EU NON-PROLIFERATION CONSORTIUM
The European network of independent non-proliferation think tanks

NON-PROLIFERATION PAPERS
No. 19 July 2012

PAKISTAN'S NUCLEAR AND WMD PROGRAMMES: STATUS, EVOLUTION AND RISKS

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I. INTRODUCTION

This paper describes Pakistan's nuclear, missile and other weapon of mass destruction (WMD) programmes and attempts to make a net assessment of the issues of concern to the international community, focusing on the nuclear question. Pakistan shows clear signs of expanding its nuclear force and is investing in the diversification of its nuclear deterrent. The international community has legitimate security concerns about the state and direction of the Pakistani nuclear programme. Such concerns are not baseless given Pakistan's troubled history and the precedent set by the A. Q. Khan network. However, they are not always well founded. In the past decade a robust set of institutions and procedures has been put in place, aimed at preventing the unauthorized use, theft or sale of nuclear and other WMD, related materials and related technology. There is no doubt that the Pakistan military has been taking nuclear and WMD security very seriously—first and foremost because it is in its own interest—and that it does so in a very professional way. This analysis shows that the main risks today are not those of 'weapons falling into the wrong hands' or an 'Islamist takeover of the country'. Rather, they are of the deliberate use of and perhaps partial loss of control of the nuclear complex in wartime, low-level leaks of WMD expertise or materials, or a radiological incident in peacetime. But in the longer term, the possibilities of a weakening of state authority over the territory and a failure of governance, or of a radicalization of current policies towards the West, should not be discounted. What, therefore, are the stakes for the European Union (EU) and can Europe help in mitigating those risks?

SUMMARY

Pakistan is estimated to have about 100 nuclear weapons and 200 ballistic missiles, and it is expanding its nuclear force. It has set up a system of institutions and procedures aimed at preventing the unauthorized use, theft or sale of nuclear and other weapons of mass destruction (WMD), related materials and technology. Nevertheless, the international community has legitimate security concerns regarding Pakistan's WMD, in particular the possible theft of a nuclear weapon or a radical change in government policies.

The main risks today are those of deliberate use of or loss of control of the nuclear complex in wartime. In the longer term, a weakening of state authority over Pakistan's territory or a radicalization of current policies towards the West should not be discounted.

The European Union (EU) has many stakes in ensuring WMD security and safety in Pakistan, but its means of direct action to mitigate those risks are limited.

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II. THE CURRENT STATE AND DIRECTION OF PAKISTAN'S NUCLEAR PROGRAMME

Nuclear complex

Pakistan has a large nuclear programme, the history of which is marked by rivalry between the Pakistan Atomic Energy Commission (PAEC), the organization initially created to deal with the nuclear programme (both civilian and military), and the Khan Research Laboratories (KRL), originally created solely for uranium enrichment. In the 1980s the KRL became a true competitor to PAEC, as both became involved in weaponization and missile acquisition. While this competition was probably deliberately encouraged by the Pakistani leadership, it also facilitated the development of the Khan network.

In the years 1999–2001, a reorganization of the nuclear programme took place. All military or dual-use activities were put under the control of the National Command Authority (NCA) and the Strategic Plans Division (SPD)—and remain so today. A division of labour was also defined as follows.

1. The National Engineering and Scientific Commission (NESCOM), created in 2001, oversees weapon systems development. It has authority over the National Development Complex (NDC), created in 1990 as an offshoot of PAEC, which is in charge of weaponization.
2. PAEC is responsible for uranium mining and processing, as well as plutonium-related programmes. It oversees the development of the Khushab complex of heavy water-moderated reactors and has authority over the reprocessing facilities of Nilore and Chashma.
3. The KRL is in charge only of uranium enrichment, at the facilities of Kahuta and Gadwal.

These facilities are not safeguarded.

Nuclear policy, doctrine and planning

Minimum deterrence and its requirements

In May 1999 Pakistan's Prime Minister, Nawaz Sharif, announced a principle of 'minimum credible deterrence'. This was part of a redesign of Pakistan's nuclear doctrine and organization, following nuclear tests that it carried out in 1998. The policy of minimum credible deterrence constantly reaffirmed since then translates into four objectives: (*a*) deterrence of all forms of external aggression; (*b*) building an effective combination of conventional and strategic forces; (*c*) avoiding a pre-emptive strike through protection and the threat of nuclear retaliation; and (*d*) stabilizing strategic deterrence in South Asia.[1]

After the 1998 tests, Pakistan adopted a long-term development plan for its nuclear force. It is now reportedly implementing its second 10-year plan. Pakistan claims that it is against an open-ended arms race in South Asia and does not seek a nuclear arsenal equivalent to that of India. It also believes in the possibility of a smaller country deterring a larger one through the threat of damage incommensurate with the stakes of the conflict. Pakistan therefore aims at being able to inflict unacceptable damage on India. However, Pakistani planners admit the difficulty of defining unacceptable damage: one quasi-official report states that 'because of the difficulty in predicting unacceptable damage, overkill would by necessity be built into the response'.[2]

In 2005 Pakistani President Pervez Musharraf claimed that Pakistan had reached the threshold of minimum deterrence; however, this bold statement may have merely referred to an initial capability to launch a small number of weapons on Indian cities with some guarantee of success.[3] Pakistan insists that the required force levels can change over time, in light of the evolution of the threat. Official statements since 1998 have consistently stressed that minimum deterrence 'cannot be quantified in static numbers'.[4]

Guaranteed unacceptable damage implies survivability even after a first strike by the adversary. Pakistan is likely to use an Indian pre-emptive strike as a planning assumption (coupled, in the future, with the deployment of missile defence by India). Pakistan's concerns have been compounded by a growing India–United States strategic partnership, which includes nuclear cooperation. In 2006 the NCA stated that 'in view of the fact that the [India–USA] agreement would

[1] Durrani, M. A., 'Pakistan's strategic thinking and the role of nuclear weapons', Cooperative Monitoring Center Occasional Paper 37, Sandia National Laboratories, SAND 2004 3375P, July 2004, <http://www.cmc.sandia.gov/cmc-papers/sand2004-3375p.pdf>, p. 23.

[2] Durrani (note 1), pp. 26–32.

[3] President of the Islamic Republic of Pakistan, 'Excerpt from report by Pakistan TV on 19 March', 19 Mar. 2005, <http://www.presidentofpakistan.gov.pk>.

[4] See e.g. Sattar, A., 'Address by the Foreign Minister to the "Pakistan Response to the Indian Nuclear Doctrine" seminar', 25 Nov. 1999, <http://www.acronym.org.uk/41pakis.htm>; and Bast, A., 'Pakistan's nuclear calculus', *Washington Quarterly*, vol. 34, no. 4 (2011), p. 78.

enable India to produce significant quantities of fissile material and nuclear weapons from unsafeguarded nuclear reactors, the NCA expressed firm resolve that our credible minimum deterrence requirements will be met'.[5] Meanwhile, Pakistan will probably resort to concealment and mobility (in a similar way to China) to ensure the survival of its force.

As an example of the type of calculations that Pakistani planners might make, a former SPD officer wrote that for a set of 10 possible targets, a country might need 68–70 warheads (without taking into account the risk of a pre-emptive strike).[6] Although the Pakistani military seems to base its planning on rational strategic calculations, domestic political factors will also inevitably affect nuclear policy decisions. No Pakistani leader can afford to appear weak vis-à-vis India.

A low nuclear threshold?

Pakistan has consistently stated that its nuclear weapons are solely intended to deter military aggression. Officials stress that 'the use of nuclear weapons as a war-fighting tool is not a contemplated doctrine in Pakistani strategic thinking'.[7] Pakistan has made efforts to think through its nuclear doctrine and to integrate the nuclear dimension into its defence strategy. In 2002 the SPD participated in a joint war game at the National Defence College and strategic force commanders are now invited to participate in the important Corps Commanders Conference.

Pakistan claims that it would only use nuclear weapons in response to conventional attacks by India as a last resort. There have been consistent statements by Pakistani officials since 1987 about the country's nuclear threshold. In 1999 General (and later President) Musharraf said nuclear weapons would only be used if its 'national integrity was threatened' and in 2001 Lieutenant General Khalid Kidwai said 'only if the very existence of Pakistan as a state is threatened'.[8] Kidwai described those circumstances in late 2001 as follows.[9]

1. *The spatial threshold*. The penetration of Indian forces on a large scale would elicit a nuclear response. The threshold could be low (50–100 kilometres) in Kashmir and in Punjab.

2. *The military threshold*. The destruction of a large part of Pakistani land or air forces could lead to a nuclear response if Pakistan believed that it was losing the cohesiveness of its defence and feared imminent defeat.[10]

3. *The economic threshold*. Economic strangulation could lead to a nuclear response. This refers primarily to a blockade of Karachi, but could also concern the stopping of the Indus River's water flow, or the capture of vital arteries such as the Indus River and the Karakoram Highway.

4. *The political threshold*. A destabilization of the country fomented by India could also be a nuclear threshold if Pakistan believed that the integrity of the country was at stake.[11]

Pakistani planners insist that these thresholds are of an indicative nature only, and should not be viewed in isolation from each other. Further, they do not accept suggestions that Pakistan is planning for an early use of nuclear weapons.

