

# Nuclear Forces

## An Overview of Nuclear Weapons Modernization

**N**ine nations today possess more than 20,000 nuclear weapons,<sup>33</sup> with a combined destructive force equivalent to 150,000 Hiroshima-sized bombs.<sup>34</sup> Despite being legally obliged to disarm, all are pursuing programmes to modernize or build up their nuclear forces – with financial institutions providing the funds to make it happen.

This chapter gives an overview of each country's nuclear weapons programme, with an emphasis on the modernization projects that are under way and the cost of such projects. The purpose is to highlight the magnitude of the problem of modernization – and the potential to tackle it through divestment.

These massive investments in the world's nuclear forces underscore the importance of building a global grassroots movement, supported by the financial sector, with the aim of strengthening the global norm against nuclear weapons, preventing further nuclear arms racing and creating the conditions for a universal ban on the use and possession of nuclear weapons.

### The Nuclear Weapons Industry

In some of the nuclear-armed states – especially the United States, the United Kingdom and France – governments award contracts to corporations to carry out work on their nuclear arsenals. The corporations are responsible for designing new warheads, extending the lifetime of old ones, and building new nuclear missiles, heavy bombers and submarines.

Chapter 4 profiles 20 companies that are heavily involved in the nuclear weapons industries of these three countries, as well as India. Most are listed on stock exchanges, making them effective targets of divestment campaigns. Even privately owned companies – such as Bechtel in the United States, which manages the Los Alamos and Lawrence Livermore nuclear weapons laboratories – can be challenged by persuading banks to deny them loans.

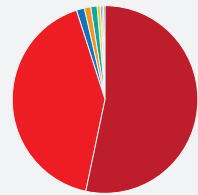
#### BOX 9

### Fact Box: The Nuclear-Armed Nations

#### NUMBER OF NUCLEAR WARHEADS

Russia	11,000
United States	8,500
France	300
China	240
United Kingdom	225
Pakistan	90–100
India	80–100
Israel	80
North Korea	<10
<b>Total</b>	<b>20,530</b>

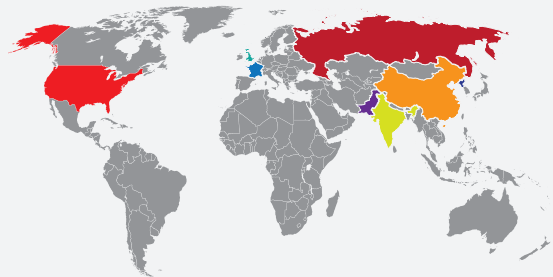
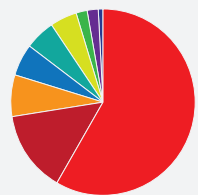
Source: SIPRI 2011



#### NUCLEAR WEAPONS SPENDING 2011

United States	US\$61.3b
Russia	US\$14.8b
China	US\$7.6b
France	US\$6.0b
United Kingdom	US\$5.5b
India	US\$4.9b
Pakistan	US\$2.2b
Israel	US\$1.9b
North Korea	US\$0.7b
<b>Total</b>	<b>US\$104.9b</b>

Source: Global Zero 2011



In other nuclear-armed countries – such as Russia, China, Pakistan and North Korea – the modernization of nuclear forces is carried out primarily or exclusively by government agencies. Options for divestment are therefore rather limited. A potentially more effective way to challenge their nuclear industries is to influence budgetary decision-making processes in national legislatures.

### Nuclear Weapons Spending

The nine nuclear-armed nations are estimated to spend a combined total of more than US\$100 billion annually on their nuclear forces,<sup>35</sup> diverting vast public resources from health care, education, climate change mitigation, disaster relief and other services. The group Global Zero predicts that spending will exceed US\$1 trillion over the next decade, with the cost “likely [to] go significantly higher as numerous modernization programs underway are ramped up”.<sup>36</sup>

### THE OPPORTUNITY COSTS

Every dollar spent on nuclear weapons could be freed up and put to more effective use. In 2002 the World Bank estimated that an annual investment of just US\$40 to \$60 billion – roughly half the amount currently spent on nuclear weapons – would be enough to meet the Millennium Development Goals by the target date of 2015.<sup>37</sup> These goals include eradicating extreme poverty and hunger, achieving universal primary education, promoting general equality and women’s empowerment, reducing child mortality, improving maternal health, combating HIV/AIDS and ensuring environmental sustainability.

### COMPARING THE COSTS

In 2010 official development assistance – the aid money given by industrialized nations to developing nations – totalled US\$128.7 billion.<sup>38</sup> Current nuclear weapons spending is equal to 80 per cent of this sum. The US aid contribution in 2010 was the largest in absolute terms at US\$30.2 billion<sup>39</sup> – about half the amount it spent on its nuclear arsenal that year.

