VII. Pakistan 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 2013 Pakistan continued development and testing trials of 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). Pakistan continues to produce HEU for military purposes and its stockpile is estimated to have been 3 tonnes in 2013 (see section X below). The enrichment is believed to take place at the uranium centrifuge facilities at Kahuta and Gadwal, Punjab.

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. Construction of a fourth heavy water reactor is under way and may be nearing completion.[2] 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 2005

[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/detail/construction-progressing-rapidly-on-the-fourth-heavy-water-reactor-at-the-k/>.

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

or 2006 and appears to have been completed in late 2011.[4] Based on satellite imagery analysis, Khushab-III appears to have become operational in late 2012 or early 2013. Additional 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]

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, appears to be under development.

Pakistan has two types of medium-range ballistic missile (MRBM): the liquid-fuelled, road-mobile Ghauri (Hatf-5), which is believed to be based on the North Korean Nodong missile; and the Shaheen II (Hatf-6), a two-stage, solid-fuelled, road-mobile MRBM.

The status of the Shaheen II is uncertain. The missile was test launched six to seven times between 2004 and 2008, including two army tests in 2008 that indicate the weapon was being inducted into the military. The US Air Force National Air and Space Intelligence Center (NASIC) stated in 2013 that the Shaheen II 'probably will soon be deployed', but there have been no reports of the missile being flight tested since 2008.[6] This could indicate that the programme has encountered serious technical difficulties. It is possible, but unknown, that the extended-range Shaheen I tested in 2012 is intended to temporarily fill the void until Shaheen II becomes operational.

[4] International Panel on Fissile Materials (IPFM), *Global Fissile Material Report 2011: Nuclear Weapon and Fissile Material Stockpiles and Production* (IPFM: Princeton, NJ, 2011), p. 19; and Kelleher-Vergantini, S. and Avagyan, R., 'Further construction progress on the fourth heavy water reactor at Khushab nuclear site', Institute for Science and International Security (ISIS) Imagery Brief, 20 Dec. 2013, <http://isis-online.org/isis-reports/detail/further-construction-progress-on-the-fourth-heavy-water-reactor-at-khushab-/>.

[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] US Air Force, National Air and Space Intelligence Center (NASIC), *Ballistic and Cruise Missile Threat*, NASIC-1031-0985-13 (NASIC: Wright-Patterson Air Force Base, OH, July 2013), p. 15.

Table 6.8. Pakistani nuclear forces, January 2014

Type	Range (km)[a]	Payload (kg)	Status
Aircraft			
F-16A/B	1 600	4 500	~30 aircraft, deployed in 3 squadrons
Mirage V	2 100	4 000	Mirage III used to test launch Ra'ad in 2012
JF-17	. .	. .	Rumoured to be equipped to carry the Ra'ad air-launched cruise missile; unclear if this indicates a nuclear-delivery role
Land-based ballistic missiles			
Abdali (Hatf-2)	180	200–400	Under development; test launched on 15 Feb. 2013
Ghaznavi (Hatf-3)	290[b]	500	Entered service with the Pakistani Army in 2004; fewer than 50 launchers deployed; most recent test-launches on 22 Apr. and 8 May 2014
Shaheen I (Hatf-4)	750	750–1 000	Entered service with the Pakistani Army in 2003; fewer than 50 launchers deployed; most recent test-launch on 10 Apr. 2013; range has apparently been extended[c]
Shaheen II (Hatf-6)	2 000	(~1 000)	Under development; last known test-launch on 21 Apr. 2008; deployment possibly soon
Ghauri (Hatf-5)	1 250	700–1 000	Entered service with the Pakistani Army in 2003; fewer than 50 launchers deployed; last test launched on 28 Nov. 2012
Nasr (Hatf-9)	60	. .	Under development; test launched on 5 Nov. 2013
Cruise missiles			
Babur (Hatf-7)	350[d]	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] US NASIC estimates the range at 250 km.

[c] The Pakistani military reports the extended range of Shaheen I as 900 km but the US Air Force NASIC set the range at 750 km, up from >450 km reported in 2009.

[d] The Pakistani military reports the range as 700 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, May 2013); 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; US National Intelligence Council, 'Foreign missile developments and the ballistic missile threat through 2015' (unclassified summary), 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.

