

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 11.8). It is widely believed that, in peacetime, Pakistan stores its nuclear warheads separate from their delivery vehicles.¹ However, the Strategic Plans Division (SPD), which operates Pakistan's nuclear forces, has never confirmed such arrangements.

Pakistan's current warhead designs are believed to use highly enriched uranium (HEU). Pakistan continues to produce HEU for military purposes and its total stockpile was estimated at 2.7–3.5 tonnes in 2014 (see section X below). The enrichment takes place at the gas centrifuge facilities located at Kahuta and Gadwal in 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 lighter and more compact warheads based on plutonium. That said, there has been no confirmation of a successful test of a plutonium-based warhead design.

Pakistan is expanding its main plutonium production complex at Khushab, Punjab. The complex currently consists of four heavy water nuclear reactors and a heavy water production plant. It is widely believed that each of the four reactors has a capacity of 40–50 megawatt-thermal (MW(t)). 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.²

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. Khushab-III was completed in late 2011 and became operational in 2013.⁴

¹ 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 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).

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

⁴ Mian, Z., 'Pakistan begins operating third Khushab plutonium production reactor', International Panel on Fissile Materials (IPFM), 30 June 2014, <http://fissilematerials.org/blog/2014/06/pakistan_begins_operating.html>.

Based on satellite imagery analysis, Khushab-IV appears to have commenced operations in 2014.⁵

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.

Aircraft

Pakistan procured 40 F-16A/B combat aircraft from the United States in the mid-1980s. There has been speculation that some of these aircraft were assigned a nuclear-weapon delivery role. The approximately 30 F-16s that remain, together with several more delivered by the USA between 2005 and 2008, are being extensively modified in a mid-life upgrade (MLU).⁶ The USA has been heavily involved in the MLU, which was procured through the US Foreign Military Sales (FMS) programme. 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'.⁷

The Pakistan Air Force (PAF) 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 in order to keep them operational, and has 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.

⁵ Albright, D. and Kelleher-Vergantini, S., 'Pakistan's fourth reactor at Khushab now appears operational', Institute for Science and International Security (ISIS) Imagery Brief, 16 Jan. 2015, <<http://isis-online.org/isis-reports/detail/pakistans-fourth-reactor-at-khushab-now-appears-operational/>>.

⁶ 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>.

⁷ 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_of.htm>.

Table 11.8. Pakistani nuclear forces, January 2015

Type	Range (km) ^a	Payload (kg)	Status
<i>Aircraft</i>			
F-16A/B	1 600	4 500	32 aircraft, deployed in 3 squadrons
Mirage V	2 100	4 000	Mirage III used to test launch Ra'ad cruise missile; possibly nuclear-capable
JF-17	Rumoured to be equipped to carry the Ra'ad air-launched cruise missile; possible nuclear role
<i>Land-based ballistic missiles</i>			
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	750–900	Entered service with the Pakistani Army in 2003; fewer than 50 launchers deployed
Shaheen IA (Hatf-4)	900	1 000	Extended-range version of Shaheen I; most recent test launch on 17 Nov. 2014
Shaheen II (Hatf-6)	1 500	(~1 000)	Operational status unclear; test-launched on 13 Nov. 2014 for first time since 2008
Shaheen III	2 750	(~750–1 000)	Under development
Ghauri (Hatf-5)	1 250	700–1 000	Entered service with the Pakistani Army in 2003; fewer than 50 launchers deployed
Nasr (Hatf-9)	60	..	Under development; test-launched on 26 Sep. 2014
<i>Cruise missiles</i>			
Babur (Hatf-7)	700 ^c	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 Air Force, National Air and Space Intelligence Center estimates the range to be 250 km.