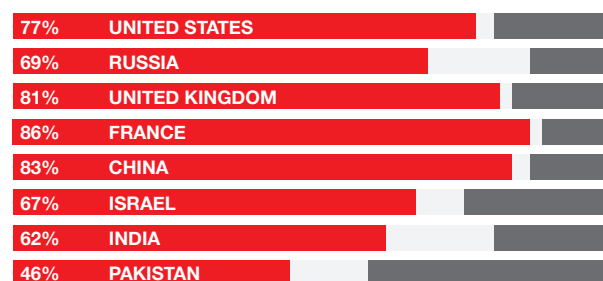
Official development assistance to Africa, the poorest continent on earth, was a paltry US\$29.3 billion in 2010,<sup>40</sup> or less than one-third the sum spent on nuclear weapons. As millions across the globe go hungry and are denied access to clean water, basic medicines and sanitation, the nuclear-armed nations spend US\$287 million every day – or US\$12 million an hour – on their nuclear forces.<sup>41</sup>

The total global nuclear weapons spending in 2011 of US\$104.9 billion was more than the gross domestic product of Bangladesh (US\$101 billion), a nation of 158.6 million people.<sup>42</sup> One year’s nuclear weapons spending is equal to 42 years of the regular UN budget of US\$2.5 billion, or 14 years of UN peacekeeping missions.<sup>43</sup> The UN Office for Disarmament Affairs, which is the principal UN body responsible for advancing nuclear disarmament, has an annual operating budget of approximately US\$10 million<sup>44</sup> – less than what the nuclear-armed nations spend on their nuclear arsenals every hour. Nuclear weapons expenditure is more than 10,000 times greater than the UN disarmament budget.

### Public Opinion

Opinion polls in all nuclear-armed nations (except for North Korea, where public polling is not readily available) show that a majority of people agree that a treaty should be negotiated to outlaw and eliminate all nuclear weapons.<sup>45</sup> Opposition to the modernization of nuclear forces has increased following major cuts in some countries to government programmes due to the global financial crisis.

### SUPPORT FOR A NUCLEAR WEAPONS BAN



Source: World Public Opinion 2008

### Warhead Dismantlement

Although spending on nuclear weapons appears to be increasing in most of the nuclear-armed nations, the total inventory of nuclear warheads globally is decreasing – due mainly to dismantlement of old warheads in the United States and Russia.<sup>46</sup>

NO. NUCLEAR WARHEADS	YEAR
26,000	2007
25,000	2008
23,300	2009
22,600	2010
20,530	2011

## BOX 10

**Ask an Expert: How Can We Challenge Modernization?**

A web of corporate players are involved in nuclear weapons modernization. **Ray Acheson**, the New York-based director of *Reaching Critical Will* – a programme of the Women's International League for Peace and Freedom – explains the situation, and why we need to challenge the new nuclear arms race.

**ICAN:** Most people favour nuclear abolition, but some have a vested interest in these weapons. Who?

**Ray Acheson (RA):** The people who profit from the nuclear weapons industry include the owners and managers of the corporations and the laboratories that produce nuclear weapons and delivery systems, as well as their paid lobbyists.

**ICAN:** The military-industrial complex is a powerful force. Can individuals have any impact through divestment campaigns?

**RA:** Yes, divestment can have an impact. We have recently seen the success of divestment from cluster munitions production, for example. The companies that design, manufacture and modernize nuclear weapons have much to lose from divestment initiatives.

Once sub-contractors are factored in, the number of beneficiaries is immense. However, they often also receive contracts directly from their government, which means it will be important to highlight the role not just of pension plans and institutional investors in these companies, but also the role that the US Congress and other legislatures play in funnelling funds to these weapons contractors.

**ICAN:** There's a lot of talk about achieving a nuclear-weapon-free world. Are governments genuine?

**RA:** Most government officials probably are genuine in their desire to eliminate nuclear weapons. These weapons waste billions of dollars every year, cause widespread death and environmental destruction when used, and their mere existence gives their possessors a tool with which to threaten or coerce other countries.

However, when leaders from nuclear-weapon states have merely said they "seek to achieve the vision" of a nuclear-weapon-free world, it is

Protesters challenge construction of a nuclear weapons facility in Kansas City, the United States, in 2010.



Photo: Joshua McElwee, National Catholic Reporter (US)

much less clear how genuine they are.

Their security policies that maintain nuclear weapons as either strategic or defensive tools, as well as their plans for modernization of their arsenals and related infrastructure, indicate that they are in reality paying lip service to the goal of nuclear disarmament.

