

VII. Pakistani nuclear forces

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Pakistan is believed to be increasing its nuclear weapon stockpile. It is estimated here to possess a stockpile of 110–130 warheads, an increase from the 100–120 warheads estimated in *SIPRI Yearbook 2015*.

The warheads are earmarked for delivery by aircraft controlled by the Pakistan Air Force and land-based missiles controlled by the Pakistan Army (see table 16.8). It is widely believed that Pakistan maintains its nuclear forces in a de-alerted status, with nuclear warheads stored separately from their delivery vehicles.¹ However, the National Command Authority, which has operational control over the country's nuclear forces, has never confirmed such an arrangement.

Military fissile material production

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).² The enrichment takes place at the uranium centrifuge facilities at Kahuta and Gadwal in Punjab.

Pakistan is expanding its main plutonium production complex at Khushab, Punjab. The complex consists of four operational heavy water nuclear reactors and a heavy water production plant.³ Each of the four reactors is estimated to have a capacity of 40–50 megawatt-thermal (MW(t)) and can produce 6–12 kilograms of plutonium annually.⁴ This amount is sufficient for building one to three nuclear warheads, depending on warhead design and fabrication skills.

Pakistan is believed to be expanding its capabilities to reprocess spent nuclear fuel, that is, to chemically separate plutonium from irradiated reactor fuel. A small reprocessing plant at the New Laboratories facility of the Pakistan Institute of Science and Technology (PINSTECH), located near Rawalpindi, became operational around 2000, after Pakistan brought online the first unsafeguarded reactor at Khushab. It was later supplemented by

¹ Tertrais, B., 'Pakistan's nuclear and WMD programmes: status, evolution and risks', EU Non-Proliferation Consortium, Non-Proliferation Paper no. 19, July 2012, p. 5.

² For a similar estimate, see Albright, D., *Pakistan's inventory of weapon-grade uranium and weapon-grade plutonium dedicated to nuclear weapons* (Institute for Science and International Security: Washington, DC, 19 Oct. 2015).

³ 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.

⁴ International Panel on Fissile Materials, 'Countries: Pakistan', 3 Feb. 2013.

Table 16.8. Pakistani nuclear forces, January 2016

Type (US/Pakistani designation)	Launchers deployed	Year first deployed	Range (km) ^a	Warhead loading ^b	No. of warheads ^c
<i>Aircraft</i>	~36				~36
F-16A/B	~24	1998	1 600	1 x bomb	~24
Mirage III/V	~12	1998	2 100	1 x bomb or Ra'ad ALCM	~12
<i>Land-based missiles</i>	~86 ^d				~86
Abdali (Hatf-2)	few	(2015)	180	1 x 12 kt	few
Ghaznavi (Hatf-3)	~16	2004	290	1 x 12 kt	~16
Shaheen-I (Hatf-4)	~16	2003	750	1 x 12 kt	~16
Shaheen-IA (Hatf-4) ^e	0	(2017)	900	1 x 12 kt	..
Shaheen-II (Hatf-6)	~8	2014	1 500	1 x 12 kt	~8
Shaheen-III (Hatf-6) ^f	0	(2018)	2 750	1 x 12 kt	..
Ghauri (Hatf-5)	~40	2003	1 250	1 x 12 kt	~40
Nasr (Hatf-9)	~6	(2013)	60	1 x 12 kt	~6
<i>Cruise missiles</i>	~8				~8
Babur GLCM (Hatf-7)	~8	(2014)	700 ^g	1 x 12 kt	~8
Ra'ad ALCM (Hatf-8)	0	(2017)	350	1 x 12 kt	..
Total					~130

.. = not available or not applicable; () = uncertain figure; ALCM = air-launched cruise missile; GLCM = ground-launched cruise missile; kt = kiloton.

^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 yields of Pakistan's nuclear warheads are not known. The 1998 nuclear tests demonstrated a yield of up to 12 kt. Since then it is possible that boosted warheads have been introduced with higher yields. There is no open-source evidence that Pakistan has developed two-stage thermonuclear warheads.

^c Aircraft and several missile types are dual-capable. Cruise missile launchers carry more than 1 missile. This estimate counts an average of 1 warhead per launcher. Warheads are not deployed on launchers but kept in separate storage facilities.

^d Some launchers might have 1 or more reloads of missiles.

^e It is unclear whether the Shaheen-IA has the same designation as the Shaheen-I.

^f It is unclear whether the Shaheen-III has the same designation as the Shaheen-II.

^g The US Air Force, National Air and Space Intelligence Center estimates the range to be 350 km.