Pakistan is also 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 15 February 2013, provides 'an operational level capability to Pakistan's Strategic Forces'.[7] The Abdali has been flight tested at least six times since 2002, but the missile is not listed by NASIC.

Similarly, the Pakistani military has described the 60 kilometre-range, road-mobile Nasr (Hatf-9) SRBM as a 'quick response system', which 'add[s] deterrence value' to the posture 'at shorter ranges' in order 'to deter evolving threats'.[8] The missile is launched from a mobile multi-tube launcher that can 'fire a four missile salvo'.[9] The development of a nuclear salvo-weapon could potentially be intended for use against large enemy troop formations in case of an Indian invasion of Pakistan.

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 (Hatf-7) and the air-launched Ra'ad (Hatf-8).

The development of new types of nuclear-capable SRBM and cruise missile may be an indication 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. It further suggests a growing concern in Pakistan about being able to counter India's superior conventional forces and nascent ballistic missile defences. The deployment of short-range, sub-strategic nuclear forces increases the risk that nuclear weapons could be used sooner in an Indian–Pakistani war and trigger escalation to the use of longer-range missiles.

Aircraft

Pakistan procured 40 F-16A/B combat aircraft from the United States in the mid-1980s. It has been suggested that some of these were assigned a nuclear-weapon delivery role. The approximately 30 of these F-16s that remain, together with several more delivered by the USA between 2005

[7] Pakistani Inter Services Public Relations, Press Release no. PR20/2013-ISPR, <https://www.ispr.gov.pk/front/main.asp?o=t-press_release&id=2242>.

[8] 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>.

[9] Pakistani Inter Services Public Relations, 'Inter-agency meeting on counter improvised explosive device (CIED) strategy', Press Release no. PR17/2013-ISPR, 11 Feb. 2013, <http://www.ispr.gov.pk/front/main.asp?o=t-press_release&id=2240>.

and 2008, are being extensively upgraded in a mid-life upgrade (MLU).[10] The USA is heavily involved in the MLU, which was procured through the US Foreign Military Sales (FMS) programme, and in 2006 a senior US official stated 'these F-16s specifically will not be sold to Pakistan to be capable of carrying a nuclear weapon'.[11] However, once the F-16s arrive in Pakistan, the Pakistani Government can choose what it uses the aircraft for.

The PAF's Mirage V combat aircraft may be more likely to have a nuclear-delivery role. The fact that the Mirage III has been used for developmental test flights of the nuclear-capable Ra'ad air-launched cruise missile could be seen as a logical extension of a potential strike role with nuclear gravity bombs on the Mirage V. Pakistan has developed a strong indigenous capability to maintain and rebuild these aircraft to keep them operational and comprehensively upgraded this system for long-range precision strike missions, including dedicated night attack. The range of the Mirage aircraft has been extended by the PAF's development of an aerial refuelling capability using Il-78 aircraft.

The Mirage V is getting old and Pakistan is acquiring the Chinese-designed JF-17 to replace it. There are rumours that the Ra'ad cruise missile might be integrated onto its JF-17 Thunder aircraft or even the F-16, but this remains to be confirmed.[12]

[10] Pakistan Air Force, 'PAF F-16 Block 15 aircraft arrives after mid life upgrade', 12 Feb. 2012, <http://www.paf.gov.pk/F-16_Mid_life_upgrade.html>.

[11] Hillen, J., Assistant Secretary, US Department of State, Bureau of Political Military Affairs, Speaking at the hearing 'Proposed sale of F-16 aircraft and weapons systems of Pakistan' before the US House of Representatives, Committee on International Relations, 20 July 2006, <http://commdocs.house.gov/committees/intlrel/hfa28787.000/hfa28787_0f.htm>.

[12] Ansari, U., 'Despite missile integration, nuke role unlikely for Pakistan's JF-17', *Defense News*, 7 Feb. 2013; Waldron, G., 'Pakistan tests nuclear-capable Ra'ad air-launched cruise missile', *Flightglobal*, 6 June 2012; and 'Pakistan test flight of new Raad air launched cruise missile', Aviation Report Global, 30 Apr. 2011, <http://www.aviationreportglobal.com/2011/04/30/pakistan-test-flight-of-new-raad-air-launched-cruise-missile/>.