Some statements have referred to the role of the Pakistani deterrent in discouraging chemical or biological attacks.[12] However, Pakistan's policy is also in line with the negative security assurances given by

[5] President of the Islamic Republic of Pakistan, 'Pakistan satisfied with nuclear deterrence capability: expresses firm resolve to meet future challenges', Press release, 12 Apr. 2006, <http://www.presidentofpakistan.gov.pk>.

[6] Salik, N., Landau Network-Centro Volta (LNCV), *Minimum Deterrence and India Pakistan Nuclear Dialogue: Case Study on Pakistan* (LNCV: Como, Mar. 2006), p. 14.

[7] Khan, F. H., 'Comparative strategic culture: the case of Pakistan', *Strategic Insights*, vol. 4, no. 10 (Oct. 2005).

[8] Levy, A. and Das Gupta, S., 'Nuclear alert sounded in Pakistan', *Sunday Times*, 30 May 1999; and Cotta-Ramusino, P. and Martellini, M., 'Nuclear safety, nuclear stability and nuclear strategy in Pakistan', A concise report of a visit by Landau Network-Centro Volta, Jan. 2002, <http://www.pugwash.org/september11/pakistan-nuclear.htm>.

[9] Cotta-Ramusino and Martellini (note 8); and Koch, A. and Foss, C., 'Pakistan strengthens nuclear security', *Jane's Defence Weekly*, 9 Oct. 2002.

[10] SPD officials explicitly refer to the army's mechanized forces, the air force's F-16s and now to the navy's Agosta submarines. Pakistani officials, Off-the-record interviews and informal conversations with author, 2004–2008.

[11] The revelation of the existence of these 4 thresholds may have been conceived as a message to various Indian constituencies: the army for the spatial threshold, the army and air force for the military threshold, the navy for the economic threshold, and the Research and Analysis Wing (RAW) for the political threshold.

[12] Statement issued by the Permanent Representative of Pakistan to the United Nations in response to Security Council Resolution 1172, 6 June 1998, <http://www.fas.org/news/pakistan/1998/06/980606-gop.htm>.

Table 1. Pakistani missiles

Name	Designation	Type	Propellant	Range (km)	Payload (kg)	Accuracy (m)	In service date	No.
Nasr	Hatf-9	Single-stage	Solid	60	..	..	(2014)	..
Ra'ad	Hatf-8	Cruise (air-launched)	Solid/ turbojet	350	..	..	(2013)	..
Babur	Hatf-7	Cruise (ground-launched[a])	Solid/ turbojet	500–700	300	..	(2012)	..
Shaheen II[b]	Hatf-6	Two-stage	Solid	Initially 2000, now probably 2500	700–1000	350	(~2010)	..
Ghauri II	Hatf-5	Single-stage	Liquid	1800	700–1000	2500	2003	25–50
Ghauri I [= Nodong /North Korea]	Hatf-5	Single-stage	Liquid	1300	700–1000	2500	2003	25–50
Shaheen I [= M-9/China]	Hatf-4	Single-stage	Solid	Initially 450, now probably 700–750	700–1000	(200) (90 if terminal guidance)	2003	50
Ghaznavi [= M-11/China]	Hatf-3	Single-stage	Solid	Initially 290, now probably 350–400	500–700	(250) (50 if terminal guidance)	2004	50
Abdali	Hatf-2	Single-stage	Solid	180	250–450	(150) (30 if terminal guidance)	(2012)	..
..	Hatf-1A/1B	Single-stage	Solid	100	500	..	1995/ 2004	100
..	Hatf-1	Single-stage	Solid	80	500	..	1992	100

.. = not available or not applicable; ( ) = uncertain figure.

[a] This missile may also be air and sea-launched.

[b] A longer range (4000–4500 km) Shaheen III may also be in development.

Sources: Official Pakistani data (various sources); Stockholm International Peace Research Institute (SIPRI), *SIPRI Yearbook 2011: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2011); International Institute for Strategic Studies (IISS), *The Military Balance 2012* (IISS: London, 2012); Jane's Strategic Weapons Systems, <http://jsws.janes.com/public/jsws/index.shtml>; and 'Pakistan's nuclear forces, 2011', Nuclear Notebook, *Bulletin of Atomic Scientists*, July/Aug. 2011.

nuclear weapon states: it will not use or threaten to use nuclear weapons against non-nuclear countries.[13]

Pakistan also threatens nuclear retaliation in case of a preventive or pre-emptive strike. Pakistan told India in 1998 that an attack against its nuclear installations (which are the subject of a non-aggression agreement between the two countries) would elicit 'swift and massive retaliation with unforeseen consequences'.[14] More precisely, the policy amounts to 'deterrence of Pakistan's adversaries from attempting a counter-force strategy against its strategic assets by effectively securing the strategic assets and threatening nuclear retaliation should such an attempt be made'.[15]

[13] Durrani (note 1), p. 23.

[14] United Nations Information Service, 'Pakistan warns in disarmament conference of massive retaliation if nuclear installations attacked', Press Release DCF/335, 29 May 1998, <http://www.fas.org/news/pakistan/1998/05/19980529_dcf335.html>.

[15] Durrani (note 1), p. 23.

Towards controlled escalation?

Pakistan will certainly want to avoid an all-or-nothing strategy, to ensure deterrence credibility and respond to a possible Indian limited nuclear strike. It has most likely developed limited strike options of its own focused on Indian territory (for instance on a base close to the border) or on Indian forces advancing on its territory. A limited strike would aim to signal Pakistan's resolve, 'establish intra-war deterrence' (in the words of an SPD official), and perhaps force other countries to intervene. Given the small size of its force, an appropriate reference might be the French doctrine of a final warning followed, if needed, by unacceptable damage.[16] Due to its lack of spatial depth, Pakistan 'cannot afford the luxury of distinguishing between tactical and strategic, within a nuclear context'.[17] Pakistani planners insist that all their nuclear weapons are of a strategic nature. However, with a bigger and more diversified arsenal, Pakistan's strategy will be closer to the flexible response strategy of controlled escalation adopted by the North Atlantic Treaty Organization (NATO).

Planning today certainly focuses on countervalue targeting, due to the low number of warheads it is believed to have and the probably poor accuracy—despite Pakistani claims to the contrary—of most missiles currently in service (see table 1). General Musharraf said that Pakistan should have 'enough missile capacity to reach anywhere in India and destroy a few cities, if required'.[18] Pakistani analysts regularly mention about a dozen cities. Given the size of India, Pakistan could not destroy a large percentage of its urban population; but targeting key cities and facilities might incur unacceptable economic and psychological costs.

It is likely that as its nuclear force grows and evolves, Pakistan will diversify its set of potential targets, as other countries have done—and it may already have done so. In a discussion of the 'pain threshold of the opponent', a former SPD official identifies possible targets as 'major population centres, industrial complexes, major military bases, and communication hubs'.[19] A diversification of targets could make Pakistani deterrence more credible, given that a strike on Indian cities would produce massive casualties among its Muslim population—something that might be hard to consider for a country whose very creation was justified by the need to provide a sanctuary and a natural homeland for South Asian Muslims.

A force on low alert

It is widely assumed that Pakistan's nuclear systems are kept on low alert. In peacetime, missiles may not be mated with warheads, and in 2003 President Musharraf referred to a 'geographical separation' between them.[20] It is also possible that warheads are kept in a disassembled form.[21] However, the SPD insists that it has never confirmed such arrangements; Kidwai states that forces are not on 'hair trigger alert' but that 'separation is more linked to time rather than space'.[22] A former SPD official has also denied that the warheads were kept in disassembled form.[23]

The time required to convert weapons into a state of launch readiness is uncertain. Some accounts suggest that assembly would only take minutes, while other refer to hours.[24] Kidwai said in 2002 that it could happen 'very quickly'.[25]

Once made operational, Pakistan's forces would have to contend with three possible scenarios: 'launch on warning; launch under attack; launch on orders'.[26]

[16] Pakistani officials (note 10).

[17] Mazari, S., 'From non-proliferation to nuclear stability: the case of South Asia', *Defence Journal*, Mar. 2000.

[18] Sawhney, P., 'How inevitable is an Asian "missile race"?', *Jane's Intelligence Review*, Jan. 2000.

[19] Salik (note 6), p. 14.

[20] Quoted in Reddy, M., 'No chance for accidental n-war with India', *The Hindu* (Chennai), 11 Jan. 2003.

[21] According to a Defence Ministry spokesman, 'the launch mechanism, the device and various other mechanisms' are kept in different places. Nuclear Threat Initiative (NTI), 'Pakistan splits nuclear weapons among three services', Global Security Newswire, 10 Aug. 2006. See also Thompson, M., 'Does Pakistan's Taliban surge raise a nuclear threat?', *Time*, 24 Apr. 2009; Sanger, D., 'So, what about those nukes?', *New York Times*, 11 Nov. 2007; and Cheema, Z. I, 'Pakistan', eds H. Born, H., B. Gill and H. Hänggi, SIPRI, *Governing the Bomb: Civilian Control and Democratic Accountability of Nuclear Weapons* (Oxford University Press: Oxford, 2010), p. 196.

[22] Quoted in Landau Network-Centro Volta (LNCV), *Security and Safety Issues about the Nuclear Complex: Pakistan's Standpoints* (LNCV: Como, 2008).

[23] Salik N., 'Ignore Hersh', 27 Nov. 2009, <http://nasirviewpoint.blogspot.se/2009/11/paknationalists-ignore-seymour-hersh.html>.

