Chapter 24

Nuclear proliferation

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Reader's Guide

This chapter examines the enduring importance of nuclear proliferation and non-proliferation efforts in world politics since 1945. The chapter begins by explaining some of the technical aspects of nuclear weapons technology, and describes the spread of this technology over time. It then considers major theoretical debates about nuclear proliferation, including why states want nuclear weapons and what effect they have on patterns of international conflict and cooperation. The chapter next looks at the evolution of various attempts by the international community to control or limit the spread of nuclear weapons. Throughout, it examines how globalization has shaped the global landscape of nuclear proliferation, and how it is likely to shape the issue in the years to come.

Introduction

The spread of nuclear weapons technology continues to be an important issue in a globalized world. The United States' explosion of the world's first atomic bomb in a New Mexico desert in 1945 marked the beginning of the 'Atomic Age', and nuclear weapons were used for the first and only time against the Japanese populations of Hiroshima and Nagasaki at the end of the Second World War in August 1945. These events demonstrated the extraordinary destructive power of nuclear weapons, a fact that has had long-term consequences for international peace and security.

Since then, basic nuclear technology that can be used for either civil or military purposes has diffused widely across the globe. Nuclear weapons themselves have spread much more gradually, with four additional nuclear powers by 1965, and only nine today. At the same time, the absolute number of nuclear weapons in existence has declined, as the United States and Russia have sought to reduce the number of nuclear weapons in their arsenals.

Globalization and the end of the cold war have introduced new and complex challenges related to nuclear proliferation. These include the growth of nuclear energy, the challenges of loose nuclear weapons and nuclear terrorism, the problmes of nuclear strategy outside the superpower/bipolar context, and continued debate over nuclear weapons programmes in Israel, Iran, and North Korea. As proliferation challenges have evolved, so have international efforts to address them.

Nuclear weapons technology and its spread

Since 1945, civil and military nuclear technology has spread across the globe. Nuclear weapons, however, have been much slower to spread. By 1965, four countries in addition to the United States had tested nuclear weapons: the Soviet Union (Russia), Britain, France, and China. These five were recognized as nuclear weapons states under the 1968 **Nuclear Non-Proliferation Treaty** (NPT), and are also the five permanent members of the United Nations (UN) Security Council. Only nine countries are thought to possess nuclear weapons today: the five nuclear weapons states, plus India, Pakistan, North Korea, and Israel. Several other states have developed or inherited nuclear weapons arsenals, but have chosen to relinquish them.

Technical basics: what is a nuclear programme?

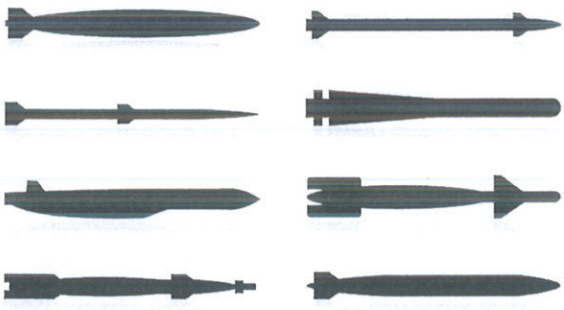
Nuclear technology is **dual-use**, meaning that it can be used either to generate energy in a nuclear reactor, or to make a nuclear weapon. A nuclear reactor uses nuclear chain reactions in a sustained, controlled process to generate power in the form of heat. A nuclear weapon, on the other hand, seeks to create a large explosion using one of two methods: fission or fusion. The earliest nuclear weapons were fission weapons, which split atoms in a chain reaction to release large amounts of energy. By the mid-1950s, however, both the United States and Soviet Union had also developed thermonuclear weapons, which use a combination of fission and a method called fusion, which compresses and heats hydrogen atoms so that they combine, or fuse, to generate energy.

Developing a nuclear weapon from scratch requires an array of sophisticated technologies arranged in complex organizational patterns. This is one reason why the creation of a full nuclear programme is difficult, and has been achieved only by a handful of states willing to devote the attention and resources needed.

One of the most difficult steps in making a nuclear weapon is obtaining weapons-grade fissile material. The two major kinds of fissile material used in the making of nuclear weapons are plutonium and uranium. Making a nuclear weapon from uranium requires Uranium-235 (U-235), which is a very small fraction of the uranium found in nature (around 0.7 per cent). U-235 must therefore be separated from the non-fissile isotope U-238 through a process called **enrichment**. Once the uranium has been enriched to 20 per cent or more of U-235, it is called highly enriched uranium (HEU), and above 90 per cent is considered **weapons-grade uranium**. Plutonium, on the other hand, is created by humans as a by-product of reactor processes, and must then be **reprocessed**, or chemically separated from the non-fissile material in spent fuel, in order to be used in a nuclear warhead.