^c The US Air Force, National Air and Space Intelligence Center estimates the range to be 350 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, <<https://www.cia.gov/library/reports/archived-reports-1/>>; US National Intelligence Council, 'Foreign missile develop-

ments and the ballistic missile threat through 2015' (unclassified summary), Dec. 2001, <http://www.ni.gov/ni/special_missilethreat2001.html>; 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 acquiring the Chinese-designed JF-17 Thunder aircraft to replace the Mirage. There are unconfirmed reports that the Ra'ad cruise missile might be integrated with its JF-17 Thunder or even the F-16.⁸

Land-based missiles

Pakistan is expanding its nuclear-capable missile arsenal. It 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 has two types of medium-range ballistic missile (MRBM): the liquid-fuelled, road-mobile Ghauri (Hatf-5) and the Shaheen II (Hatf-6), a two-stage, solid-fuelled, road-mobile MRBM.⁹ Pakistan is developing a longer-range Shaheen III missile capable of reaching targets throughout India. It could begin flight testing in 2015.

The operational status of the Shaheen II is unclear. On 13 November 2014 Pakistan announced that a Shaheen II had been successfully test-launched as part of an Army Strategic Force Command training exercise.¹⁰ This marked the first test of the missile since 2008. According to some analysts, the long gap between flight tests indicated that the missile's design and technical parameters might not have been fully validated.¹¹

Pakistan has been developing nuclear-capable short-range missiles that appear to be intended for tactical nuclear roles and missions. According to the Pakistan military, the 180 kilometre-range Abdali (Hatf-2) provides 'an operational level capability to Pakistan's Strategic Forces'.¹² The Abdali has been flight-tested at least six times since 2002, most recently in February

⁸ Ansari, U., 'Despite missile integration, nuke role unlikely for Pakistan's JF-17', *Defense News*, 7 Feb. 2013; and Waldron, G., 'Pakistan tests nuclear-capable Ra'ad air-launched cruise missile', *Flightglobal*, 6 June 2012, <<http://www.flightglobal.com/news/articles/pakistan-tests-nuclear-capable-raad-air-launched-cruise-372647/>>.

⁹ 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. 17.

¹⁰ Pakistani Inter Services Public Relations, Press Release no. PR248/2014-ISPR, 13 Nov. 2014, <https://www.ispr.gov.pk/front/main.asp?o=t-press_release&id=2701#pr_link2701>.

¹¹ Nagappa, R., et al., 'Launch of Pakistani Shaheen-II (Hatf-VI) ballistic missile on November 13, 2014: an analysis', International Strategic and Security Studies Programme (ISSSP), National Institute of Advanced Studies, Bangalore, India, 24 Dec. 2014, <<http://isspp.in/launch-of-pakistani-shaheen-ii-hatf-vi-ballistic-missile-on-november-13-2014-an-analysis/>>.

¹² Pakistani Inter Services Public Relations, Press Release no. PR20/2013-ISPR, 15 Feb. 2013, <https://www.ispr.gov.pk/front/main.asp?o=t-press_release&id=2242>.

2013, but is not listed in the global inventory of missiles prepared by US Air Force National Air and Space Intelligence Center (NASIC).

Pakistan's military has described the 60 km-range, road-mobile Nasr (Hatf-9) missile as a 'quick response system', which 'add[s] deterrence value' to the posture 'at shorter ranges' in order 'to deter evolving threats'.¹³ The Nasr system uses a mobile multi-tube launcher that can fire a four-missile salvo. This capability was demonstrated by the successive test-launch of four missiles on 26 September 2014.¹⁴

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 cruise missiles and SRBMs, including so-called battlefield nuclear weapons such as the Hatf-9 missile, reflects Pakistan's pursuit of military options for using nuclear weapons to offset India's superior conventional forces as part of a 'full-spectrum deterrence' posture.¹⁵ It may also indicate a growing concern in Pakistan about its ability to counter India's nascent ballistic missile defences.

¹³ 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>.

¹⁴ Pakistan successfully test-fires Hatf-IX', Dawn, 26 Sep. 2014, <www.dawn.com/news/1134471>.

¹⁵ Sultan, A., 'NCA's "full spectrum" response', *Express Tribune*, 7 Nov. 2013; and Sankaran, J., 'Pakistan's battlefield nuclear policy: a risky solution to an exaggerated threat', *International Security*, vol. 39, no. 3 (Winter 2014/15), pp. 118–151.