[24] Jones, O. B., *Pakistan: Eye of the Storm* (Yale University Press: New Haven, CT, 2003), p. 212; and Windrem, R.,'Pakistan: "the crazy soup"', NBC News, 6 Feb. 2004, <http://www.msnbc.msn.com/id/4216102/ns/nbcnightlynews/t/pakistan-crazy-soup/#.T9Xf1vFCfR0>.

[25] Kidwai, quoted in Cotta-Ramusino and Martellini (note 8).

[26] Khan, F. H., 'Pakistan's nuclear force posture', ed. Z. S. Davis, *The India–Pakistan Military Standoff: Crisis and Escalation in South Asia* (Palgrave MacMillan: London, 2011), p. 135.

Fissile material and nuclear warheads

India and Pakistan are the only two states known to be producing highly enriched uranium (HEU) today. Pakistan began producing HEU in the mid-1980s. As of 2011 it was believed to have produced 2–3.5 tonnes of HEU.[27] It may be producing 120–180 kg per year, enough for 10–15 warheads. The Kahuta plant is believed to have a capacity of 15 000–45 000 separative work units per year.

More recently, Pakistan has begun developing an important plutonium production capability. At Khushab, two reactors are operating and two others are being built. New reprocessing facilities are also being constructed at Nilore (the current one having a capacity of 20–40 tonnes of heavy metals per year) and probably at Chashma (with a projected capacity of 50–100 tonnes of heavy metals per year), which hosts a never-completed plant of French origin. As of 2011 Pakistan had stockpiled around 100–160 kilograms of plutonium. Production levels at Khushab are difficult to estimate: the two reactors in service do not operate continuously and may not be of the same type. Khushab-1 can produce 5.7–11.5 kg of plutonium per year depending on its duration of operation, enough for 1–3 warheads.

Pakistan has increased its stockpile in recent years and probably has around 100 warheads.[28] Estimates remain uncertain: they are based on available information and assumptions regarding the number of launchers, the amount of fissile material produced and converted into weapon cores, and the amount of material Pakistan uses in each weapon. The potential production of warheads today is 7–18 per year.[29]

The nuclear tests that Pakistan carried out on 28 May 1998 involved HEU fission devices of 5–20 (probably 8–12) kilotons. Pakistan claims that five devices were tested, but seismological data implied that the real number might have been two. Questions also remain regarding the 3–11 (probably 4–6) kt test on 30 May, which may have been a plutonium or a composite core. Open source analysis remains divided, although in 2006 President Musharraf stated: 'we do not have a plutonium weapon'.[30]

Pakistan has several functional weapon designs. Two models were developed by PAEC for Pakistan Air Force aircraft, with reported yields of 2–10 kt and 10–20 kt.[31] Pakistan partly based its weapon designs on a 15–25 kt HEU implosion Chinese warhead, which can be carried by a missile (PAEC and the KRL both worked on this design). The 1998 tests allowed Pakistan to refine its designs. Missiles are probably armed with low-yield warheads: tentative evaluations are warheads of 15–35, 12–20 and 1–5 kt for the short-range missiles (if endowed with nuclear weapons).[32] Inquiries into the Khan network uncovered the existence of two modern, sophisticated designs to make warheads smaller, lighter and more powerful than the Chinese warhead.

Whether or not Pakistan already has a proven plutonium-based implosion design, it is likely that it will continue to rely on HEU weapons for a long time.

Means of delivery

Pakistan initially relied on aircraft as delivery vehicles for its nuclear weapons and in the mid-1980s it procured 40 F-16 aircraft from the USA that, when modified, could be used for that purpose. However, in 1985 the Pressler Amendment was passed, which made the delivery of additional F-16 aircraft dependent on US Presidential certification that Pakistan did not possess a nuclear device. In 1990 the Pressler Amendment was finally invoked, ending US military assistance to Pakistan. By then, Pakistan had already begun to examine a ballistic missile alternative, prompted additionally by the development of India's programmes.

Over the past 15 years, Pakistan has begun placing part of its deterrent on missiles (see section III), dramatically increasing the probability of the success of a strike on Indian territory. However, this capability remains limited. With a range of less than 1000 km, the Shaheen and Ghaznavi are more theatre than strategic missiles (though they could reach some of India's cities if placed in the eastern part of Pakistan). The Ghauri

[27] The data on fissile material is from Stockholm International Peace Research Institute (SIPRI), *SIPRI Yearbook 2011: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2011) and the International Panel on Fissile Materials (IPFM), *Global Fissile Material Report 2011* (IPFM: Princeton, NJ, 2011), p. 11.

[28] This includes 10–50 bombs, according to 'Nuclear bombs (Pakistan), offensive weapons', *Jane's Strategic Weapons Systems*, 24 Aug. 2011.

[29] This figure is 11–18 according to SIPRI (note 27) and 7–14 according to others. See e.g. Albright, D. and Brannan, P., 'Pakistan doubling rate of making nuclear weapons: time for Pakistan to reverse course', Institute for Science and International Security (ISIS), 16 May 2011, <http://isis-online.org/isis-reports/detail/pakistan-doubling-rate-of-making-nuclear-weapons-time-for-pakistan-to-rever/>.

[30] 'Musharraf says Pakistan didn't enable N Korea test', Agence France-Presse, 12 Oct. 2006.

[31] *Jane's Strategic Weapons Systems* (note 28).

[32] *Jane's Strategic Weapons Systems* (note 28).

missile has a longer range but it is liquid-fuelled, and therefore less reliable and more vulnerable. Thus, planners refer to the solid-fuelled, long-range Shaheen II as the mainstay of the country's future deterrent.[33] If based in Punjab, it could reach the eastern cities of Kolkata, Bangalore and Chennai.

The limitations of the Pakistani missile capability explain why Pakistan will continue to maintain an air-based component. Also, the value of diversity in the force is well known. Aircraft could, for instance, be used to target an Indian formation on Pakistani territory. Some officials in Pakistan believe that the multiplication of nuclear assets and bases makes Pakistan a 'target-rich' environment and lessens the possibility of a pre-emptive strike.[34] To that effect, Pakistan has equipped some of its ground attack aircraft—probably part of its US F-16C/D force (one squadron) and Mirage V force (three squadrons)—with nuclear bombs. It is not known whether the new JF-17 Chinese fighter, which has equipped one squadron of the Pakistan Air Force since 2010, has a nuclear capability.

Nuclear command and control

Since President Muhammad Zia-ul-Haq's death in 1988, the army has managed Pakistan's nuclear programme. The decision-making apparatus was revamped after the 1998 tests and the 1999 coup. General Musharraf instituted a National Security Council (NSC) comprising the 13 main civilian and military leaders. The NSC announced a consolidation of nuclear command and control in February 2000, putting the programme under full military control and establishing the accountability of laboratories for the first time.

The current structure, sometimes referred to as the Strategic Command Organization (SCO), comprises three elements: the NCA, the SPD and three Strategic Forces Commands (SFCs). The SFCs report to the NCA and are in charge of technical, training and administrative control. The army's SFC is the most powerful since it is in charge of all missiles in service and is headed by a three-star general (as opposed to two-star officers for the two other commands).[35] In November 2000 all strategic organizations participating in the nuclear and missile programmes—the KRL, NESCOM, PAEC and the Pakistan Space and Upper Atmosphere Research Commission (SUPARCO)—were put under the control of the NCA.[36] SUPARCO, created in 1981, participated in the development of ballistic missiles and uses them as launch vehicles.

The NCA is composed of the top civilian and military officials and is meant to take all major decisions regarding nuclear and space policy. It meets two or three times a year. The 18th Amendment to the Pakistani Constitution shifted power to the prime minister and made him the chairman of the NCA.[37] Prime Minister Yousaf Raza Gillani chaired his first meeting of the NCA in January 2010. The legal framework of the NCA was formalized through the NCA Act of March 2010 (retroactively in force since December 2007) and the turning into law of the 18th Amendment in April 2010.

The foreign minister is deputy chairman of the Employment Control Committee (ECC), which defines nuclear strategy and would decide on nuclear use. It includes the main ministers and the military chiefs. The chairman of the Joint Chiefs of Staff Committee—a symbolic position in Pakistan—is deputy chairman of the less important Development Control Committee (DCC), which is responsible for weapon development and oversight. It includes military and scientists, but no political leader. The planned deliberative process for nuclear use is compared by the SPD to that of a 'board of directors'.[38] The principle of unanimity was affirmed by the NCA in 2003. A decision to use nuclear weapons would need 'consensus within the NCA, with the chairman casting the final vote'.[39] If consensus were impossible, however, a majority vote would suffice.[40] Given that the ECC comprises five civilians and four military ex officio members (not including the SPD head), it is not unreasonable to conclude that the military would be the de facto decision maker. However, it would probably ensure that the civilians shared the responsibility of the decision to use nuclear weapons.

[33] Pakistani officials (note 10).

[34] Pakistani officials (note 10).

[35] Pakistani officials (note 10). The army's Strategic Forces Command (SFC) includes 12 000–15 000 personnel. International Institute for Strategic Studies (IISS), *The Military Balance 2012* (IISS: London, 2012), p. 263.

[36] NESCOM is not mentioned in the 2010 NCA Act.

[37] A possible sign that the President is now outside the loop is President Asif Ali Zardari's 2008 public statement that he would favour a no-first-use doctrine.

[38] Pakistani officials (note 10).

[39] Durrani (note 1), p. 24.

[40] Kidwai quoted in Pennington M., 'Pakistan: nuclear assets safe, outlines nuclear protocol', Associated Press, 26 Jan. 2008.