Once this weapons-grade fissile material has been obtained, it must still be weaponized, or made into a

Case Study 1 A. Q. Khan and 'proliferation rings'



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Abdul Qadeer (A.Q.) Khan was considered the father of Pakistan's nuclear weapons programme and a public hero for his work to develop the uranium enrichment technology used for Pakistan's nuclear weapons. A metallurgist educated in Germany who worked in the Netherlands, Khan returned to Pakistan to work on uranium enrichment after India's 1974 nuclear explosion. In 2004, Khan admitted his involvement in an extensive international network that traded in nuclear technology and materials, stretching across the globe from Europe to Dubai to South East Asia. He claimed that this activity was undertaken without the knowledge of the Pakistani government, a claim that many outside observers were sceptical of and which he later retracted. Khan admitted that his network had provided assistance to nuclear weapons programmes in Iran, North Korea, and Libya; it also appears to have offered assistance to Iraq.

Although Khan's network was discovered and halted, the incident raised troubling questions about proliferation in an age of globalization. First, it highlighted the role that covert business and illicit networks can play in proliferation, and raised the question of whether states can maintain control over sub-state actors whose financial or professional interests might be helped by proliferation even if the state's national interest is not. Second, it drew attention to what Braun and Chyba call 'proliferation rings', or 'second-tier proliferation'—cases in which states in the developing world with varying technical capabilities trade among themselves to bolster one another's nuclear and strategic weapons efforts'. Third, the case raised concern about whether or not the Pakistani government is in full control of its nuclear assets, and whether internal crisis or instability might produce a 'loose nukes' problem in Pakistan.

Source: Braun and Chyba 2004: 5–6.

warhead that can be delivered to its intended target. Uranium and plutonium can both be used to make implosion-type bombs, in which explosives around a mass of fissile material implode the fissile material to reach critical mass and start the nuclear reaction. Uranium, however, can also be used to make a gun-type bomb, in which one piece of uranium is fired into another to achieve critical mass.

Because of their explosive capacity, nuclear weapons are considered **weapons of mass destruction** (WMD), along with chemical, biological, and radiological weapons, sometimes abbreviated together as CBRN. The explosive yield of nuclear weapons is measured in kilotons (thousands of tons) of TNT equivalent, or in megatons (millions of tons). Fission nuclear weapons, the kind of weapon dropped on Hiroshima and Nagasaki, can release energy equivalent to tens of thousands of tons of TNT; the destructive capacity of the fusion or thermonuclear weapons developed later reached as much as several megatons. Nuclear weapons release their energy, and can therefore cause damage, in three different ways: a blast; thermal radiation (heat); and nuclear radiation. Nuclear weapons also cause an electromagnetic pulse that can disrupt the operation of electronic equipment, as well as fires that create further damage (Eden 2006).

Globalization has heightened concern that a non-state actor such as a terrorist organization or criminal group might try to acquire a nuclear weapon or radiological material—the kind that could be used in a so-called 'dirty bomb' (Allison 2005). Because of the complexity of establishing a full nuclear programme, these actors are generally expected to acquire a nuclear weapon by stealing one or purchasing it on the black market, rather than developing it themselves. Concern about nuclear theft has been particularly acute since the dissolution of the Soviet Union—the only time that a state with a nuclear arsenal experienced political disintegration. Command and control arrangements over those weapons became questionable. In response, the United States and the international community launched a series of efforts to secure nuclear materials in the countries of the former Soviet Union. More recently, the discovery of the global proliferation network run by Pakistani scientist A.Q. Khan raises concerns that in a globalized world states will not be able to control the diffusion of nuclear materials, technology, and knowledge (**see Case Study 1**).

Nuclear proliferation since 1945

During the cold war, the superpowers built large arsenals of nuclear weapons, with widely ranging yields and a

number of different delivery vehicles. Some of the weapons were smaller, tactical nuclear weapons, which are generally intended for use against targets on the battlefield and so are delivered by methods like aircraft, artillery, or short-range ballistic or cruise missiles. Others were strategic nuclear weapons, typically with larger yields, delivered by means such as long-range bombers, land-based intercontinental ballistic missiles (ICBMs), or submarine-launched ballistic missiles (SLBMs). Starting in the 1970s, some of these missiles carried multiple independently targetable re-entry vehicles (MIRVs), which meant that a single missile could carry multiple warheads that could strike different targets.

Thinking about nuclear weapons during the cold war focused primarily on the bipolar competition between the United States and the Soviet Union. The main question was how to prevent conventional or nuclear war between the superpowers. A huge body of literature examined **nuclear deterrence**—the question of 'how nuclear weapons could be used to prevent an opponent from taking an undesirable action' (Walton 2013: 198). Thomas Schelling (1980) famously discussed deterrence as 'the threat that leaves something to chance'—the idea that if there was even a small risk that conventional attack would cause an opponent to escalate to nuclear conflict in response, that risk would deter the conventional attack.