They are certainly against the further proliferation of nuclear weapons, but most of them have said that they will keep their own nuclear weapons until all other nuclear weapons are eliminated. This is quite a catch-22 for disarmament.

**ICAN:** You said that nuclear weapons cost billions of dollars. Where exactly is the money going?

**RA:** Most of the money goes to the laboratories and factories where the nuclear weapons and delivery systems are manufactured, assembled and so on, and to the firms that manage these laboratories. Some money is also spent on building or replacing the facilities used to create these weapons. Money also goes to universities and firms for research and design of new and "better" nuclear weapons or delivery systems.

**ICAN:** How does modernization affect the chances of abolition?

**RA:** The modernization of nuclear weapons directly undermines the opportunities for achieving nuclear abolition. Modernization significantly

extends the lifetime of weapons and/or adds new military capabilities to them. Even while some nuclear-weapon states have agreed to "reduce" their nuclear arsenals, their modernization means that they need fewer weapons to wield the same threat.

By investing billions of dollars in nuclear weapons, delivery systems and the infrastructure to create them, governments are investing in a future where arsenals of weapons of mass destruction continue to be construed as providers of security rather than as direct impediments to security.

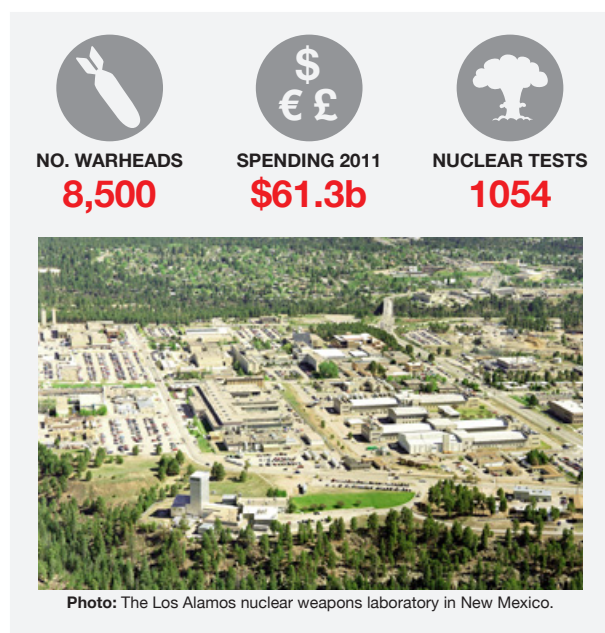
**ICAN:** Are any governments investing in disarmament?

**RA:** Some governments invest in disarmament by supporting non-governmental work in this area. Others invest time and resources in their diplomats to work on concrete initiatives for promoting disarmament.

The United Nations is vastly under-resourced in this area. Its Weapons of Mass Destruction branch, which is tasked with nuclear disarmament issues, is the smallest substantive branch of the UN Office for Disarmament Affairs. The overall UN budget is a pittance compared with the billions being spent on nuclear weapons every year.

For more information, visit [www.reachingcriticalwill.org](http://www.reachingcriticalwill.org)

## United States



### Summary

The United States spends more on its nuclear arsenal than all other nuclear-armed nations combined. Despite President Barack Obama's stated commitment to seek "the peace and security of a world without nuclear weapons",<sup>47</sup> the current administration is pursuing a long-term programme to modernize each component of the US nuclear arsenal. This includes the construction of three new nuclear warhead production facilities.

Under the Obama presidency, spending on nuclear arms has risen, and major outlays are projected for the coming decade. Meanwhile, funding for warhead dismantlement has dropped off steeply, resulting in a decline in the rate of disassembly. Several US companies are directly involved in nuclear weapons production, and many banks and other institutions finance these companies. Universities are also heavily involved in the nuclear weapons programme.

### Nuclear Arsenal

The United States possesses approximately 8,500 nuclear warheads, of which 2,150 are ready for use, 2,850 are held in reserve and 3,500 are "awaiting dismantlement".<sup>48</sup> Its warheads are deliverable by land-based intercontinental ballistic missiles, ballistic missile submarines and heavy bomber planes. Hundreds of US nuclear weapons are set to launch automatically on warning of an enemy attack.<sup>49</sup>

The US nuclear posture review of 2010 committed the country to maintaining its air-, sea- and land-based nuclear war-fighting capability for decades to come.<sup>50</sup> It decided that the nation should retain 420 deployed land-based intercontinental ballistic missiles, 14 submarines with 240 deployed ballistic missiles (each carrying multiple warheads), and 60 nuclear-armed heavy bombers equipped with gravity bombs and cruise missiles. Eight of the US nuclear-armed submarines are based in the Pacific Ocean and six in the Atlantic Ocean, with "a patrol rate comparable to that during the cold war".<sup>51</sup>