The SPD, a 70-officer body, is the NCA's secretariat and has evolved into a true nuclear enclave in the Pakistani defence system.[41] The same (now retired) army officer, Kidwai, has led it since its inception. This reflects both the army's dominant position in the armed forces (as in China, Pakistan's number one ally) and the seriousness and continuity of Pakistani nuclear policy. The division is also involved in the selection and training of students called on to serve in the nuclear complex.

There is every reason to believe that Pakistan takes good care of its nuclear weapons. It sees them as the ultimate guarantee of it survival. And it knows that it cannot afford to make a mistake.

The outlook

Towards a continuous expansion of the nuclear arsenal

The expansion and diversification of Pakistan's nuclear arsenal is highly likely in the coming decade, for both psychological and strategic reasons.

In late 2010 Pakistan had enough fissile material for at least 160 warheads, and perhaps as many as 240.[42] The coming online of the third and fourth Khushab reactors could bring the total Pakistani build-up capacity to 19–27 weapons per year.[43] Reprocessing facilities are being expanded (including the completion of the French-built plant). Plutonium weapons will represent an increasingly important share of the arsenal.

Pakistan is probably not satisfied yet with its ability to inflict unacceptable damage on such a big country as India. A larger arsenal would also protect Pakistan against the risk of a first strike, although only if coincidental with an increase in the dispersal and diversification of sites. Pakistan is particularly worried that an increase in Indian military spending, along with closer India–USA cooperation, will widen the conventional gap between the two countries and allow India to consider a conventional disarming strike on Pakistan's strategic assets. Some claim that the international momentum for a fissile material cut-off treaty (FMCT) also explains why Pakistan has increased the rate of conversion of its stockpile to weapons. Two developments could boost the expansion trend even further: (*a*) the appearance of another, non-friendly nuclear-capable country at its borders (e.g. Iran); and (*b*) the need for increased military commitment in the western regions of Pakistan (i.e. Balochistan, the Federally Administered Tribal Areas and Khyber Pakhtunkhwa).

It would be logical for Pakistan to develop boosted fission weapons, and perhaps also thermonuclear weapons. The extent to which such designs would need to be tested depends on the level of assistance China has given and will give in the future.

A 2004 quasi-official report stated that 'Pakistan will work towards the development of a triad by giving the Pakistani Navy nuclear capability'.[44] At that time, Pakistani planners did not refer to it as a priority.[45] The pace of the programme will depend on the scope of India's own effort (its first nuclear-powered ballistic missile submarine begins sea trials in 2012); Pakistan's confidence in the survivability of its land-based missiles; available resources and technical obstacles; and perhaps also the navy's ability to defend its own parochial interests. A navy component could be surface or undersea-based, the latter requiring an unlikely adaptation of the French-built Agosta-class diesel-electric submarines, or the acquisition of dedicated submarines (e.g. from China). It would likely rely on Hatf-7 cruise missiles.

By 2020 Pakistan should have a large, seamless family of nuclear capabilities. As its potential grows, Pakistan will probably be tempted to move away from minimum deterrence and increasingly towards flexible response and escalation dominance (a temptation which could also be a factor behind the expansion of the stockpile). A major question is whether it will endow its forces with a large number of short-range nuclear missiles such as the Nasr (see below). According to one estimate, by 2020 Pakistan could have 200 warheads, and perhaps many more.[46] This assumes, however, that it will have the resources and capabilities to produce enough fissile material and warhead components.

[41] The SPD is part of the Joint Chiefs of Staff Committee, a weak institution in Pakistan, and its Director General does not participate in the Corps Commanders Conference, arguably the apex of the Pakistani military system.

[42] Kristensen, H. and Norris, R., 'Pakistan's nuclear forces, 2011', *Bulletin of the Atomic Scientists*, vol. 67, no 4 (July/Aug. 2011).

[43] This figure is 19–26 according to Albright and Brennan (note 29) and 13–27 according to SIPRI (note 27), p. 347.

[44] Durrani (note 1), p. 31.

[45] Pakistani officials (note 10).

[46] Kristensen and Norris (note 42); and Kristensen, H. and Norris, R., 'Estimated Pakistani nuclear weapons and fissile materials', Chart, Federation of American Scientists (FAS) Strategic Security Blog, 17 July 2011, <http://www.fas.org/blog/ssp/2011/07/pakistannotebook.php>.

Few prospects for constraints on force development

It is unlikely that Pakistan will be the first Asian nuclear-capable country to ratify the 1996 Comprehensive Nuclear-Test-Ban Treaty (CTBT), unless—like France in 1995—it takes the decision to do so after a final testing campaign. It is equally unlikely that Pakistan will be the first to test again. But if India were to conduct a test, Pakistan would probably seize the opportunity to follow suit, either for technical reasons (e.g. enhancing reliability and security, testing new designs for smaller warheads or new types of warhead such as boosted fission or thermonuclear devices) or political motivations (e.g. 'settling the score' once again). Thus there are three scenarios.

1. Pakistan resumes testing after an Indian testing campaign. CTBT ratification then becomes an option.
2. Pakistan resumes testing after a critical design flaw is detected in one of its warhead formulas (unless China is willing to assist).
3. Pakistan announces that it will join the CTBT after conducting a final testing campaign.

Pakistan has produced a large stockpile of fissile material but wants to avoid any regime that would give a perpetual edge to India. Therefore, its position is that three conditions should be met before Pakistan joins a fissile material cut-off treaty.

1. Stock reductions should be progressive.
2. Transfers of stockpiles to civilian use should be organized in such a way that states with the largest ones lead the way in a verifiable fashion.
3. Caps on future stocks should reduce asymmetries in existing stocks.

In addition, Pakistan is worried that the India–USA deal could free India's military production capability. Pakistan's concern about the growing military and technological gap between itself and India has led it to increase its fissile material production. It will not participate in an FMCT unless India does so as well, while also reducing any asymmetry in the process. Meanwhile, Pakistan will continue to build up its stockpile and delay the opening of negotiations for such a treaty.[47] However, it claims that if it were the recipient of a Nuclear Suppliers Group waiver (as was the case with India), it would be willing to enter the negotiations.

III. BALLISTIC AND CRUISE MISSILE PROGRAMMES

By the late 1980s PAEC had begun to import Chinese missiles. A few years later, the KRL approached the Democratic People's Republic of Korea (DPRK, or North Korea) on behalf of the Pakistani military. Pakistan needed longer-range missiles, and China was being put under pressure by the USA to limit its ballistic technology transfers.

PAEC introduced the Ghaznavi solid-fuelled missile based on the Chinese M-11. The KRL introduced the liquid-fuelled, single-stage Ghauri based on the North Korean Nodong. The NDC, created in 1990 as an offshoot of PAEC, developed the single-stage Shaheen I based on China's M-9. All of these missiles were inducted into the Pakistani armed forces in 2003–2004. The NDC then developed the long-range, two-stage Shaheen II, now entering service and slated to become the crown jewel of the Pakistani deterrent. In 2011 Pakistan was estimated to have had a total of fewer than 100 of those medium and long-range missiles.

Pakistan is also developing a large family of theatre or battlefield-range missiles. In the 1980s SUPARCO developed the Hatf-1, which could possibly be nuclear-armed but is primarily intended to play a conventional role. As of 2011 Pakistan had about 100 Hatf-1 missiles. This family is now being enlarged through the development of a shorter-range missile (Nasr) and a longer-range missile (Abdali). The first test of the Nasr in 2011 was troublesome since it was advertised as nuclear-capable, when in fact a 60 km-range missile suggests more of a tactical than a strategic role (even though Pakistan considers all of its nuclear-armed missiles to be strategic in nature).

In the 2000s, partly in reaction to India's own programmes, Pakistan began developing two nuclear-capable cruise missile programmes: the Babur (ground-launched, possibly with other modes) and the longer-range Ra'ad (air-launched).

[47] Pakistan's Ambassador to the Conference on Disarmament (CD), Zamir Akram, said at the end of 2011 that 'In the time that we can, we need to enhance our own capabilities so that we have sufficient material for what we would then feel is a credible second-strike capability'. 'The South Asian nuclear balance: an interview with Pakistani Ambassador to the CD Zamir Akram', *Arms Control Today*, Dec. 2011.

Box 1. Screening programmes

Pakistan has set up screening procedures to ensure the loyalty and mental balance of personnel serving in the most sensitive positions. These procedures were established in the early 2000s, took two years to set up and required overcoming various forms of resistance.

Two different programmes exist: a Human Reliability Program for civilian personnel and a Personnel Reliability Program for military personnel. They have been applied to up to 4000 people (although the numbers vary), including about 2000 scientists or engineers working in particularly sensitive areas or who have critical knowledge, and who continue to be monitored after retirement.[a] The Strategic Plans Division (SPD) plans to extend these programmes to 10 000 personnel with access to sensitive information. The screening process can take up to a year and involves four different agencies: the Intelligence Bureau, the Inter-Services Intelligence (ISI), the Military Intelligence and the SPD. There are clearance rechecks every two years.

Unsurprisingly, checks are said to focus on finances and religious beliefs. Punjabis (who make up two-thirds of Pakistan's officers) are reportedly privileged over people of other origins. There have been reports of attempts by militant groups to infiltrate the nuclear complex through Pakistani scientists trained abroad.

[a] SPD officials estimate that 7000 to 10 000 people out of a total of 70 000 people in the nuclear and missile complex are nuclear scientists and engineers.

