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Armaments, Disarmament and International Security

Pakistani nuclear forces

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VII. Pakistani nuclear forces

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Pakistan is estimated to possess about 100–120 nuclear weapons for delivery by aircraft and land-based missiles (see table 6.8). It is widely believed that, in peacetime, Pakistan stores its nuclear warheads separate from their delivery vehicles. According to some accounts it is also possible that the warheads are kept in disassembled form.¹ However, the Strategic Plans Division (SPD), which operates Pakistan's nuclear forces, has never confirmed such arrangements. In 2012 Pakistan conducted a series of missile trials testing most of its nuclear-capable missile types that are currently in operational service or still under development.

Pakistan's current warhead designs are believed to use highly enriched uranium (HEU). However, the expansion of Pakistan's plutonium-production capabilities and the development of smaller nuclear-capable ballistic and cruise missiles could indicate a trend towards an arsenal based partly on plutonium. Warheads using plutonium could be lighter and more compact than those using HEU to achieve similar yields. Nevertheless, there is no confirmation of a successful test of a plutonium-based warhead design so far.

Pakistan is expanding its main plutonium production complex at Khushab, Punjab. The complex currently consists of three heavy water nuclear reactors and a heavy water production plant. Work on a fourth heavy water reactor appears to have started in late 2010 and is reportedly halfway to completion.² It remains unclear whether Pakistan intends to construct a fifth reactor at the Khushab site. It is widely believed that each of the four reactors has a capacity of 40–50 megawatts-thermal. The first reactor at the site, Khushab-I, has been operational since 1998 and is estimated to produce 6–12 kilograms of plutonium annually (depending on operational efficiency), or enough for one to three nuclear warheads, depending on warhead design and fabrication skills.³ The second reactor, Khushab-II, may have commenced operation in late 2009 or 2010. Construction of the third reactor at Khushab began in 2006 and appears to have

¹ See Tertrais, B., 'Pakistan's nuclear and WMD programmes: status, evolution and risks', Non-Proliferation Papers no. 19, EU Non-Proliferation Consortium, July 2012, <<http://www.nonproliferation.eu/activities/activities.php>>, p. 5.

² Albright, D. and Avagyan, R., 'Construction progressing rapidly on the fourth heavy water reactor at the Khushab nuclear site', Institute for Science and International Security (ISIS) Imagery Brief, 21 May 2012, <<http://isis-online.org/isis-reports/>>.

³ International Panel on Fissile Materials, 'Countries: Pakistan', 3 Feb. 2013, <<http://fissilematerials.org/countries/pakistan.html>>.

Table 6.8. Pakistani nuclear forces, January 2013

Type	Range (km) ^d	Payload (kg)	Status
<i>Aircraft</i>			
F-16A/B	1 600	4 500	Undergoing mid-life upgrades, to be completed in 2014
Mirage V	2 100	4 000	Used to test launch the Ra'ad; possibly nuclear-capable
<i>Land-based ballistic missiles</i>			
Abdali (Hatf-2)	~180	200–400	Under development; test launched on 5 and 11 Mar. 2012
Ghaznavi (Hatf-3)	290 ^b	500	Entered service with the Pakistani Army in 2004; fewer than 50 launchers deployed; most recent test-launch on 10 May 2012
Shaheen I (Hatf-4) ^c	650 ^d	750–1 000	Entered service with the Pakistani Army in 2003; fewer than 50 launchers deployed
Ghauri (Hatf-5)	>1 200	700–1 000	Entered service with the Pakistani Army in 2003; fewer than 50 launchers deployed; last test-launched on 28 Nov. 2012
Shaheen II (Hatf-6)	2 500	(~1 000)	Under development; last known test-launch on 21 Apr. 2008; expected to become operational soon
Nasr (Hatf-9)	~60	..	Under development; test launched on 29 May 2012
<i>Cruise missiles</i>			
Babur (Hatf-7)	600 ^e	400–500	Under development; test launched on 17 Sep. 2012; initially ground-launched, but sea- and air-launched versions reportedly also under development
Ra'ad (Hatf-8)	350	..	Under development; air-launched; most recent test-launch on 31 May 2012

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

^a Aircraft range is for illustrative purposes only; actual mission range will vary according to flight profile and weapon loading. Missile payloads may have to be reduced in order to achieve maximum range.

^b The US Government estimates the range of the Ghaznavi to be 400 km.

^c An extended-range version of the Shaheen I, the Shaheen 1A (also designated Hatf-4), is under development. The Shaheen 1A was test launched on 25 Apr. 2012.

^d The US Government estimates the range of the Shaheen I to be 450 km or more.

^e Since 2006 the range of flight-tests has increased from 500 km and the goal is rumoured to be 1000 km.