More concretely, the United States and its North Atlantic Treaty Organization (NATO), allies feared that the Soviet Union would take advantage of its conventional military superiority to invade Western Europe; they relied on the threat of nuclear retaliation to prevent it from doing so. To deter the Soviet Union, the United States and its allies used two different nuclear targeting strategies. In a **counterforce strategy**, American nuclear weapons targeted the Soviet Union's nuclear and conventional military assets. In a **countervalue strategy**, the assets threatened with nuclear retaliation were targets of industrial or social value, typically cities with large populations. The USSR's nuclear strategy during the cold war evolved as well, as the Soviet arsenal grew in size and the country's leaders considered the utility of nuclear weapons for deterrence and war-fighting purposes.

The United States also developed what was known as **extended deterrence**—the threat of nuclear response in order to deter an attack on one of its allies. This, however, created a dilemma: if an attack on an American ally led the US to retaliate with nuclear weapons against the opponent's home territory, that opponent might itself retaliate by using nuclear weapons against American soil. Was the US really willing to trade New York for Paris, or Los Angeles for Berlin?

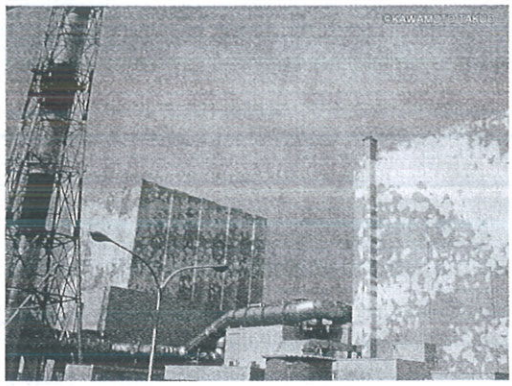
More recently, global growth of the nuclear power industry has created additional challenges for international security and nuclear safety. Two are particularly noteworthy. First, fissile material is necessary to generate nuclear energy, but controlling the production and use of fissile material is also one of the most important ways to limit the spread of nuclear weapons. The International Atomic Energy Agency (IAEA) is in charge of monitoring and ensuring that countries that have signed the NPT do not divert fissile material from their nuclear power plants to build nuclear weapons. Much of the international concern about Iran's nuclear programme, for example, is centred on the belief that Iran is leveraging fissile material created in an ostensibly peaceful nuclear energy programme to endow itself with a latent nuclear weapons capability (**see 'Definitions' section, next pages and Case Study 3**).

Second, the systems used to produce nuclear energy are complex, and so nuclear energy carries the risk of accidents that have high human and environmental consequences. The March 2011 earthquake and tsunami in Japan, and the resulting meltdown of three reactors at Fukushima, underscore this safety risk (**see Case Study 2**). The global anti-nuclear movement—which includes organizations such as Greenpeace, the Campaign for Nuclear Disarmament, and others—points to the risk of disasters like Fukushima, and the safety issues associated with nuclear waste, to call for nuclear disarmament and oppose the use of nuclear power.

Key Points

- The underlying technology used in nuclear energy or nuclear weapons programmes has spread rapidly since 1945. Nuclear weapons themselves have spread much more slowly.
- Nuclear weapons use either fission or fusion. One of the key obstacles to having a nuclear arsenal is obtaining weapons-grade fissile material (either plutonium or uranium).
- Nuclear weapons are weapons of mass destruction, which produce blast, heat, and radiation, and have explosive yields equivalent to thousands or millions of tons of TNT.
- Nuclear deterrence is about using nuclear weapons to prevent an adversary from taking an undesirable action they would otherwise take. Nuclear deterrence can be achieved using strategic or tactical nuclear warheads employed in a range of delivery vehicles in either a counterforce or countervalue strategy.
- The growth of nuclear energy and the spread of dual-use nuclear technology have raised concerns that non-state actors could acquire nuclear or radiological material.

Case Study 2 The Fukushima nuclear disaster



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On 11 March 2011, a powerful 9.0 earthquake shook Japan, leaving over 15,000 people dead and almost 3,000 missing. The Fukushima Daiichi nuclear disaster occurred when a tsunami struck the Fukushima I nuclear power plant on the coast of the island of Honshu. It was the largest nuclear disaster since Chernobyl in 1986.

Although Fukushima's reactors automatically shut down when the tsunami struck, flooding from the tsunami caused power outages that prevented the circulation of coolant water, and led the reactors to overheat. Delays in flooding the reactors with seawater then led three of them to experience meltdown. The meltdown complicated existing damage from the earthquake and tsunami, releasing radioactive material into the atmosphere and water. 160,000 people in the area around the plant were eventually evacuated, and the plants have not been reopened. The government of Japan, which initially reported the disaster at a 4 on the International Nuclear Event Scale (INES), eventually raised its assessment to a level 7, and has been subject to sharp criticism for underestimating the severity of the disaster. As of December 2012, fuel had not yet been removed from the damaged reactor site, and the process of decommissioning the reactors had not yet begun.