Sources: Goldberg, J. and Ambinder, M., 'The ally from hell', *The Atlantic*, Dec. 2011; Landau Network-Centro Volta (LNCV), 'Security and safety issues about the nuclear complex: Pakistan's standpoints' (LNCV: Como, 2008); Luongo, K. and Salik, N., 'Building confidence in Pakistan's nuclear security', *Arms Control Today*, Dec. 2007; Pennington M., 'Pakistan: nuclear assets safe, outlines nuclear protocol', Associated Press, 26 Jan. 2008; Sanger, D., *The Inheritance: The World Obama Confronts and the Challenges to American Power* (Harmony Books: New York, 2009), p. 212; and Wonacott, P., 'Inside Pakistan's drive to guard its A-bombs', *Wall Street Journal*, 29 Nov. 2007.

There have been unconfirmed plans for a Ghauri III, which may have been cancelled in favour of a planned Shaheen III.

Pakistan is not known to have exported its missiles or missile technology.

IV. CHEMICAL, BIOLOGICAL AND RADIOLOGICAL WEAPONS

Pakistan is reasonably well endowed with chemical and biological research and development facilities and industries. It also has a number of research centres that are assumed to conduct chemical and biological weapon defence and protection activities.[48] Pakistan would thus, on paper, be well placed to produce chemical or biological warfare agents.

However, there is no evidence of any active Pakistani programme in the areas of offensive chemical or biological warfare. Over the years accusations have been made to the contrary, notably in the Indian media, but they have never been seriously substantiated. The US sanctions imposed in 1998 on Pakistani entities on the suspicion that they could be involved in chemical or biological weapon activities have since been lifted.

Pakistan is a party to 1993 Chemical Weapons Convention (CWC), ratified in 1997, and to the 1972 Biological and Toxin Weapons Convention (BTWC), ratified in 1974. In 2000 it adopted legislation banning the development, production and use of chemical weapons, and there is no evidence that any inspection has revealed suspicious activities. Pakistan has been an active promoter of the CWC, probably in part because it signed it as a non-possessor (whereas India joined the convention as a possessor). Pakistan has also been at the forefront of BTWC negotiations.[49] However, it was stigmatized along with others such as China, India and Russia for its 'obstructionist' attitude at the most recent BTWC Review Conference.[50]

As stated above, India sought to pre-empt a Pakistani option to use chemical or biological weapons in a conflict by announcing in 2003 that it would not be

[48] The two most important research centres are based in Karachi: the Chemical and Biological Weapons Research Institute (at the University of Karachi's Husein Ebrahim Jamal Research Institute of Chemistry) and the Chemical Weapons and Biological Weapons Warfare Research and Development Laboratory (part of the official Defence Science and Technology Organization).

[49] Revill, J., 'Pakistan, biological weapons and the BTWC', Pakistan Security Research Unit (PSRU), University of Bradford, PSRU Brief no. 1, Mar. 2007, <http://spaces.brad.ac.uk:8080/download/attachments/748/Brief1finalised.pdf>.

[50] Bansak, K., 'A hinge moment for the BWC?', *Bulletin of Atomic Scientists*, 30 Jan. 2012.

Box 2. Physical security and surveillance

Three levels of nuclear security exist. The first level (or inner ring) is managed by the Strategic Plans Division (SPD), which controls around 9000 personnel dedicated to this task.[a] The SPD's directorate in charge of nuclear security is led by a two-star general and is endowed with its own counter-intelligence team. It has a cell in each of the four laboratories controlled by the National Command Authority (NCA), each headed by a one-star general. The second level is physical, including fencing, sensors and so on. The third level (or outer ring) is surveillance and monitoring of suspicious activities around the sites, with Inter-Services Intelligence (ISI) involvement. The SPD has a system of sensitive material control and accounting, which involves regular and surprise inspections. It has reportedly adopted inventory systems to track individual components of warheads. Theft- and tamper-proof containers and vehicles are used for storage and transport. The SPD has set up a 'Special Response Force' presumably to deal with nuclear incidents.

On the civilian side, the Pakistan Nuclear Regulatory Authority (PNRA), created in 2001 and including 200 experts, is in charge of the physical security of fissile material and radioactive sources. The military is strongly involved and the SPD's director general is a member of the PNRA. A five-year Nuclear Security Action Plan, designed to enhance the safety and security of nuclear materials and radioactive sources, was adopted by the PNRA in 2006. Special border controls have been set up. In 2011 a safety review of existing and planned facilities was conducted. All known sources have reportedly been registered, orphan sources have been recovered and two secure storage sites have been set up.

Pakistan cooperates with the International Atomic Energy Agency (IAEA) to improve nuclear safety.[b] It ratified the 1980 Convention on the Physical Protection of Nuclear Materials (CPPNM) in 2000 and participates in the Global Initiative to Combat Nuclear Terrorism. Pakistan has not, however, ratified the 2005 Amendment to the CPPNM and is not a party to the International Convention for the Suppression of Acts of Nuclear Terrorism.

[a] SPD officials give numbers ranging from 8000 to 10 000. A 2011 report by Rezaul Laskar claims that over 8000 new personnel will be trained by 2013 at the SPD Training Academy. A report by Andrew Bast mentions two army divisions, or about 18 000 troops, with the source being the former President Musharraf in a 2011 on-the-record interview with the author. This number may refer to the total of the current and future force.

[b] According to Michael Krepon, in 2006 the Stimson Center began hosting fellows from the PNRA.

Sources: Bast, A., 'Pakistan's nuclear surge', *Newsweek*, 23–30 May 2011; Inter-Services Public Relations (ISPR), Press Release PR29/2012-ISPR, 27 Feb. 2012; Krepon, M., 'Addressing the US–Pakistan strategic relationship', Testimony before the US Senate Committee on Homeland Security and Governmental Affairs, 12 June 2008 (US Government Printing Office: Washington, 2009); Landau Network-Centro Volta (LNCV), 'Security and safety issues about the nuclear complex: Pakistan's standpoints' (LNCV: Como, 2008); Laskar, R., 'Pak plans to train over 8000 personnel to augment N-security', Press Trust of India (PTI), 18 Oct. 2011; and Lavoy, P., 'Islamabad's nuclear posture: its premises and implementation', ed. H. Sokolski, *Pakistan's Nuclear Future: Worries Beyond War* (Strategic Studies Institute: Carlisle, PA, 2008), p. 152.

bound by its no-first-use posture in case it was attacked by such means.

There is no evidence that Pakistan either has or has had in the past any interest in radiological weapons.

V. ISSUES OF CONCERN FOR THE INTERNATIONAL COMMUNITY

Concerns about Pakistani WMD can be broken down into three categories: (*a*) WMD-related transfers; (*b*) loss of control of nuclear weapons; and (*c*) deliberate nuclear use. Two sets of measures taken in the post-1998 context (with limited US assistance) are supposed to contribute to the prevention of the first two categories: screening programmes, and physical security and surveillance measures (see boxes 1 and 2). The USA has helped Pakistan to refine such measures through the sharing of expertise and possibly equipment. These risks and their associated preventative measures are summarized in table 2.

Concerns about WMD materials, technology and expertise

The first category of risks involves the export of WMD materials or expertise by Pakistani authorities, or the transfer of such materials or expertise to a foreign state or to a non-state actor for domestic or foreign use.

State-sanctioned exports: a thing of the past?

For more than a decade, no known deliberate, state-approved transfer of WMD-related technology to foreign actors has occurred.

Consequently, there is little risk of a sudden radical change in Pakistani policy. Analysts agree that the risk of an Islamist coup does not exist. Islamist

Table 2. Pakistani nuclear and WMD risks and associated preventive measures

An x denotes the existence of a preventive measure.

Risk	Screening programmes	Separation of cores/ warheads/ launchers	Codes	Physical security and surveillance	Export controls
State-sanctioned export of WMD	–	–	–	–	–
Transfer of WMD expertise	x	–	–	x	–
Theft of WMD material	x	–	–	x	–
Export of WMD material	x	–	–	x	x
Capture of a nuclear weapon	x	x	–	x	–
Unauthorized use of a nuclear weapon	x	–	x	x	–
Deliberate use of a nuclear weapon	–	–	–	–	–

WMD = weapon(s) of mass destruction.

political forces are weak and divided; they do not fare well in elections. A US researcher stated in 2010 that 'The fortunes of the religious parties in the political space will continue to wax and wane, but not approach anything like a takeover of the government, much less the state'. He also concluded that 'speculation of a Taliban takeover dramatically overestimates the willingness of the political and military elites to surrender power to the Taliban'.[51] Indeed, public attitudes towards the Taliban have shifted in recent years. On the military side, there is no organized radical Islamist entity within the armed forces. Even when soldiers or officers have Islamist sympathies—many of them are members of the Jamaat-e-Islami—their primary loyalties generally lie with the military as an institution. As one analyst puts it, 'the army remains a conservative institution at heart, it is not yet a breeding ground for large numbers of radical Islamists'.[52]

However, in the long term, a change in Pakistan's policy preferences, along with a degradation of the relations with the USA and its allies, could lead it to make different deliberate strategic choices.

The possibility of uncontrolled leaks

Measures taken to prevent the transfer of WMD-related expertise and materials include, first and foremost, reliability programmes as well as physical security and surveillance.