The United States is the only nation to station its nuclear weapons on foreign soil. As part of a NATO nuclear-sharing arrangement, five European nations – Belgium, Germany, Italy, the Netherlands and Turkey – host US nuclear weapons on their territory.<sup>52</sup> Due to strong and persistent pressure from campaigners and governments in Europe, as well as US concerns about cost, it appears likely that these weapons will be removed in the near future. Their presence in Europe violates the nuclear Non-Proliferation Treaty.<sup>53</sup>

### Modernization

The United States is in the process of modernizing its entire nuclear arsenal. Its warhead "life-extension" programme involves equipping existing warheads with "new, improved and significantly modified components".<sup>54</sup> It is constructing three new nuclear weapons factories – in Oak Ridge, Los Alamos and Kansas City – with the capacity to produce 80 nuclear warheads a year. The estimated cost of building the factories is US\$180 billion.<sup>55</sup>

In addition to its nuclear warhead life-extension programme, the United States is developing new nuclear weapons delivery vehicles and modernizing existing ones. For example, it is extending the service life of the Minuteman III intercontinental ballistic missiles, with a projected completion date of 2030.<sup>56</sup> It also plans to replace its fleet of *Ohio*-class nuclear-armed ballistic missile submarines, with construction scheduled to begin in 2019.<sup>57</sup>

In recent years, the United States has conducted several "sub-critical" nuclear tests as part of its nuclear weapons modernization programme.<sup>58</sup> Unlike standard nuclear tests, they do not involve a chain reaction. Nonetheless, such tests allow the United States to make qualitative improvements to its nuclear arsenal, and are against the spirit of the Comprehensive Nuclear-Test-Ban Treaty.



## Weapons Industry

Of the 20 nuclear weapons producers examined in this report, half are based in the United States. They are involved in all aspects of the US nuclear weapons programme, from designing and assembling warheads to building nuclear missiles and carrying out simulated nuclear tests. More than half of the banks and other institutions that finance nuclear weapons producers are also based in the United States.

The US nuclear weapons industry has close ties with a number of major academic institutions – particularly the University of California, which, along with Bechtel, manages the Los Alamos and Lawrence Livermore nuclear weapons laboratories.<sup>59</sup> These facilities have “researched, designed and tested every nuclear weapon in the US arsenal”.<sup>60</sup> The involvement of academia provides intellectual resources to the industry, as well as a cloak of legitimacy.

## Dismantlement

During the 1990s, the United States took apart on average more than 1,000 nuclear warheads annually. In more recent years, the rate of dismantlement has slowed down considerably. An estimated 320 warheads were dismantled in 2011 compared with 648 in 2008.<sup>61</sup> There has been a corresponding decline in expenditure on dismantlement. In the 2009 fiscal year it was US\$186 million, which was slashed to US\$96 million in 2010 and just US\$58 million in 2011.<sup>62</sup>

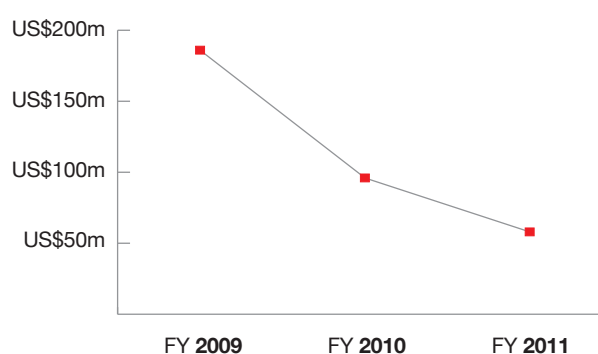
As spending on the modernization of nuclear weapons has increased, disarmament work has been scaled back because the same facilities are used for disassembly as for warhead modernization. In other words, “refurbishing” old nuclear warheads has taken priority over dismantlement. The United States now spends at least 1,000 times more maintaining, manufacturing and modernizing nuclear weapons than it does on dismantling warheads.