Residents appear to have been exposed to only a fraction of the radiation released in Chernobyl, and the incident is not predicted to significantly increase their risk of cancer and radiation-related illnesses (Tabuchi 2013; World Health Organization 2013). Nevertheless, the disaster has raised questions about the future of the nuclear power industry, both in Japan and elsewhere, by reminding observers that even the most carefully designed and properly maintained systems experience disaster (Sagan 1995). Prior to the meltdown, nuclear reactors provided nearly a third of Japan's power supply, but the crisis has reopened political debate over Japan's reliance on nuclear energy, and in September 2012 the government said that it would attempt to phase out nuclear energy by 2040. Globally, the impact of the Fukushima crisis on the nuclear power industry—in partial resurgence prior to 2011 amid increased concerns about carbon emissions and climate change—is not yet clear.

Theoretical debates about nuclear proliferation

Examining motivations

A number of interesting questions surround states' behaviour with regard to nuclear weapons. Why do states want nuclear weapons? Why have some states chosen to give them up? Why have nuclear weapons been used only once in their history? And why do states help other states to acquire nuclear technology?

Early scholars writing about nuclear weapons focused on their potential utility in fighting and winning major international armed conflicts. Indeed, this is the only context in which nuclear weapons have ever been used: against Japan in 1945. During the cold war, however, nuclear weapons were seen as useful largely for strategic reasons, in particular for their ability to deter one's adversaries from engaging in military provocation or conventional attack. This led to a technological determinism about nuclear weapons: the belief that all countries that were capable of developing nuclear weapons would eventually do so, given the security benefits that these weapons provide. As the gap between states that have the capability to acquire nuclear weapons and states that have actually acquired them has widened, however, scholars have examined a

Box 24.1 Why do states build nuclear weapons?

1 **The security model**: States build nuclear weapons to increase national security against foreign threats, especially nuclear threats.

2 **The domestic politics model**: States build nuclear weapons because these weapons advance parochial domestic and bureaucratic interests.

3 **The norms model**: States build nuclear weapons because weapons acquisition, or restraint in weapons development, provides an important normative symbol of a state's modernity or identity.

4 **The psychology model**: States build nuclear weapons because political leaders hold a conception of their nation's identity that leads them to desire the bomb.

5 **The political economy model**: States build nuclear weapons because the nature of their country's political economy—mostly, whether or not it is globally integrated—gives their leaders different incentives for or against having nuclear weapons.

6 **The strategic culture model**: States build nuclear weapons because their strategic culture leads them to hold certain ideas about how valuable the acquisition and use of nuclear weapons will be.

Evolution of non-proliferation efforts

Almost immediately after the first nuclear test and first nuclear weapons use in 1945, countries began thinking about how to limit the destructive power of nuclear weapons while still harnessing nuclear power for peaceful purposes. A 1946 vote by the United Nations General Assembly to establish a UN Atomic Energy Commission that would eliminate nuclear weapons and place nuclear energy under international control failed because of disagreements between the United States and the Soviet Union. In December 1953, however, US President Dwight Eisenhower called for an 'Atoms for Peace' programme that would share the benefits of nuclear energy with the international community. In 1957, the International Atomic Energy Agency was established under UN auspices to assist in the sharing of scientific and technical information related to nuclear energy.

Efforts to limit the spread and destructive impact of nuclear weapons have taken a range of forms. These efforts have been aimed at limiting both **horizontal proliferation** (the spread of nuclear weapons to new countries) and **vertical proliferation** (when nuclear weapons states increase the size of their nuclear arsenals). Some of these efforts have focused on achieving universal non-proliferation and complete nuclear disarmament, while others have focused on controlling vertical proliferation by the superpowers through various arms control agreements which emphasize nuclear restraint rather than abolition. Still others have taken a counter-proliferation approach and tried to interrupt the acquisition of nuclear capabilities once a state appears to have decided to acquire nuclear weapons.

Non-proliferation, disarmament, and arms control during the cold war

Efforts at non-proliferation accelerated in the 1960s, particularly after the October 1962 Cuban Missile Crisis brought the superpowers close to nuclear war and heightened their awareness of the risk of inadvertent escalation from conventional to nuclear conflict (**see Ch. 3**). After a trilateral agreement between the United States, Britain, and the Soviet Union to impose a moratorium on nuclear testing from 1958–61, in 1963 the three states signed a Partial Test Ban Treaty (PTBT), which limited these three states to underground nuclear tests rather than tests in the atmosphere, in outer space, or underwater. French and Chinese leaders declined to sign, because they believed that these efforts worked to the advantage of the states that already had nuclear weapons; France and China tested their first nuclear weapons in 1960 and 1964 respectively (**see Table 24.1**).