In 1999 the Pakistani Commerce Division issued a statutory regulatory order to control the export of nuclear technology.[53] It implicated PAEC in the vetting of travel by officials linked with the nuclear programme. This did not prevent the KRL from advertising, in 2000, the sale of nuclear technology in newspapers, nor the Khan network from continuing its activities. Only after a scandal erupted in 2003–2004 did Pakistan become serious about exports controls. Pakistan's Export Control on Goods, Technologies, Material and Equipment related to Nuclear and Biological Weapons and their Delivery Systems Act was adopted in September 2004. Controlled items—a list of which was issued in 2005—include those of various nuclear and biological multilateral export control regimes, and the legislation includes a catch-all clause. In 2006 a Strategic Exports Control Division (SECDIV), headed by the foreign minister, was created. A revised control list was published in 2011. Fissile materials are likely to be stored near installations such as Kahuta or Khushab, which are located in Punjab, the part of Pakistan best controlled by the military.

As in any country, but perhaps more so in Pakistan than elsewhere, the measures summarized above are not guaranteed to be foolproof. A limited transfer of knowledge remains a possibility. Given the ambitions of Pakistan's civilian nuclear programme, in particular, any breakdown of law and order in the future could facilitate the theft of radiological sources or various non-fissile nuclear materials. A weakening of state cohesion would also make the scenario of very small

[51] Paris, J., *Prospects for Pakistan* (Legatum Institute: London, Jan. 2010), p. 28.

[52] Nawaz, S., *Crossed swords: Pakistan, Its Army, and the Wars Within* (Oxford University Press: Oxford, 2008), p. 585.

[53] Abbasi, A., 'Pakistan puts curbs on export control material,' *Dawn*, 11 Mar. 1999, quoted in Kampani, G., 'Military coup in Pakistan: implications for nuclear stability in South Asia', James Martin Centre for Non-proliferation Studies, Oct. 1999, <http://cns.miis.edu/reports/gaurav.htm>.

quantities of fissile material being gradually stolen from bulk processing facilities a real possibility.

Pakistan has been ranked 31st on a list of 32 states with respect to the security of weapon-usable nuclear materials.[54] The reasons given for this ranking include: the continued production of materials; political instability and corruption; the presence of non-state actors willing to seize materials; the non-ratification of several international agreements; and the fact that 'Pakistani government statements about the security of the arsenal do not necessarily address the nuclear materials security conditions for materials that may be in bulk-processing facilities, in transit, or in storage'. India has been ranked 28th on the same list.

The risk of radiological attack

A related risk is that of an attack designed to release large amounts of radioactivity during the transportation of nuclear material (e.g. spent nuclear fuel or radioactive sources). About 50 public and private firms handle the sources of greatest concern. However, only 6 per cent of these sources fall under IAEA categories 1 and 2. Pakistan seems well aware of the possible risks. PNRA experts regard the radiological attack scenario as a 'very remote probability bordering near impossibility'.[55] Nevertheless, the fear of a dirty bomb drove the US Government to attempt, without success, the repatriation of spent fuel from the Nilore research reactor, which until 1990 operated on HEU provided by the USA in the 1960s.

Concerns about loss of control of nuclear weapons

The second category of risks is that of loss of control of nuclear weapons to a terrorist group or rogue military unit. Preventive measures for this category also include reliability programmes and physical security and surveillance.

As stated above, weapons are probably kept in a disassembled form, but there is considerable uncertainty about the location of Pakistan's nuclear weapons. Some suggest that even the director of the Inter-Services Intelligence (ISI) does not know where the weapons are.[56] It would make sense for most of them to be located in the northern and central parts of Pakistan, in the safest and most secure area of Punjab. After the terrorist attacks on the USA of 11 September 2001, Pakistan ordered a redeployment of its arsenal (to at least six new secret locations according to one account), for fear of an Indian attack.[57] A similar redeployment occurred after the Abbottabad raid by the USA in May 2011, this time for fear of a US raid.[58] Pakistan plays some kind of shell game with its nuclear weapons and dummy locations reportedly exist. If the country has about 100 warheads, it would be surprising if more than 10 sites host weapons at any given time.[59] Some of these sites are subterranean and Pakistan has certainly gone to great lengths to physically protect them.

Any attack against a nuclear base would need to confound SPD and ISI surveillance and then break the physical and military barriers that would preclude access to a nuclear weapon. Insider complicity would be needed to defeat the reliability programmes, and any military involvement would require a breakdown in the culture of loyalty inherent to the Pakistani armed forces. If Pakistan has 10 storage sites, it presumably has hundreds (or possibly thousands) of personnel available to protect each of them. Further, access to a warhead is conditional on the attackers being able to secure both the fissile core and the warhead itself.

The initial security arrangements were primarily designed 'with India in mind'.[60] But in 2008 the SPD began to seriously address the potential threat posed by suicide bombers, instituting 'new protocols'.[61] The

[54] Nuclear Threat Initiative (NTI), 'NTI Nuclear Materials Security Index', Jan. 2012, <http://www.ntiindex.org/static/pdfs/nti_index_final.pdf>.

[55] Mannan, A., 'Preventing nuclear terrorism in Pakistan: sabotage of a spent fuel cask or a commercial irradiation source in transport' in ed. H. Sokolski, *Pakistan's Nuclear Future: Worries Beyond War* (Strategic Studies Institute: Carlisle, PA, 2008), p. 267.

[56] The director of the ISI is not a member of the NCA.

[57] Moore, M. and Khan, K., 'Pakistan moves nuclear arsenal and tightens control over arms', *International Herald Tribune*, 12 Nov. 2001. The move was confirmed by the director general of the SPD. Koch and Foss (note 9).

[58] 'Briefing for Adm. Mike Mullen, Chairman, Joint Chiefs of Staff', Confidential memorandum (undated), The Cable, *Foreign Policy*, 17 Nov. 2011, <http://www.foreignpolicy.com/files/fp_uploaded_documents/111117_Ijaz%20memo%20Foreign%20Policy.PDF>. The authors of this memorandum to the US Government wrote: 'One of the greatest fears of the military-intelligence establishment is that with your stealth abilities to enter and exit Pakistani airspace at will, Pakistan's nuclear assets are now legitimate targets.'

[59] When splitting their arsenals between different bases, nuclear-capable states have to balance various operational, logistic, security and cost constraints. Assuming no less than 10 nuclear warheads per site would be a good compromise.

[60] Cheema (note 21), p. 207.

[61] US Embassy in Islamabad, 'Pakistan: CJCS Mullen meets with General Kidwai on safeguarding nuclear assets', Cable to US State Department, no. 08ISLAMABAD736, 20 Feb. 2008, <http://wikileaks.org/cable/2008/02/08ISLAMABAD736.html#>.

terrorist attacks that have taken place in recent years against key military facilities, however, can hardly be considered as precedents. A potential danger is an attack designed to show the weakness of the state or create tensions within the country (or with India). But such an attack would not in itself lead to access to warheads. Even the sophisticated 2009 attack on the Pakistani Army's General Headquarters in Rawalpindi by the Tehrik-i-Taliban Pakistan (Taliban Movement of Pakistan) pales in comparison with what would be needed to gain such access.

Intention is also debatable: radical Islamists are generally proud of Pakistan's nuclear capability and have so far shown little interest in attacking the country's nuclear infrastructure. Discussions of attacks against Pakistani nuclear facilities are sometimes seen on jihadist forums, but protecting nuclear assets from US seizure in case of a hypothetical Taliban takeover of the country seems at least as important a priority. Only avowed adversaries of the regime mention their interest in having access to Pakistan's weapons after they take control of the state.[62]

Even if a non-state actor or rogue military unit were able to take control of a nuclear warhead, it would still need to transport it—including perhaps taking it out of the country—while continuing to defeat the army's defences. The alternative would be detonation on site; but even then, a rapid launch would require access to a mated missile (although suicide detonation could be an option).

The last line of defence is coding. Coding is now carried out during the manufacturing process: the launch officer receives the code a few moments before use and inserts it via a computer.[63] For aircraft, pilots receive the code during flight.[64] It has been surmised that 12-digit alphanumerical codes, generated by the Military Intelligence agency, are used.[65] Codes are physically present on bases, split between two officers according to a two-man rule.[66] There are both enabling and authenticating codes.[67] These arrangements are supplemented by 'a tightly controlled ID system' and there is no involvement of intelligence services in the chain of command.[68] At some points in the chain of command, a three-man rule operates 'for technical reasons', according to the SPD.[69] One informed source claims that the arming code is divided between three persons.[70]

Gauging the possibility of unauthorized use depends on the exact nature of the codes used by Pakistan. Are the arming mechanisms buried deep in the warhead design, or can coding be bypassed? Do they include disabling features? Is there a code for each warhead or set of warheads, or just a general nuclear release enabling mechanism? Does physically arming a warhead depend on a code transmitted down the chain of command at the last minute, or would the code(s) already present at the base be enough?

The NCA authorizes each step of the process leading to nuclear use. According to the SPD, 'no delegation of authority concerning nuclear weapons is planned'.[71] However, devolution procedures have been set up to ensure continuous control of the arsenal in case of the leadership being incapacitated (or decapitated in wartime). The prime minister can delegate his NCA powers to the chairman of the Joint Chiefs of Staff Committee (and not to the head of the army, the most powerful military officer in the country). The deputy chairs of the DCC and the ECC have the authority to replace the prime minister if he is incapacitated.