Sources: Pakistan Ministry of Defense; US Air Force, National Air and Space Intelligence Center (NASIC), *Ballistic and Cruise Missile Threat* (NASIC: Wright-Patterson Air Force Base, OH, May 2013); International Institute for Strategic Studies, *The Military Balance 2015* (Routledge: London, 2015); 'Nuclear notebook', *Bulletin of the Atomic Scientists*, various issues; and authors' estimates.

the construction of a second small plant.⁵ Commercial satellite imagery indicates that Pakistan is constructing a larger reprocessing plant, located

⁵ Albright, D. and Kelleher-Vergantini, S., 'Pakistan's Chashma plutonium separation plant: possibly operational', ISIS Imagery Brief, 20 Feb. 2015.

at the Chasma Nuclear Power Complex in Punjab, in order to separate the relatively large amount of plutonium produced in the four Khushab reactors. The status of the plant is unknown, although there were indications from satellite imagery in 2015 that it may be operational.⁶

The expansion of the Khushab nuclear complex, combined with Pakistan's continuing HEU production, has led to warnings from non-governmental experts that the size of the country's nuclear weapon stockpile could be set to increase several-fold.⁷ Some analysts predict a significant increase in the size of Pakistan's nuclear stockpile, to approximately 220–250 warheads, over the next decade.⁸ However, predictions of a rapid expansion of the stockpile assume that Pakistan will have sufficient capacity to reprocess spent fuel as well as an adequate supply of uranium to fuel the reactors at Khushab—factors which may constrain the growth of its arsenal.⁹

Aircraft

Pakistan procured 40 F-16A/B combat aircraft from the US 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, have been extensively modified in a mid-life upgrade (MLU). The USA was actively involved in the MLU, which was procured through the US Foreign Military Sales (FMS) programme. In 2006 a senior US official stated before Congress that 'these F-16s specifically will not be sold to Pakistan to be capable of carrying a nuclear weapon'.¹⁰

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 (see below) could be seen as a logical extension of a potential strike role with nuclear gravity bombs on the Mirage V. The range of the Mirage aircraft has been extended by the PAF's development of an aerial refuelling capability using Il-78 aircraft.

⁶ Albright and Kelleher-Vergantini (note 5).

⁷ See Koblenz, G. D., *Strategic Stability in the Second Nuclear Age* (Council on Foreign Relations: Washington DC, Nov. 2014); and Dalton, T. and Krepon, M., *A Normal Nuclear Pakistan* (Stimson Center and Carnegie Endowment for International Peace: Washington, DC, Aug. 2015).

⁸ Kristensen, H. M. and Norris, R., 'Pakistani nuclear forces 2015', *Bulletin of the Atomic Scientists*, vol. 71, no. 6 (Nov.–Dec. 2015), pp. 59–66.

⁹ Lewis, J., 'Patton on Pakistan's U supply', *Arms Control Wonk*, 3 Dec. 2012.

¹⁰ 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.

Pakistan is acquiring the JF-17 Thunder aircraft, a low-cost multi-role lightweight fighter jointly developed with China, to replace the Mirage.¹¹ There are reports that the PAF may intend to integrate the new Ra'ad air-launched cruise missile on to the aircraft. Whether this signifies a nuclear delivery role for the JF-17 remains unclear.¹²

Land-based missiles

Pakistan is expanding its nuclear-capable ballistic 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 nuclear-capable medium-range ballistic missile (MRBM): the liquid-fuelled, road-mobile Ghauri (Hatf-5) with a range of 1250 km; and the two-stage, solid-fuelled, road-mobile Shaheen II (Hatf-6) with a range of 1500 km.¹³ The operational status of the Shaheen II is unclear. In November 2014 the Pakistan army announced that it had conducted a successful 'training launch' of a Shaheen-II missile that had revalidated 'different design and technical parameters of the weapon system'.¹⁴ This marked the first test of the missile since 2008. Some analysts have speculated that the long gap between flight tests may reflect a combination of technical problems and resource constraints on the missile's development programme.¹⁵

Pakistan is developing a longer-range Shaheen-III MRBM capable of carrying nuclear and conventional warheads. On 9 March 2015 a Shaheen III was test-fired into the Arabian Sea. According to the director of the Strategic Plans Division of Pakistan's Strategic Command Organization, the test-launch marked a technical milestone in 'validating various design and technical parameters of the weapon system at maximum range'.¹⁶ With a stated range of 2750 km, the Shaheen-III will be capable of reaching targets throughout India. The missile was successfully flight-tested again on 11 December 2015.¹⁷

¹¹ Majumdar, D., 'Need a cheap fighter aircraft? The JF-17 might work', *The National Interest*, 13 Nov. 2015.

¹² Ansari, U., 'Despite missile integration, nuke role unlikely for Pakistan's JF-17', *Defense News*, 7 Feb. 2013.

¹³ 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, July 2013), p. 17.

¹⁴ Pakistani Inter Services Public Relations, Press Release no PR248/2014-ISPR, 13 Nov. 2014.

¹⁵ 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.

¹⁶ Pakistani Inter Services Public Relations, 'Shaheen 3 missile test', Press Release no. PR248/2014-ISPR, 9 Mar. 2015.