In the late 1970s, the five nuclear weapons states all issued negative security assurances with regard to not using nuclear weapons against non-nuclear weapons states. These assurances varied in their formulation; China has stated that it will not be the first party in a conflict to threaten or use nuclear weapons against non-nuclear states, while US policy as of 20 it would not use nuclear weapons against co had signed and were in compliance with th

The issue of nuclear non-proliferation increasing traction in the international outside of the nuclear weapons states. B 1960s, the IAEA had implemented a safe gramme, in which it sought to monitor an fissile materials and technology for peace energy were not being diverted to make nu ons. In 1967, the Tlatelolco Treaty creat nuclear weapons-free zone in Latin Ameri the Zangger Committee adopted a set o that applied IAEA safeguards to nuclear e in 1975, the Nuclear Suppliers Group– response to India's 1974 'peaceful nuclear further strengthened the safeguards and applied to particularly sensitive nuclear ex as uranium enrichment and plutonium r facilities. In 1987, a group of states also sign ment to limit the export of nuclear-capable

Table 24.1 Timeline of nuclear weapons tests

1945	United States of America
1949	Soviet Union
1952	Great Britain
1960	France
1964	People's Republic of China
1966	Israel (alleged cold test)
1974	India ('peaceful nuclear explosion')
1979	Vela Incident (potential test by Israel and S
1998	India (weapon)
	Pakistan
2006	North Korea

cruise missiles, called the Missile Technology Control Regime (MTCR).

The centrepiece of the modern nuclear non-proliferation regime, however, is the Nuclear Non-Proliferation Treaty. After a wave of international attention to and discussion of nuclear issues in the 1960s, the NPT was opened for states to sign in 1968, and the Treaty entered into force in 1970. Under the terms of the treaty, five states—the US, Britain, the Soviet Union, France, and China—were recognized as having the right to possess nuclear weapons. All other states agreed to forego the development of nuclear arsenals in exchange for an agreement by the five nuclear weapons states to move towards the elimination of their arsenals, and in exchange for non-nuclear weapons states obtaining access to peaceful nuclear technology. Because of this, United States Ambassador Thomas Graham, whose long diplomatic career focused on arms control and non-proliferation, has described the NPT as a 'bargain' based on three pillars: non-proliferation, eventual disarmament, and peaceful use of nuclear energy (**see Box 24.4**).

In the late 1960s and early 1970s, the superpowers also began to think more seriously about arms control, and in particular about how to limit the build-up of strategic nuclear weapons and delivery vehicles in their own arsenals. In 1972, the United States and the Soviet Union signed the Strategic Arms Limitation Treaty (SALT I), which tried to prevent an arms race by limiting the number of missiles and **ballistic missile defences** (BMD) that could be deployed. The Treaty had a major weakness, however, in that it did not sufficiently address qualitative rather than quantitative improvements to the two superpowers' nuclear arsenals. Critics also charged that SALT I froze a status quo that advantaged the Soviet Union.

Some of these agreements were addressed at the SALT II negotiations in 1979, which was tacitly honoured by both sides despite the suspension of the Treaty's ratification following the Soviet Union's invasion of Afghanistan. An Intermediate Nuclear Force (INF) Agreement in 1987 further limited the deployment of mid-range nuclear-armed missiles. Although these efforts provided a forum for cooperation and discussion between the superpowers, they fell short of achieving the reduction in superpower tension that arms control advocates had hoped for.

Box 24.4 The NPT's 'grand bargain'

'The NPT is based on a central bargain: the NPT non-nuclear-weapon states agree never to acquire nuclear weapons and the NPT nuclear-weapon states in exchange agree to share the benefits of peaceful nuclear technology and to pursue nuclear disarmament aimed at the ultimate elimination of their nuclear arsenals. To use the words of a former Indian foreign minister, the NPT was not designed to establish "nuclear apartheid", permanently authorizing great-power status and nuclear weapons to a small group of states and assigning the rest of the world to permanent second-class status. Maintaining both ends of this central bargain is vitally important to the long-term viability of the NPT.'

Source: Graham 2004.

After the cold war

The end of the cold war provided a new opportunity for the United States and Russia to revisit arms control. In 1991, the two sides signed a Strategic Arms Reduction Treaty (START), which went beyond merely limiting the number of warheads and delivery vehicles and agreed to reduce them. START II was signed in 1993, and, most significantly, banned the use of MIRVs on ICBMs.

In 2002, however, the US–Russia arms control relationship changed in a number of ways. The US withdrew from the Anti-Ballistic Missile Treaty, and Russia withdrew from START II. The United States' reason for withdrawing from the ABM Treaty was largely in order to develop a national ballistic missile defence shield, which critics have charged is expensive and ineffectual. The Obama administration has cancelled some elements of missile defence while continuing others, including ground-based interceptors intended to protect the continental United States, and sea-based BMD platforms to defend its European allies against short- and medium-range missiles from Iran.

Under the Strategic Offensive Reductions Treaty (SORT, or the Moscow Treaty), also signed in 2002, the two countries agreed to reduce their stockpiles of operationally deployed weapons still further. SORT was replaced in 2010 by the New START treaty, which commits the two countries to additional reductions in the numbers of deployed strategic nuclear warheads (to 1,550 each), and limits the number of missile launchers.