## Expenditure

Annual expenditure by the United States on nuclear weapons exceeds that of all other nuclear-armed nations put together. In 2011 it spent an estimated US\$61.3 billion.<sup>63</sup> By comparison, Russia spent US\$14.8 billion. Massive increases in spending are projected. According to the Ploughshares Fund, the total cost of implementing the Obama administration’s modernization plans over the coming decade will be US\$700 billion – including US\$100 billion to sustain and modernize delivery systems and US\$92 billion to modernize and maintain nuclear warheads and warhead production facilities.<sup>64</sup>

The United States spends twice as much on its nuclear weapons as it does on foreign aid.<sup>65</sup> Its annual nuclear weapons budget of US\$61.3 billion is roughly equivalent to the gross domestic product of Sudan and South Sudan (US\$62 billion), whose combined population is 45 million.<sup>66</sup> One year of US spending on nuclear weapons could fund the United Nations for a quarter of a century.<sup>67</sup>

### DROP IN US SPENDING ON WARHEAD DISMANTLEMENT



## Russia



### Summary

Russia has the largest nuclear arsenal of any nation, consisting of approximately 11,000 warheads, with 2,400 of them ready for use.<sup>68</sup> Many are maintained on constant hair-trigger alert.<sup>69</sup> Russia is overhauling much of its nuclear arsenal and has plans to deploy new intercontinental ballistic missiles and a new type of submarine-launched ballistic missile.

### Nuclear Arsenal

Russia's nuclear arsenal comprises heavy bombers, intercontinental ballistic missiles and submarine-launched ballistic missiles. Its 76 deployed bombers each carry between six and 16 nuclear warheads, and the 300 or so land-based intercontinental ballistic missiles in the Russian arsenal have ranges up to 15,000 km and yields up to 800 kilotons<sup>70</sup> – more than 50 times greater in destructive force than the Hiroshima bomb. Russia deploys 11 nuclear-armed submarines carrying a total of 576 warheads.<sup>71</sup> Each warhead has an explosive yield of up to 100 kilotons.

### Modernization

Russia is in the process of upgrading and extending the service life of all of its nuclear-armed heavy bombers.<sup>72</sup> Its intercontinental ballistic missiles are also undergoing “life-extension” work, with plans to develop a new intercontinental ballistic missile system in the near future, to be completed by 2018.<sup>73</sup>

The missile modernization programme has involved several test launches in recent years. From 2013, Russia intends to double its production of ballistic missiles.<sup>74</sup> It also plans to build up to eight new *Borey*-class nuclear-armed submarines, which will form the centrepiece of its nuclear arsenal up until 2040. Each will be equipped with 16 new Bulava missiles with a range of up to 9,000 km.<sup>75</sup>

### Weapons Industry

Rosatom, a government-owned and -operated corporation, controls the civilian and military nuclear industry in Russia. It is responsible for the country's highly enriched uranium production, plutonium production and warhead dismantling processes. Rosatom has facilities spread throughout the country, with major storage sites and processing centres located in Ozersk and Zheleznogorsk.<sup>76</sup>

### Dismantlement

Russia is currently dismantling some of its nuclear forces, according to government statements. Many of the nation's nuclear weapons are in storage and are said to be awaiting dismantlement. However, Russia has reaffirmed its nuclear strategy with regard to the United States, saying that it will “maintain numerical parity with the USA's offensive strategic weapons in the most cost-effective way”.<sup>77</sup>

### Expenditure

In 2011 Russia spent an estimated US\$14.8 billion on its nuclear forces – a significant increase from the previous year (US\$9.7 billion).<sup>78</sup> The projected cost of modernizing the land-, sea- and air-based components of its nuclear arsenal until 2020 is US\$70 billion.<sup>79</sup>

## United Kingdom



### Summary

The United Kingdom maintains a fleet of four nuclear-armed submarines, which are nearing the end of their operational lives. The decision on whether to replace them has been put off until after the next general election. Following major budget cuts to education and health care, the UK government is under mounting pressure to abandon the costly proposal to build a new class of submarines.

### Nuclear Arsenal

The UK nuclear arsenal consists of up to 225 nuclear warheads, of which 160 are operationally deployed.<sup>80</sup> Its nuclear-armed submarines are equipped with Trident II missiles, which it leases from the US navy. The missiles are fitted with warheads designed and built at the Atomic Weapons Establishment in the United Kingdom.<sup>81</sup> One nuclear-armed submarine is on patrol at any given time, equipped with 16 missiles carrying up to 48 nuclear warheads in total.<sup>82</sup> Each warhead has a yield of approximately 100 kilotons – equivalent to seven Hiroshima bombs.