¹⁷ Pakistani Inter Services Public Relations, Press Release no. PR378/2015-ISPR, 11 Dec. 2015.

Pakistan has prioritized the development of nuclear-capable short-range missiles that appear to be intended for tactical nuclear roles and missions.¹⁸ The development of so-called battlefield nuclear weapons reflects the pursuit of what Pakistan officials describe as a ‘full-spectrum deterrence’ posture aimed at offsetting India’s superior conventional forces.¹⁹ Military planners have given particular attention to developing nuclear options to respond 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.²⁰

Pakistan is developing two nuclear-capable short-range ballistic missiles. According to the Pakistan Army, the 180-km range, road-mobile Abdali (Hatf-2), with its ‘varied manoeuvrability options’, provides ‘an operational level capability’ for the country’s strategic forces.²¹ The Abdali has been flight-tested at least six times since 2002, most recently in February 2013, but has yet to enter service.

The Pakistan Army has described the 60-km range, road-mobile Nasr (Hatf-9) missile as a quick-response ‘shoot-and-scoot’ system’ which ‘add[s] deterrence value’ to the posture ‘at shorter ranges’ in order ‘to deter evolving threats’.²² The Nasr system uses a mobile multi-tube launcher that can fire a four-missile salvo. This capability was demonstrated by the test-launch of four missiles in succession in 2014.²³ The Nasr missile appears to carry a compact nuclear warhead described as ‘appropriate yield with high accuracy’, for what appears to be battlefield use.²⁴

Sea-based missiles

Pakistan has acknowledged that it is seeking to match India’s nuclear triad by developing a sea-based nuclear force.²⁵ In 2012 the Pakistan Navy announced the establishment of the Headquarters Naval Strategic Forces Command (NSFC), which it described as the ‘custodian of the second strike force’.²⁶ There has been considerable speculation that the sea-based force will initially consist of nuclear-armed, submarine-launched cruise missiles

¹⁸ Craig, T. and DeYoung, K., ‘Pakistan is eyeing sea-based and short-range nuclear weapons, analysts say’, *Washington Post*, 21 Sep. 2014.

¹⁹ Alta, B., ‘Pakistan’s full spectrum deterrence’, *Daily Times* (Pakistan), 24 Nov. 2015.

²⁰ 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; and Sultan, A., ‘NCA’s “full spectrum” response’, *Express Tribune*, 7 Nov. 2013.

²¹ Pakistani Inter Services Public Relations, Press Release no. PR20/2013-ISPR, 15 Feb. 2013.

²² Pakistani Inter Services Public Relations, Press Release no. PR94/2011-ISPR, 19 Apr. 2011.

²³ ‘Pakistan successfully test-fires Hatf-IX’, *Dawn*, 26 Sep. 2014.

²⁴ Pakistani Inter Services Public Relations, Press Release no. PR94/2011-ISPR (note 22).

²⁵ Khan, B., ‘Is it finally the Pakistan Navy’s turn?’, *Quwa Defence News Group*, 3 Oct. 2015.

²⁶ Pakistani Inter Services Public Relations, Press Release no. PR122/2012-ISPR, 19 May 2012.

(SLCMs) deployed on Agosta-class submarines or on surface ships.²⁷ However, Western experts are divided over whether Pakistan has the ability to build warheads that are compact enough for use on tactical or sea-launched weapons.²⁸

Cruise missiles

Pakistan continues to develop cruise missiles as part of its full-spectrum deterrence posture. The country's missile development organization, the National Engineering and Scientific Commission (NESCOM), is currently developing two types of nuclear-capable cruise missile: the ground-launched Babur (Hatf-7); and the air-launched Ra'ad (Hatf-8). A submarine-launched variant of the Babur may also be under development.

On 2 February 2015 Pakistan announced that it had flight-tested a Ra'ad air-launched cruise missile equipped with advanced guidance and navigation systems.²⁹ The announcement marked the first flight-test of the system since 2012 and the fifth confirmed test since 2007. Pakistan conducted a sixth flight-test of the Ra'ad on 19 January 2016.³⁰ To date the Ra'ad has been tested exclusively on the Mirage III combat aircraft.

²⁷ See e.g. Khan, F. H., 'Going tactical: Pakistan's nuclear posture and implications for stability', *Proliferation Papers* no. 53, Institute Français des Relations Internationales (IFRI), Sep. 2015, p. 41.

²⁸ Craig, T., and DeYoung, K., 'Pakistan is eyeing sea-based and short-range nuclear weapons, analysts say', *Washington Post*, 21 Sep. 2014.

²⁹ 'Pakistan conducts flight test of Ra'ad', *Dawn*, 2 Feb. 2015.

³⁰ Pakistani Inter Services Public Relations, Press Release no. PR16/2016-ISPR, 19 Jan. 2016.