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, IAEA, 8 November 2011,

<sup>195</sup> James Clapper, Unclassified statement for the record on the worldwide threat assessment of the US Intelligence Community for the Senate Committee on Intelligence, Director of National Intelligence, 31 January 2012

and industrial capacity to eventually produce nuclear weapons, making the central issue its political will to do so.<sup>196</sup>

Concern over Iran's potential threshold status has led to intense diplomatic efforts over the last few years to reach agreement on Iran's nuclear programme, in exchange for the lifting of international sanctions which have been imposed against the regime since 2002.

A tentative agreement was reached in 2013 which put in place a number of confidence building measures upon which to make further progress. Negotiations on a final agreement continued, and a deal on Iran's nuclear programme was eventually reached in 2015. In exchange for limitations on Iran's enrichment activities, and access to all Iranian nuclear facilities by the IAEA the UN, US and EU agreed to suspend all nuclear related sanctions against Iran.

However, the future of the Iran nuclear deal is currently uncertain after US President Donald Trump threatened to withdraw from the agreement. Top officials in the Trump administration, including the US Defense Secretary, James Mattis, have expressed the view that Iran continues to abide by the nuclear agreement and that upholding it is in the US' national security interests. Were the agreement to fall apart Iran's President has stated that the country could restart its nuclear programme.

The history of Iran's nuclear programme and details of the recent nuclear deal are outlined in a series of Library briefing papers:

- Library briefing paper, CBP7178, [The Lausanne Accord with Iran](#), 16 October 2015
- CBP6890, [Negotiations with Iran: update May 2014](#)
- CBP6780, [The deal with Iran](#), December 2013
- CBP6336, [Iran: could there be a compromise?](#), June 2012
- CBP6222, [Is Iran building a nuclear weapon?](#), February 2012

## Syria

Syria, which is also a party to the NPT, has also been under investigation by the IAEA in response to concerns within the international community that it had been developing a secret nuclear weapons programme. Allegations of collaboration with North Korea and assistance through the AQ Khan network led to Israel bombing a suspected nuclear reactor on Syrian territory in September 2007. Both Syria and North Korea refuted the allegations and in 2007 the then Head of the IAEA, Dr Mohammed El Baradei, also reported that "no country has provided any hard evidence that would implicate Syria in the black market set up by Abdul Qadeer Khan".<sup>197</sup>

The West has continued to view Syria as a strong candidate for nuclear proliferation however, believing that the existence of a small civilian

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<sup>196</sup> Ibid

<sup>197</sup> *Is Syria a candidate for nuclear proliferation?*, Monterey Institute for International Studies, March 2008

nuclear capability leaves Syria's ability to pursue a military programme within reach.<sup>198</sup>

A report by the IAEA Director General, published on 31 May 2011, fuelled those concerns after it revealed that Syria was blocking IAEA access to a number of military sites, including the site bombed by Israel in 2007 and that Syria had revealed some details of past nuclear experiments to UN inspectors which should have been previously reported under its safeguards agreement. The IAEA subsequently called for Syria to adopt the IAEA Additional Protocol as a matter of urgency.<sup>199</sup> In June 2011 the IAEA Board of Governors passed a resolution finding Syria in non-compliance with its NPT safeguards agreement and reported the case to the UN Security Council.

Verification and monitoring of suspected nuclear sites by IAEA inspectors has been complicated by the ongoing civil war. Nevertheless, in a statement to the 2015 NPT review conference the IAEA Director General renewed his call on Syria to "cooperate fully with [the IAEA] in connection with unresolved issues related to the Dair Alzour site and other locations".<sup>200</sup>

#### Box 9: Suggested reading

- Mark Fitzpatrick, *Asia's Latent Nuclear Powers*, IISS, 2016

<sup>198</sup> *ibid*

<sup>199</sup> IAEA, [Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic: Report by the Director General](#), 31 May 2010

<sup>200</sup> Statement to the 2015 Review Conference of Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), "Statement by the Director General, International Atomic Energy Agency, April 27, 2015

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