### Modernization

The United Kingdom's nuclear-armed submarines will reach the end of their service lives from 2024. A strategic defence and security review by the Ministry of Defence in 2010 affirmed the country's commitment to a sea-based "nuclear deterrent" equipped with Trident missiles.<sup>83</sup> For budgetary reasons, the main decision on the acquisition, design and number of submarines has been delayed until about 2016.<sup>84</sup> Pending construction of the new submarines, the United Kingdom intends to extend the service lives of the existing fleet.<sup>85</sup>

### Weapons Industry

Work on the United Kingdom's nuclear arsenal is carried out primarily by the Atomic Weapons Establishment, which is operated by a consortium of Jacobs Engineering, Lockheed Martin and Serco.<sup>86</sup> These companies have a contract to run the nuclear weapons facilities at Aldermaston and Burghfield until 2025. Other companies, such as Redhall Group, are also contracted to provide services to the AWE.<sup>87</sup>

The UK Ministry of Defence is working in collaboration with BAE Systems, Rolls-Royce and Babcock International to develop the proposed new submarine that will replace the existing fleet.<sup>88</sup> Work on the Trident missiles will be carried out in the United States, while work on the warheads will be the responsibility of the AWE.

### Expenditure

The cost of designing and constructing the new nuclear-armed submarines was initially estimated at US\$40 billion, "even without missiles, warheads or running costs".<sup>89</sup> The UK Campaign for Nuclear Disarmament has forecast that, if the project is given parliamentary approval, the total cost of construction will be closer to US\$160 billion.<sup>90</sup> In 2011 the United Kingdom spent an estimated US\$5.5 billion on its nuclear weapon programme.<sup>91</sup> According to Ministry of Defence documents, US\$1.2 billion has been committed for the construction of a new uranium enrichment facility in Berkshire.

## France



### Summary

France is nearing the end of its most recent nuclear force modernization cycle. All four of its new nuclear-armed submarines are now complete and operational, and its new nuclear-capable fighter aircraft has entered service. French President Nicolas Sarkozy has affirmed his country's commitment to maintaining its nuclear arsenal for the foreseeable future.

### Nuclear Arsenal

France possesses approximately 300 nuclear weapons of varying yields, deliverable by air and sea.<sup>92</sup> Most are deployed on *Triomphant*-class submarines, one of which is on patrol at any given time. The submarines are equipped with M45 and M51 ballistic missiles. The M45 is the main strike weapon of the French military and has a range of up to 4,000 km, while the M51 can reach between 6,000 and 9,000 km.<sup>93</sup> The air component of France's nuclear arsenal consists of approximately 50 land- and carrier-based fighter aircraft, each equipped with a 300-kiloton warhead.<sup>94</sup>

### Modernization

In 2010 France deployed the fourth and final *Triomphant*-class ballistic missile submarine. These new vessels are gradually being equipped with M51 ballistic nuclear missiles, which have a significantly greater range and yield capacity than the existing M45 missiles. Several companies are involved in the production of the M51 missiles, including EADS, Safran, SNPE, DCN and Thales.

France is also modernizing its air-based nuclear component. The *Mirage* 2000N is slowly being retired and replaced by the more advanced *Rafale*, both of which are capable of delivering nuclear weapons. By 2018 all French nuclear air delivery vehicles will be completely modernized.<sup>95</sup> A new and improved cruise missile is being deployed with the *Rafale*, with a longer range and greater reliability than its predecessor.

France remains committed to sustaining its nuclear weapons complex, including research and development capabilities.<sup>96</sup>

### Dismantlement

In a 2008 speech given at the Cherbourg shipyard, President Sarkozy announced that France would reduce the airborne components of its nuclear weapons stockpile.<sup>97</sup> However, with the full deployment of the new *Triomphant*-class ballistic missile submarines, this reduction amounts to no real change to the country's nuclear weapons capacity.

### Expenditure

French expenditure on nuclear weapons and their associated platforms is kept classified. However, it is estimated that in 2011 total spending was around US\$6 billion, a small increase from 2010.<sup>98</sup> Budgetary pressure caused by the global financial crisis has kept spending steady. Under a deal struck with the United Kingdom in 2010, French nuclear weapons facilities will be used for British nuclear weapons maintenance and computer simulations – a service for which France will charge in order to subsidize its own nuclear weapons programme.<sup>99</sup>



## China



### Summary

China has approximately 240 nuclear weapons, which are deliverable from land, air and sea.<sup>100</sup> Although it does not appear to be increasing the number of warheads in its stockpile, it is enhancing the sea-based component of its nuclear forces and building new medium- and long-range nuclear missile delivery systems. The Chinese government is not known to provide contracts to private companies to carry out modernization work on its nuclear weapons.

### Nuclear Arsenal

Of China's 240 nuclear weapons, roughly 185 are deployed, with rest in reserve.<sup>101</sup> China's nuclear arsenal consists primarily of land-based ballistic missiles with ranges from 2,100 km to 13,000 km.<sup>102</sup> Each missile carries one nuclear warhead. The long-range missiles are thought to be targeted at the United States and Russia, and possibly also India.<sup>103</sup> The newer missiles are solid-fuelled, meaning that they can be launched more rapidly than previous models. All but a few of the missiles are road-mobile.