Global efforts at non-proliferation also gained renewed momentum in the early 1990s. After the Gulf War and the discovery that Iraq's nuclear weapons programme had advanced further than the international community had thought, the Nuclear Suppliers Group and Zangger Committee reviewed and updated their

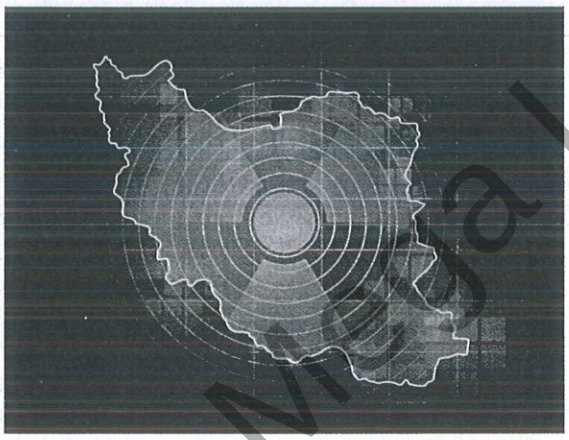
safeguards lists to focus on dual-use items. In 1995, the signatories to the Nuclear Non-Proliferation Treaty met to review its provisions, and decided to extend it indefinitely. Today, 190 states have signed the NPT. For these reasons, the NPT Review and Extension Conference, and the NPT itself, are generally regarded as successful.

The NPT Review Conference, however, also highlighted some of the on-going issues facing the international community with regard to nuclear proliferation. The first problem is that the NPT is not universal. Israel, India, and Pakistan never signed the Treaty; North Korea signed, but withdrew in 2003. A resolution adopted alongside the extension agreement in 1995 called for all states in the Middle East to accede to the NPT, and countries have worked bilaterally and multilaterally for years to convince North Korea to return to the NPT and come into compliance. These efforts have thus far been unsuccessful. Second, the NPT has weak provisions for enforcement, as evidenced by the on-going debates over how to address the North Korean and Iranian pursuit of nuclear weapons (**see Case Study 3**).

Third, critics of the NPT charge that it is fundamentally unfair. By freezing the nuclear status quo, they argue, it privileges the nuclear status of the five nuclear weapons states recognized in the Treaty over other countries, and does not put enough pressure on the five nuclear weapons states to actually dismantle their nuclear arsenals.

Two other non-proliferation measures discussed around the same time encountered similar objections and difficulties of implementation. The Comprehensive Nuclear Test-Ban Treaty (CTBT), which would ban nuclear weapons testing entirely, was adopted and

Case Study 3 Nuclear programmes in North Korea and Iran



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Much international concern over nuclear proliferation in the post-cold war period has focused on North Korea and Iran. The two countries, however, present different challenges to the non-proliferation regime.

North Korea withdrew from membership in the NPT in 2003, and is currently believed to possess approximately six to eight nuclear weapons. Fears in the early 1990s that the country was pursuing a covert nuclear weapons programme prompted the signing of the Agreed Framework in October 1994. Under the Agreed Framework, North Korea agreed to shut down the plutonium reactor it had built at Yongbyon in exchange for two Light Water Reactors (LWRs) and shipments of fuel oil until the new reactors were finished. Following delays in the shipment of fuel oil and the construction of the LWRs, and amid continued political uncertainty exacerbated by North Korea's missile testing over Japan in 1998, North Korea again announced its intention to withdraw from the NPT. Six-party talks from 2003 to 2005 produced a 2005 Joint Statement affirming the goal of a denuclearized Korean peninsula, but after a round of new financial sanctions, including the designation of Banco Delta Asia as a money-laundering concern, North Korea tested a nuclear weapon in October 2006. A February 2007 deal to implement the 2005 agreement was reversed in 2008, and a second nuclear test followed in May 2009. Pyongyang has also announced that it is pursuing a uranium enrichment programme, which had already been suspected but never confirmed; once operational, the programme could significantly increase the size of the country's nuclear arsenal.

Iran remains a formal member of the NPT, but its nuclear energy programme is the subject of international contention. Iran's nuclear energy programme began under the US Atoms for Peace programme in the 1950s, and its first nuclear power plant, constructed at Bushehr with Russian assistance, became operational in 2011. In 2003, the IAEA reported that Iran had failed to declare enrichment activities as required under the IAEA's safeguards agreements, which led the UN Security Council to demand that Iran stop its enrichment activity. Negotiations with the United Kingdom, Germany, and France (the EU-3) produced temporary suspension, but no resolution; Iran has argued that it needs enrichment to achieve energy security, and cited its right to nuclear energy under the NPT. In November 2011, the IAEA reported that Iran had conducted research and experiments aimed at developing a nuclear weapons capability. This report heightened concern that Iran's strategy is to use nuclear energy facilities to achieve a latent nuclear capacity, from which it can then quickly 'break out' to become a fully fledged nuclear weapons state. The stand-off has resulted in heavy sanctions against Iran, though the degree of participation in these sanctions has varied country by country.

opened for signature in autumn 1996 after three years of intensive negotiations (Hansen 2006). To enter into force, however, the CTBT requires signature and ratification by forty-four states, including all five recognized nuclear weapons states as well as nuclear powers not recognized as such by the NPT. Critics of the CTBT focus on concerns over whether the Treaty is effectively verifiable, as well as whether a commitment not to test would constrain the national security interests of existing nuclear powers who might want to maintain the right to test in order to continue to advance the sophistication of their nuclear weapons programmes. There is no sign today that the CTBT will ever enter into force, and countries (India, Pakistan, and North Korea) have tested nuclear weapons since the Treaty was opened for signature.