Sources: Pakistani Ministry of Defence; US Air Force, National Air and Space Intelligence Center (NASIC), *Ballistic and Cruise Missile Threat* (NASIC: Wright-Patterson Air Force Base, OH, June 2009); US Central Intelligence Agency, 'Unclassified report to Congress on the acquisition of technology relating to weapons of mass destruction and advanced conventional munitions, 1 January through 30 June 2002', Apr. 2003, <<https://www.cia.gov/library/reports/archived-reports-1/>>; US National Intelligence Council (NIC), *Foreign Missile Developments and the Ballistic Missile Threat through 2015*, Unclassified summary of a National Intelligence Estimate (NIC: Washington, DC, Dec. 2001); International Institute for Strategic Studies, *The Military Balance 2006–2007* (Routledge: London, 2007); 'Nuclear notebook', *Bulletin of the Atomic Scientists*, various issues; and authors' estimates.

been completed in late 2011.⁴ Analysis of commercial satellite imagery suggests an increase in the Khushab reactors' cooling capacity. This could allow the reactors to operate at an increased capacity and produce slightly more plutonium than previously estimated.⁵

Pakistan also continues to produce HEU for military purposes. The enrichment is believed to be taking place at the uranium centrifuge facilities at Kahuta and Gadwal. Pakistan's stockpile of HEU is estimated to have been 3 tonnes in 2012 (see section X below).

The Khushab nuclear complex, combined with Pakistan's continuing HEU production, could increase Pakistan's annual nuclear warhead production capacity several-fold. This will depend, however, on the country having sufficient capacity to reprocess spent fuel as well as an adequate supply of uranium to fuel the reactors at Khushab.

Land-based missiles

Pakistan is expanding its nuclear-capable missile arsenal. The SPD currently deploys the Ghaznavi (also designated Hatf-3) and Shaheen I (Hatf-4) solid-fuelled, road-mobile short-range ballistic missiles (SRBMs). An extended-range version of the Shaheen I, the Shaheen IA, is under development. Pakistan's only operational medium-range ballistic missile (MRBM), the liquid-fuelled, road-mobile Ghauri I (Hatf-5), is believed to be based on the North Korean Nodong missile.

Additional types of nuclear-capable ballistic missile are currently under development. The Shaheen II (Hatf-6) is a two-stage, solid-fuelled, road-mobile MRBM that may eventually replace the Ghauri I MRBM.

Unlike India, Pakistan is developing several nuclear-capable SRBMs that appear to be intended for battlefield missions. According to the Pakistani military, the short-range Abdali (Hatf-2), which was test-fired on 5 and 11 March 2012, provides 'an operational level capability, additional to the strategic level capability'.⁶ This could suggest that the Abdali will become operational soon. Similarly, the Pakistani military has described the 60 kilometre-range, road-mobile Nasr (Hatf-9) SRBM as a 'quick response

⁴ International Panel on Fissile Materials, *Global Fissile Material Report 2011: Nuclear Weapon and Fissile Material Stockpiles and Production* (IPFM: Princeton, NJ, 2011), p. 19; and Albright, D. and Brannan, P., 'Pakistan appears to be building a fourth military reactor at the Khushab nuclear site', Institute for Science and International Security (ISIS) Imagery Brief, 9 Feb. 2011, <<http://isis-online.org/isis-reports/>>.

⁵ Patton, T., 'Combining satellite imagery and 3D drawing tools for nonproliferation analysis: a case study of Pakistan's Khushab plutonium production reactors', *Science & Global Security*, vol. 20, nos 2–3 (2012).

⁶ Pakistani Inter Services Public Relations, Press Release no. PR34/2012-ISPR, 5 Mar. 2012, <http://ispr.gov.pk/front/main.asp?o=t-press_release&id=1979>; and Pakistani Inter Services Public Relations, Press Release no. PR62/2011-ISPR, 11 Mar. 2011, <http://www.ispr.gov.pk/front/main.asp?o=t-press_release&id=1689>.

system', which 'add[s] deterrence value' to the posture 'at shorter ranges' in order 'to deter evolving threats'.⁷ The missile is launched from a mobile multi-tube launcher that can 'fire a four missile salvo' in 'evolving scenarios'.⁸

Pakistan's missile development organization, the National Engineering and Scientific Commission (NESCOM), is also developing two types of nuclear-capable cruise missile: the ground-launched Babur and the air-launched Ra'ad.

The development of new types of nuclear-capable SRBM and cruise missile may be an indication of Pakistan's growing concern about being able to counter India's superior conventional forces and nascent ballistic missile defences. It further suggests that Pakistan's strategic planning has evolved to include a wider range of contingencies for the use of nuclear weapons, possibly in response to the Indian Army's Cold Start doctrine, under which India could carry out rapid but limited conventional attacks on Pakistani territory using forward-deployed forces.

Strike aircraft

It is widely believed that the Pakistani Air Force (PAF) has previously given a nuclear delivery role to its 32 F-16A/B combat aircraft, but it is unclear whether they are currently assigned a nuclear mission. The F-16 aircraft, which are organized in three squadrons, were supplied by the United States in the 1980s. They are currently undergoing a mid-life upgrade (MLU), which is expected to be completed in 2014. Turkish Aerospace Industries, which was contracted to upgrade the aircraft, handed over the first batch of F-16 Block 15 MLU aircraft to the PAF in February 2012.

The PAF's Mirage V combat aircraft could also have a nuclear-delivery role. The range of the Mirage aircraft has been extended by the PAF's development of an aerial refuelling capability using Il-78 aircraft.

⁷ Pakistani Inter Services Public Relations, Press Release no. PR94/2011-ISPR, 19 Apr. 2011, <http://www.ispr.gov.pk/front/main.asp?o=t-press_release&id=1721>.

⁸ Pakistani Inter Services Public Relations, Press Release no. PR17/2013-ISPR, 11 Feb. 2013, <http://www.ispr.gov.pk/front/main.asp?o=t-press_release&id=2240>.