It is noteworthy that the control of nuclear weapons has survived an abrupt change in leadership (in 1988), a military coup (in 1999) and a major constitutional change (in 2010). Instability in Pakistan has not been dramatically higher than in other nuclear-capable states: China survived the Cultural Revolution of 1966–76; the Soviet Union experienced the 1991 attempted coup and breakup of the country, and the 1993 crisis; and France went through the 1958 regime change and the 1961 attempted coup. There is no reason to believe

[62] Roggio, B., 'Taliban commander wants Pakistan's nukes, global Islamic caliphate', *Long War Journal*, 20 Mar. 2012.

[63] Geo TV, Interview with Samar Mubarakmand, 5 Mar. 2004, <http://www.pakdef.info/forum/showthread.php?9214-Dr.-Samar-Mubarakmand-s-Interview-with-Geo-TV&s=17bc29067b55ad963942c681bd13eb18>. The first Pakistani warheads were not fitted with coding mechanisms. Luongo, K. and Salik, N., 'Building confidence in Pakistan's nuclear security', *Arms Control Today*, Dec. 2007.

[64] Durrani (note 1), p. 33.

[65] Moreau, R., 'Pakistan's nukes', *Newsweek*, 26 Jan. 2008; and Gregory, S., 'The security of nuclear weapons in Pakistan', Pakistan Security Research Unit (PSRU), University of Bradford, PSRU Brief no. 22, 18 Nov. 2007, <http://spaces.brad.ac.uk:8080/download/attachments/748/Brief_22finalised.pdf>, p. 4.

[66] Durrani (note 1), p. 33.

[67] Gregory (note 65), p. 4.

[68] Gregory (note 65), p. 3; and Gregory, S., 'Nuclear command and control in Pakistan', *Defence and Security Analysis*, vol. 23, no 3 (Sep. 2007), p. 319.

[69] Pakistani officials (note 10).

[70] Durrani (note 1), pp. 24, 33.

[71] Quoted in Cotta-Ramusino and Martellini (note 8). See also Cheema (note 21), p. 208.

that Pakistan's command and control arrangements, for instance, could not survive another military coup.[72]

The Pakistani context, however, calls for caution. One respected US expert worries that the country is 'losing its coherence as a State'.[73] In the longer term, the legal and institutional barriers that have been put into place to protect the arsenal could erode. A weakening of the state and an increased sympathy for radical militants within the armed forces or the nuclear establishment would make for a dangerous combination.[74] For instance, the generation of military leaders brought up under the presidency of Zia-ul-Haq will soon reach the top echelons of the Pakistani Army. If the army was stretched thin due to grave domestic unrest and tensions with India, the control of the nuclear complex could suffer. Finally, how the SPD, currently rather insulated from the rest of the military and endowed with a rather benign view of the USA, will transition to the post-Kidwai era is also open to question.[75]

Most importantly, no one can guarantee that the robust set of procedures and controls that secure the arsenal would resist the extraordinary pressures of a nuclear crisis, and the fog of war during a conflict with India. Some also fear that a well-organized non-state actor could deliberately create a domestic or an international crisis to trigger the movement of warheads and then attempt to capture some of them. Any such movement, for operational or security reasons, creates vulnerabilities. A precaution such as their transportation in non-descript convoys could backfire if used in a crisis, since such convoys are inherently less well guarded than military ones.[76]

A dispersal of warheads might increase the risk of a loss of control. Further, the development of a tactical nuclear capability might lead to a possible change in the Pakistani posture, with permanent mating and at least partial predelegation.[77] Likewise, if Pakistan developed more elaborate and miniaturized designs, separation of the core and the rest of the warhead might become impossible. Pakistan faces a classic dilemma: survivability and readiness call for dispersion, movement and pre-delegation, whereas security and secrecy call for concentration, no movement and code retention.[78]

Another issue worth raising is how the system would resist a rift within the NCA in wartime if, for instance, the prime minister publicly opposed the use of nuclear weapons.

Concerns about deliberate nuclear use

The most important Pakistani nuclear risk today, in relative terms, is in fact the third category of deliberate nuclear use.

The induction of nuclear weapons in South Asia has had mixed consequences. Since 1998 there has been no major conventional war in the region, but the propensity for risk taking remains high: Pakistan risked war in 1999 by sending armed militants across the Line of Control, wrongly believing that India would be deterred from reacting; both countries went to the brink of war in the winter of 2001–2002; and India was close to retaliating against Pakistan after the 2008 Mumbai terrorist attacks.

India has attempted to checkmate Pakistan and block the avenues that it thinks Pakistan might open with its nuclear capability. The 1999 incident led to India stating that it would not hesitate to wage a limited war. The 2001–2002 crisis led to India's adoption in 2004 of the Cold Start doctrine: a fast campaign with limited objectives, capturing territory up to 50–80 km inside Pakistan, but without months of mobilization—leaving

[72] The memogate controversy—a 2011 scandal involving backchannel communications between parts of the Pakistani civilian government and the US Government—suggested differences of appreciation between the military and part of the civilian leadership about the current nuclear security arrangements. See 'Briefing for Adm. Mike Mullen, Chairman, Joint Chiefs of Staff' (note 58).

[73] Stephen Cohen quoted in Goldberg, J. and Ambinder, M., 'The ally from hell', *The Atlantic*, Dec. 2011.

[74] A well-known Pakistani nuclear physicist notes that students in his department at Quaid-i-Azam University (a recruitment pool for the nuclear complex) have become increasingly conservative. Wonacott, P., 'Inside Pakistan's drive to guard its A-bombs', *Wall Street Journal*, 29 Nov. 2007.

[75] Kidwai—who like many Pakistani officers of his generation was partly trained in the USA—has won unanimous praise from Western security establishments. His biography is recounted in Sanger, D., *The Inheritance: The World Obama Confronts and the Challenges to American Power* (Harmony Books: New York, 2009), pp. 195–200.

[76] The use of 'civilian-style vehicles' was reported in Goldberg and Ambinder (note 73). Note that weapons would probably be encased in tamper-proof containers.

[77] A former SPD official admitted as much in 2005 when writing that 'partial pre-delegation' would be an 'operational necessity because dispersed nuclear forces as well as central command authority . . . are vulnerable'. Khan, F. H., 'Nuclear command and control in South Asia during peace, crisis and war', *Contemporary South Asia*, vol. 14, no. 2 (June 2005), pp. 168–169.

[78] Some analysts claim that the expansion of the Pakistani arsenal will create additional vulnerabilities. This would be true if there was a corresponding increase in the number of nuclear bases, which might not be needed (and Pakistan presumably has a higher number of vaults than warheads in order to move them).

Box 3. The Saudi Arabian scenario: how credible?

Over the past 15 years analysts have speculated about the possibility of a Pakistani option should Saudi Arabia decide to replace its old fleet of CSS-2 missiles or obtain its own nuclear deterrent. Several variants of this scenario are possible.

1. A Pakistani nuclear guarantee to Saudi Arabia.
2. A stationing of Pakistani missiles on Saudi Arabian soil.
3. The sale of Pakistani missiles to Saudi Arabia.
4. The stationing of nuclear-armed aircraft or missiles on Saudi Arabian soil (without relinquishing control of the warheads).
5. The sale of Pakistani missiles armed with nuclear weapons to Saudi Arabia.

The first scenario is highly credible, whereas the fifth scenario is highly implausible. A former Strategic Plans Division (SPD) official referred in 2005 to the deployment of Pakistani warheads on Saudi Arabian soil as 'worse than the Cuban missile crisis'.[a]

While there is no hard evidence of nuclear cooperation between the two countries in the public domain, it would be surprising if Saudi Arabia and Pakistan did not discuss such scenarios. The two countries have a deep and longstanding relationship, including in the military domain, and Pakistan has benefitted from indirect Saudi Arabian assistance that has helped to cover the cost of its nuclear programme.

[a] Pakistani officials, Off-the-record interviews and informal conversations with author, 2004–2008.

no time for Pakistan or the international community to react.

The stability–instability paradox seems appropriate in characterizing the strategic situation in the region. The strong possibility that one incident will degenerate into full-scale war is far from trivial. Another attack like that in Mumbai could be enough to trigger such a confrontation.

If war were to erupt, the nuclear question might be raised after just a few days of fighting—as might have been the case for NATO against the Soviet Union. India has sought to foreclose any non-conventional option that Pakistan could have. In 2003 it warned Pakistan that it would not feel bound by its no-first-use posture in the case of the use of chemical or biological weapons. It has informed Pakistan that any detonation of a weapon of Pakistani origin on Indian soil would be treated as intentional even if Pakistan denied responsibility.

In 2003 India also made known that it would use nuclear weapons in response to any use of such weapons against it, even on Indian forces operating on Pakistani territory. But it is far from certain that this would deter Pakistan from crossing the threshold if it felt compelled to do so to ensure its survival. Pakistan, in turn, now implicitly threatens to develop a tactical nuclear capability to block a sudden invasion of its territory. Despite its no-first-use doctrine, India could react by considering pre-emptive options—just as the Soviet Union did during the cold war to counter the possibility of the first use of a nuclear weapon by NATO.

In summary, the risk is that a combination of nationalist passion (on both sides), self-confidence, misunderstanding (compounded by the fact that both leaderships believe they understand each other) and miscommunication (despite the existence of dedicated channels, which are not used in crisis time) would turn a small-scale crisis into nuclear war.