In addition to its land-based nuclear forces, China also maintains approximately 20 nuclear bombs for delivery on H-6 bombers. The sea-based component of its arsenal is believed to consist of three submarines, each carrying 12 intermediate-range single-warhead ballistic missiles, although not all three submarines are fully operational at present.<sup>104</sup>

### Modernization

China is increasing the number of DF-31A road-mobile intercontinental ballistic missiles in its arsenal, as well as developing a new missile capable of delivering multiple individually targeted nuclear warheads.<sup>105</sup> It is thought to be building anti-satellite weapons and decoys designed to counter other nations' ballistic missile defences.

Between three and five nuclear-armed submarines are under construction. They are designed to carry ballistic missiles with an estimated range of 7,200 km. Once construction is complete, China will have the capacity to have at least one submarine on patrol at all times. Over coming decades, it is expected that China will increase the size of its nuclear arsenal to approximately 300 warheads.

### Expenditure

It is estimated that the total cost of China's nuclear weapons programme in 2011 was US\$7.6 billion.<sup>106</sup> This accounted for roughly 5 per cent of its overall military spending. Its nuclear weapons spending is projected to increase significantly in coming years.

## India



### Summary

India is steadily increasing the size of its nuclear arsenal and enhancing its nuclear weapons delivery capabilities, with new nuclear-capable ballistic missiles and submarines under construction.

Its production of weapons-grade plutonium is set to increase in coming years. India has no nuclear disarmament programme in place and is outside the nuclear Non-Proliferation Treaty.

### Nuclear Arsenal

India is thought to possess between 80 and 100 nuclear weapons, of which 50 are fully operational and actively deployed.<sup>107</sup> India has not disclosed any details about the size and composition of its nuclear arsenal. Many of its military platforms are dual-capable, meaning that they can be used to launch conventional weapons as well as nuclear weapons. This includes India's jet fighter forces and the short-range ballistic missile, Prithvi I.

### Modernization

The largest area of growth in India's nuclear weapons programme is in the area of delivery systems. In 2009 India launched its first ballistic missile submarine, the *INS Aribant*, which will be capable of carrying out a nuclear strike from sea. Four other submarines of the same class are also in development.<sup>108</sup>

India's ballistic missile capability is also going through a period of rapid expansion. The Agni I, with a range of 700 km, is entering its last stages of construction and could be deployed in 2012. The Agni II was successfully tested in 2010 and is reported to have a range of 2,000 km. The Agni IV, which is being developed, will have a range of 5,000 km. An intercontinental version is also under consideration.

The Indian military is researching advanced nuclear warhead technology with the aim of developing multiple-warhead ballistic missiles. This would allow it to increase the destructive capacity of its current and future ballistic missile capability. The projected deployment date is 2020.<sup>109</sup>

### Weapons Industry

The government-owned Defence Research and Development Organisation conducts the majority of India's nuclear weapons research.<sup>110</sup> It is involved in testing and constructing the nation's ballistic missile capability, including its sea-based component.

India's plutonium is provided by several fast-breeder reactors. A number of new reactors are nearing completion. This would allow India to increase its nuclear weapons production rate by a factor of five to an estimated 28 to 35 weapons a year.<sup>111</sup> Some of these reactors are not under International Atomic Energy Agency safeguards.

### Expenditure

In 2011 India spent an estimated US\$4.9 billion maintaining and expanding its nuclear arsenal.<sup>112</sup> This includes expenditure on delivery vehicles and the associated technology.

## Pakistan



### Summary

Pakistan is making substantial improvements to its nuclear arsenal and associated infrastructure. It has no nuclear disarmament programme in place and is not a party to the nuclear Non-Proliferation Treaty.

### Nuclear Arsenal

Pakistan possesses between 90 and 110 nuclear weapons.<sup>113</sup> Its arsenal has grown substantially in recent years, from 60 to 80 nuclear weapons in 2008. Government and other sources report that the nation aims to double the size of its nuclear arsenal in the next 5 to 10 years, with the eventual goal of 250 to 350 nuclear weapons of varying yields.<sup>114</sup>

Pakistan's military is able to launch nuclear weapons from land and air. It possesses an estimated 50 Hatf-3 nuclear-capable ballistic missiles, with a short range of 400 km. A further 10 Hatf-4 missiles are operational, with a range of 450 km, and 25 Hatf-5 missiles, with an estimated range of 1,200 km.<sup>115</sup> The primary aircraft for delivering nuclear weapons is the US-manufactured F-16.