Similar difficulties have been encountered with attempts to implement a Fissile Material Cut-off Treaty (FMCT). Although some nuclear weapons states saw this as a way to prevent the further spread of nuclear weapons, and some non-nuclear weapons states saw it as a way to constrain the vertical proliferation of the nuclear weapons states, others lodged objections to the Treaty. India, for example, objected to both the CTBT and the FMCT as measures that would constrain its retention of a 'nuclear option'. There was also disagreement over whether the Treaty should only prevent the creation of new fissile material stockpiles, or whether it should encompass plans for the elimination of existing stockpiles (something Pakistan wanted, for example, to address the advantage that it believed India had in fissile material). And, as with the CTBT, effective verification has been a major criticism of the FMCT.

New approaches: counter-proliferation and a return to disarmament?

As the post-cold war optimism about arms control and non-proliferation weakened, there was also a growing sense among policy-makers and the non-proliferation community that these traditional agreements might not be sufficient to deal with the new, more complicated landscape of nuclear threats. CIA Director James Woolsey famously compared the situation to having killed a dragon, only to find oneself lost in a jungle full of poisonous snakes (Woolsey 1998). (There was also the sense that, just as the United States and NATO had used nuclear weapons to compensate for an inferiority in conventional forces relative to the USSR during the cold war, so now might smaller powers seek nuclear weapons to offset tremendous American advantages in conventional military capability.) As a result, the international community began to look for other initiatives and strategies capable of addressing these new proliferation challenges.

One of these was **counter-proliferation**, a term that has been used in a variety of ways, but which generally describes efforts to obstruct, slow, or roll back the programmes of states that are actively pursuing nuclear weapons, as well as to deter and defend against the actual use of nuclear weapons (**see Box 24.5**).

One of the new approaches was United Nations Security Council Resolution 1540, adopted in April 2004. Resolution 1540 requires states to prohibit individuals, companies, or other actors from supporting non-state actors that are seeking to acquire WMD. It also requires states to enforce the domestic legislation prohibiting these activities, and to establish effective controls over items and financing that might support these activities. A 1540 Committee was set up to report on the monitoring and implementation of this resolution, to provide support and assistance in implementation, and to facilitate international cooperation on these efforts. The 1540 Committee's mandate has been extended several times, most recently in 2011 for a period of ten years, until 2021.

Two other counter-proliferation efforts are the Proliferation Security Initiative (PSI), launched in

Box 24.5 The US definition of counter-proliferation

Counter-proliferation efforts aim to eliminate or reduce the threats caused by the development and spread of WMD. To do this, the US Government focuses on five objectives:

- Discourage interest by states, terrorists, or armed groups in acquiring, developing, or mobilizing resources for WMD purposes.
- Prevent or obstruct state, terrorist, or other efforts to acquire WMD capabilities, or efforts by suppliers to provide such capabilities.
- Roll back or eliminate WMD programmes of concern.
- Deter weapons use by those possessing nuclear, radiological, biological, and chemical weapons and their means of delivery.
- Mitigate the consequences of any use of WMD against the United States or its allies.

Source: US National Counterproliferation Center, www.counterwmd.gov/

2003, and the Nuclear Security Summit, first held in 2010. The US-led PSI focuses specifically on improving international cooperation in efforts to interdict the trafficking and transfer of WMD materials and related delivery systems. A voluntary initiative without a set multilateral framework, PSI began with eleven members and has expanded, as of late 2012, to nearly 100 participating countries. The Nuclear Security Summit, held in Washington in 2010 and Seoul in 2012, is an effort to increase international cooperation to secure nuclear materials and prevent nuclear smuggling, with the ultimate goal of preventing nuclear terrorism.

Disarmament has also returned to the forefront of discussion in the past few years. In 2007, four senior statesmen of the cold war published an op-ed in which they called for a renewed commitment by the United States and others to disarmament, and the eventual complete abolition of nuclear weapons from the global landscape (**see Box 24.6**).

The 'Global Zero' movement was also bolstered by US President Barack Obama's speech in Prague in 2009, in which he called for a world free of nuclear weapons. While many agree that a nuclear weapon-free world is a laudable end goal, the question is how to get there; no state wants to relinquish nuclear weapons before others do. As of 2012, the Obama administration has continued to request funding to maintain and modernize the American nuclear stockpile. And although the 2010 Nuclear Posture Review also placed seemingly stricter limits on the role of nuclear weapons in American strategy (United States Department of Defense 2010), scholars have noted that limiting American extended deterrence could actually have negative consequences for proliferation, if allies feel less secure and become more interested in obtaining a nuclear deterrent themselves. The future of these calls for disarmament, therefore, remains unclear, and disarmament at any point in the near future seems highly unlikely.