VI. EUROPEAN UNION POLICIES AND CONCERNS

The EU's relationship with Pakistan began to develop in 2004 through a third generation cooperation agreement focused on partnership and development.[79] A European Commission Pakistan Country Strategy Paper for 2007–13 also focuses on poverty reduction through 'rural development and natural resources management in [Khyber Pakhtunkhwa] and Baluchistan' and 'education and human resources development'. From 2000 to 2006 the EU allocated €338 million in grants to Pakistan. The strategy paper allocated €398 million for 2007–13 through the Development Cooperation Instrument, approximately €200 million of which was spent between 2007 and 2010. At the second EU–Pakistan Summit in 2010, a

[79] Council Decision of 29 Apr. 2004 concerning the conclusion of the Cooperation Agreement between the European Community and the Islamic Republic of Pakistan, *Official Journal of the European Union*, L378, 23 Dec. 2004.

50 per cent increase in development assistance for 2011–13 was announced. The EU spends about 10 per cent of what the USA does on Pakistan, yet, taken together, the EU and its members are the number one provider of development assistance to the country, and the EU is Pakistan's first trading partner.[80]

Despite the physical distance between the EU and Pakistan, there are three main concerns for the EU and its members regarding Pakistan's nuclear and WMD programmes: (*a*) the use of nuclear weapons; (*b*) imports of WMD technologies and materials from the EU; and (*c*) proliferation to the EU neighbourhood.

Use of nuclear weapons: consequences for the EU

The EU should be primarily concerned about the global impact of any use of nuclear weapons on the South Asian subcontinent. Even a limited nuclear strike (the detonation of a single weapon) would have a profound and lasting psychological impact on global financial and economic markets. A true nuclear exchange between India and Pakistan would have even more important consequences and would significantly hamper both countries growth and modernization. In addition, such an exchange would most likely have physical (e.g. climate-related) consequences that would be felt in Europe as in the rest of the world.

There is no evidence at this point that Pakistan is interested in obtaining intercontinental-range missiles that could cover the EU territory.[81] However, EU members might have military facilities within reach of Pakistani longer-range missiles (e.g. France and the United Kingdom in the Gulf) or temporary bases and personnel (during an operation in the region). In the case of a deterioration in Pakistan's relations with the West, this could be a subject of concern.

In the event of a complete state breakdown, WMD materials could find their way onto black markets for possible use on European territory by non-state actors.

Imports of WMD technologies and materials from the EU

Pakistan's nuclear weapon programme may not be completely self-sufficient. Having based the programme on foreign imports, and being endowed with a relatively weak industrial base, Pakistan has continued to import components for spare parts and upgrades for the modernization of its facilities and weapons. Even if Pakistan could produce most of the parts itself, it would still have an incentive to seek more advanced, higher quality components from abroad. In 2005 an intelligence report for the EU apparently claimed that Pakistan was still shopping for high-grade aluminium, ring magnets and machine tools that could be useful for its nuclear programme, stating that 'Since the beginning of 2004 extensive procurement efforts for the Pakistani nuclear sector have been registered'. The report allegedly listed 20 Pakistani institutions involved in such imports.[82]

Proliferation to the EU neighbourhood

As already stated, the risk of deliberate state-sponsored Pakistani WMD transfers is low today (with the exception perhaps of the Saudi Arabia scenario—see box 3), but that risk would increase in the case of a breakdown in Western relations with Pakistan or a complete reorientation of Pakistan's policies in the future. Such a hypothesis would open up the possibility of government-level strategic cooperation with countries close to Europe, either in North Africa or the Middle East. At this point, however, it remains a theoretical possibility—as does the risk of unauthorized transfers of fissile material to Europe.

VII. CONCLUSIONS AND RECOMMENDATIONS

The EU is still a minor strategic player in Pakistan and it seems to be almost inactive regarding what is arguably one of the world's foremost WMD concerns. Granted, the EU is likely to remain a secondary actor in this field, due to the prominence of the Pakistan–USA relationship and the importance of Pakistan–UK bilateral relations, which the UK would be reluctant to 'Europeanize'. However, the advantage that Europe has in its relationship with Pakistan is that it does not come

[80] European External Action Service, 'Pakistan', <http://eeas.europa.eu/pakistan/index_en.htm>; Chappell, G., *Pakistan: What Role for the European Union?*, German Institute for International and Security Affairs (SWP) Working Paper (SWP: Berlin, July 2009); and Castillejo, C., *Pakistan's Crisis: What Role for the EU?*, FRIDE Policy Brief, Agora Asia–Europe no. 1 (FRIDE: Madrid, Dec. 2011).

[81] There are unconfirmed plans for a 4000–4500-km range Shaheen III.

[82] Traynor, I. and Cobain, I., 'Intelligence report claims nuclear market thriving', *The Guardian*, 4 Jan. 2006.

with the heavy baggage, full of mutual suspicions and recriminations, which characterizes Pakistan–USA relations. Thus, a few recommendations can be suggested.

1. Within the framework of the EU–Pakistan 5-year Engagement Plan, the dialogue with Pakistan should include WMD proliferation issues.[83] The dialogue should also be primarily aimed at gaining a better understanding of Pakistani positions and should not be focused on lecturing Pakistan on joining the 1968 Non-Proliferation Treaty, the CTBT or an FMCT, which would probably be useless and counterproductive.

2. Pakistan should be encouraged to endorse the 2005 Amendment to the CPPNM and the International Convention for the Suppression of Acts of Nuclear Terrorism, but not before a majority of EU member states have themselves done so.

3. As stated above, some of the major WMD-related risks that could develop in Pakistan would stem from a weakening of the state or radicalization of its elites. Given its expertise on justice and security sector reform, the EU could reorient some of its assistance to the strengthening of the rule of law in the country. Investing in education reform would also be a sound priority. Poverty reduction and humanitarian assistance are laudable goals but perhaps the EU should focus on areas where its real added value can be of most benefit.

4. The EU could provide technical assistance and exchange best practices in a number of areas, including the safety and security of civilian nuclear installations (due to its two decades of assistance to Eastern Europe and the former Soviet Union) as well as export control laws and regulations.

5. Conditionality—a tool of the EU Strategy against the Proliferation of WMD—should be used with caution. Pakistan's commitment to maintaining its nuclear deterrent is extremely strong and it will probably not accept any unequal treatment compared with India.[84]

6. Finally, the EU and its members should be aware that their technology transfers and military sales to South Asian countries could have an impact on Pakistan's WMD programmes. It would be excessive to say that transfers and sales to India could increase Pakistan's reliance on nuclear weapons and that transfers and sales to Pakistan could decrease it. Further, even if true as a general principle, it could not form the basis of a European policy towards the region. (There are good reasons, for instance, for India to be considered a privileged partner of Europe.) However, Europe should at least realize that its technology and military trade choices could have strategic consequences for the stability and security of the region.

[83] The dialogue could benefit from information provided by the UK and France, based on the more in-depth discussions that the two countries presumably have (or could have) with Pakistan on nuclear matters.

[84] The EU–India free trade agreement will not include a conditionality clause. Emergency trade preferences granted by the EU to Pakistan after the 2010 floods were not conditional.

ABBREVIATIONS

BTWC	Biological and Toxin Weapons Convention
CPPNM	Convention on the Physical Protection of Nuclear Materials
CTBT	Comprehensive Nuclear-Test-Ban Treaty
CWC	Chemical Weapons Convention
DCC	Development Control Committee
ECC	Employment Control Committee
FMCT	Fissile material cut-off treaty
HEU	Highly enriched uranium
ISI	Inter-Services Intelligence
KRL	Khan Research Laboratories
NATO	North Atlantic Treaty Organization
NCA	National Command Authority
NDC	National Development Complex
NESCOM	National Engineering and Scientific Commission
PAEC	Pakistan Atomic Energy Commission
SPD	Strategic Plans Division
WMD	Weapon(s) of mass destruction

EU Non-Proliferation Consortium

The European network of independent non-proliferation think tanks

A EUROPEAN NETWORK

In July 2010 the Council of the European Union decided to create a network bringing together foreign policy institutions and research centres from across the EU to encourage political and security-related dialogue and the long-term discussion of measures to combat the proliferation of weapons of mass destruction (WMD) and their delivery systems.

STRUCTURE

The EU Non-Proliferation Consortium is managed jointly by four institutes entrusted with the project, in close cooperation with the representative of the High Representative of the Union for Foreign Affairs and Security Policy. The four institutes are the Fondation pour la recherche stratégique (FRS) in Paris, the Peace Research Institute in Frankfurt (PRIF), the International Institute for Strategic Studies (IISS) in London, and Stockholm International Peace Research Institute (SIPRI). The Consortium began its work in January 2011 and forms the core of a wider network of European non-proliferation think tanks and research centres which will be closely associated with the activities of the Consortium.

MISSION

The main aim of the network of independent non-proliferation think tanks is to encourage discussion of measures to combat the proliferation of weapons of mass destruction and their delivery systems within civil society, particularly among experts, researchers and academics. The scope of activities shall also cover issues related to conventional weapons. The fruits of the network discussions can be submitted in the form of reports and recommendations to the responsible officials within the European Union.

It is expected that this network will support EU action to counter proliferation. To that end, the network can also establish cooperation with specialized institutions and research centres in third countries, in particular in those with which the EU is conducting specific non-proliferation dialogues.

http://www.nonproliferation.eu

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PRIF Peace Research Institute Frankfurt — HSFK Hessische Stiftung Friedens- und Konfliktforschung

PEACE RESEARCH INSTITUTE IN FRANKFURT

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