### Modernization

Pakistan is rapidly improving its ballistic missile technology. The Shaheen II missile is under development. If successful, it will have an operational range of 2,000 km. Several nuclear-capable cruise missiles are also nearing design completion. The Hatf-7 and Hatf-8 are short-range cruise missiles capable of penetrating air-defence systems.<sup>116</sup>

Pakistan is also improving its nuclear infrastructure to allow for an increase in its production of weapons-grade plutonium and highly enriched uranium. Two new plutonium reactors are under construction, along with a reprocessing plant. According to some analysts, these investments will help Pakistan replace its heavy uranium-based nuclear weapons with lighter and more advanced plutonium-based ones, giving its ballistic missiles a greater range.<sup>117</sup>

### Expenditure

In 2011 Pakistan spent an estimated US\$2.2 billion on its nuclear weapons programme, up from US\$1.8 billion in 2010. Expenditure is projected to increase substantially due to maintenance costs for its new plutonium infrastructure.<sup>118</sup>

## Israel



### Nuclear Arsenal

Israel will neither confirm nor deny that it possesses nuclear weapons. Estimates of the size of its nuclear arsenal vary considerably. Based on its production of plutonium, it is generally thought that Israel has approximately 80 nuclear warheads.<sup>119</sup>

Israel has a large and modern air force, mainly consisting of F-16 fighter aircraft, some of which are nuclear-capable.<sup>120</sup> Its ballistic missile capability is also advanced. The Jericho II ballistic missile is Israel's main nuclear strike option, with a range of 1,500 to 1,800 km. Fifty were deployed in 1990.

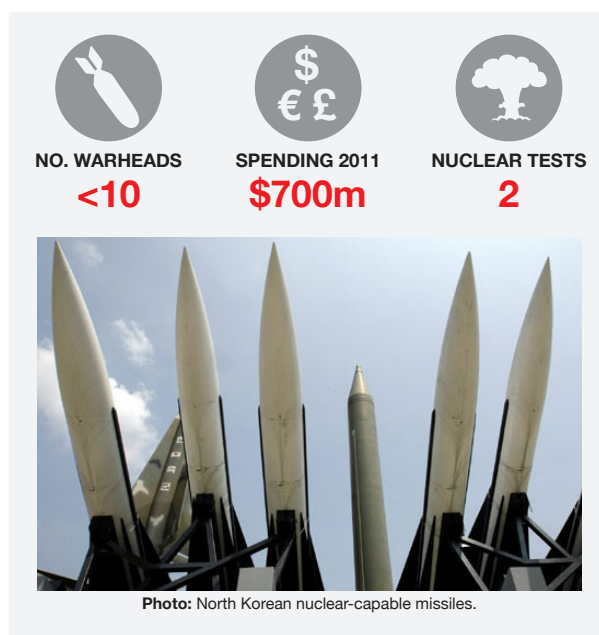
In addition, Israel recently acquired a sea-based nuclear option in the form of three *Dolphin*-class submarines purchased from Germany. It is widely believed that they possess nuclear-capable ballistic missiles with a range of up to 1,500 km.<sup>121</sup>

### Modernization

Israel is continuing to modernize its nuclear arsenal. In recent years, several satellites have been launched into orbit with the Shavit rocket. These launches are also believed to be tests for the Shavit's intercontinental capability. The Jericho III, based upon the Shavit's design, is under development, with an estimated range of 4,000 to 6,000 km.<sup>122</sup>

In 2010 Israel spent an estimated US\$1.9 billion on its nuclear weapons programme, with no significant increase in expenditure in 2011.<sup>123</sup>

## North Korea



### Nuclear Arsenal

North Korea announced its withdrawal from the nuclear Non-Proliferation Treaty in 2003, and conducted its first nuclear test in 2006, with a second carried out in 2009. It is not yet known whether the North Korea possesses a weaponized nuclear capability.<sup>124</sup> If it does, its operational nuclear stockpile would likely consist of fewer than 10 warheads.

The nation's main nuclear facility is located at Yongbyon, North Pyongan. In November 2010, a delegation of US scientists were shown a uranium enrichment facility there, which was reported to contain 2,000 centrifuges in six cascades producing uranium with an average enrichment level of 3.5 per cent.<sup>125</sup>

### Modernization

North Korea is investing mainly in its ballistic missile programme. In October 2010, it unveiled a new missile, the BM/25, with an estimated range of 2,500 to 4,000 km, which makes it capable of hitting targets in both Japan and Guam. North Korea has also successfully tested the Taepodong-2, with a possible range greater than 10,000 km.<sup>126</sup>

It is difficult to estimate how much North Korea spends on its nuclear weapons programme. Global Zero suggests that the figure for 2011 was approximately US\$700 million, representing about 6 per cent of overall military spending.<sup>127</sup>