Box 24.6 Global Zero?

In January 2007, four senior statesmen of the cold war, subsequently nicknamed the 'Four Horsemen'—Henry Kissinger, George Shultz, William Perry, and Sam Nunn—wrote an editorial in the *Wall Street Journal*. In it, they asserted that reliance on nuclear weapons to achieve security was becoming 'increasingly hazardous and decreasingly effective . . . Unless urgent new actions are taken, the United States soon will be compelled to enter a new nuclear era that will be more precarious and psychologically disorienting, and economically even more costly than was cold war deterrence'.

They called for the United States to work with 'leaders of the countries in possession of nuclear weapons to turn the goal of a world without nuclear weapons into a joint enterprise'. Among the steps they recommended were the following:

- Changing the cold war posture of deployed nuclear weapons to increase warning time and thereby reduce the danger of an accidental or unauthorized use of a nuclear weapon.
- Continuing to reduce substantially the size of nuclear forces in all states that possess them.
- Eliminating short-range nuclear weapons designed to be forward-deployed.
- Initiating a bipartisan process with the Senate, including understandings to increase confidence and provide for periodic review, to achieve ratification of the Comprehensive Test-Ban Treaty, taking advantage of recent technical advances and working to secure ratification by other key states.
- Providing the highest possible standards of security for all stocks of weapons, weapons-usable plutonium, and highly enriched uranium everywhere in the world.
- Getting control of the uranium enrichment process, combined with the guarantee that uranium for nuclear power reactors could be obtained at a reasonable price, first from the Nuclear Suppliers Group and then from the International Atomic Energy Agency (IAEA) or other controlled international reserves. It will also be necessary to deal with proliferation issues presented by spent fuel from reactors producing electricity.
- Halting the production of fissile material for weapons globally, phasing out the use of highly enriched uranium in civil commerce, and removing weapons-usable uranium from research facilities around the world and rendering the materials safe.
- Redoubling our efforts to resolve regional confrontations and conflicts that give rise to new nuclear powers. Achieving the goal of a world free of nuclear weapons will also require effective measures to impede or counter any nuclear-related conduct that is potentially threatening to the security of any state or peoples.

Source: Shultz, Perry, Kissinger, and Nunn 2007.

Key Points

- Non-proliferation efforts seek to address both horizontal and vertical proliferation. They can focus either on complete disarmament, or on limiting nuclear weapons and their delivery vehicles through arms control.
- The NPT is seen as a bargain between nuclear weapons states and non-nuclear weapons states. However, critics complain that it is not universal, it is difficult to monitor and enforce, and it is fundamentally unfair.
- Since the end of the cold war, the international community has also used counter-proliferation approaches to disrupt nuclear smuggling and the pursuit of nuclear weapons. These have included UNSC Resolution 1540, Proliferation Security Initiative, and the Nuclear Security Summit.
- In the past few years, there has been more discussion of a return to disarmament and the eventual elimination of all nuclear weapons.

Conclusion

Nuclear technology for both peaceful and military purposes has spread steadily since 1945, but nuclear weapons themselves have spread far more slowly. The end of the cold war marked a shift in focus, from a world of two nuclear superpowers in bipolar competition to a more globalized world containing a larger number of nuclear powers with arsenals of varying size and appearance. The spread of nuclear weapons technology thus reflects both the extent and the unevenness of globalization processes.

This global change in the nuclear landscape has forced scholars to re-examine some of their assumptions about nuclear weapons: why they are acquired, why states forego them, and under what conditions they work best to deter conflict. At the same time, the spread of nuclear technology, the increased complexity of the global nuclear environment, and the potential for non-state actors to play a role in proliferation have also become important strategic challenges. Much of the current debate, therefore, has to do with how we should think about the security environment in a globalized world, and the complex set of challenges that it presents.

Efforts to limit or combat nuclear proliferation have evolved too, from an early focus on disarmament to efforts to limit nuclear stockpiles through arms control to a more recent focus on counter-proliferation. The very complexity of the contemporary nuclear landscape suggests that no single policy is likely to be a panacea; different challenges demand different solutions. As the proliferation landscape evolves, so too will the efforts of individual states and the international community to meet that challenge.

Questions

1. Why have nuclear weapons spread so slowly, even though nuclear capabilities have spread more rapidly?
2. Why do states decide to build nuclear weapons? Why do they choose not to?
3. Have the motivations for building nuclear weapons changed since 1945?
4. Are you a proliferation optimist, or a proliferation pessimist? Why?
5. How does having nuclear weapons change patterns of international conflict?
6. What role do non-state actors play in nuclear proliferation? Are they a new kind of nuclear challenge?
7. How has arms control and non-proliferation changed since 1945?
8. Is Global Zero a good idea? Why or why not?
9. How has globalization changed proliferation?
10. What new policies or initiatives are needed to address the challenge of nuclear proliferation today?