

VII. Pakistani nuclear forces

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Pakistan continues to prioritize the development and deployment of new nuclear weapons and delivery systems as part of its ‘full spectrum deterrence posture’ vis-à-vis India. It is estimated that Pakistan possessed 140–50 warheads as of January 2018 (see table 6.8). Pakistan’s nuclear weapon arsenal is likely to expand significantly over the next decade, although estimates of the increase in warhead numbers vary considerably.¹

Pakistan is believed to be gradually increasing its military fissile material holdings, which include both plutonium and highly enriched uranium (HEU) (see section X). Pakistan’s plutonium production complex is located at Khushab in the province of Punjab. It consists of four operational heavy water nuclear reactors and a heavy water production plant.² Pakistan appears to be increasing its capacity to reprocess spent nuclear fuel—that is, to chemically separate plutonium from irradiated reactor fuel. A small reprocessing plant has been expanded at the New Laboratories facility of the Pakistan Institute of Science and Technology (PINSTECH) near Rawalpindi. A larger reprocessing plant has been constructed at the Chashma Nuclear Power Complex in Punjab and may already be operational.³

Uranium enrichment takes place at the gas centrifuge plant in the Khan Research Laboratories (KRL) complex at Kahuta in Punjab and at a smaller plant located at Gadwal, also in Punjab. A new uranium enrichment centrifuge plant may be under construction in the KRL complex at Kahuta.⁴ Pakistan’s capacity to produce HEU for nuclear weapons is constrained by its limited indigenous supply of natural uranium.⁵

Aircraft

The Pakistan Air Force’s (PAF) Mirage III and Mirage V combat aircraft are the most likely aircraft to have been given a nuclear delivery role. The Mirage III has been used for developmental test flights of the nuclear-capable

¹ Dalton, T. and Krepon, M., *A Normal Nuclear Pakistan* (Stimson Center and Carnegie Endowment for International Peace: Washington, DC, Aug. 2015); and Kristensen, H. M. and Norris, R., ‘Pakistani nuclear forces, 2016’, *Bulletin of the Atomic Scientists*, vol. 72, no. 6 (Oct.–Nov. 2016), pp. 368–76.

² Burkhard, S., Lach, A. and Pabian, F., ‘Khushab update’, Institute for Science and International Security, Report, 7 Sep. 2017.

³ Albright, D. and Kelleher-Vergantini, S., ‘Pakistan’s Chashma plutonium separation plant: possibly operational’, Institute for Science and International Security, Imagery Brief, 20 Feb. 2015.

⁴ Cartwright, C. and Dewey, K., ‘Spin strategy: likely uranium facility identified in Pakistan’, *Jane’s Intelligence Review*, vol. 28, no. 11 (Nov. 2016), pp. 48–52.

⁵ International Panel on Fissile Material (IPFM), ‘Pakistan may be building a new enrichment facility’, IPFM Blog, 16 Sep. 2016.

Table 6.8. Pakistani nuclear forces, January 2018

Type (US/Pakistani designation)	Launchers deployed	Year first deployed	Range (km) ^a	Warheads x yield ^b	No. of warheads ^c
<i>Aircraft</i>	36				36
F-16A/B ^d	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>	102 ^e				102
Abdali (Hatf-2)	10	(2015)	200	1 x 12 kt	10
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) ^f	..	(2017)	900	1 x 12 kt	..
Shaheen-II (Hatf-6)	12	2014	1 500	1 x 10–40 kt	12
Shaheen-III (Hatf-6) ^g	..	(2018)	2 750	1 x 10–40 kt	..
Ghauri (Hatf-5)	24	2003	1 250	1 x 10–40 kt	24
Nasr (Hatf-9)	24	(2013)	60–70	1 x 12 kt	24
Ababeel (Hatf-.)	0	..	2 200	MIRV or MRV	0 ^h
<i>Cruise missiles</i>	12				12
Babur GLCM (Hatf-7)	12	(2014)	350 ⁱ	1 x 12 kt	12
Babur-2 GLCM (Hatf-.) ^j	700	1 x 12 kt	..
Babur-3 SLCM (Hatf-.)	0	.. ^k	450	1 x 12 kt	0
Ra'ad ALCM (Hatf-8)	..	(2017)	350	1 x 12 kt	..
Ra'ad-2 ALCM (Hatf-.)	..	(2018)	>350	1 x 12 kt	..
Total					140–150

.. = not available or not applicable; () = uncertain figure; ALCM = air-launched cruise missile; GLCM = ground-launched cruise missile; kt = kiloton; MIRV = multiple independently targetable re-entry vehicle; MRV = multiple re-entry vehicle; SLCM = sea-launched cruise missile.

^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 2-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 There are unconfirmed reports that some of the 40 F-16 combat aircraft procured from the USA in the 1980s were modified by Pakistan for a nuclear delivery role.

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

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

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

^h According to the Pakistani armed forces, the missile is 'capable of delivering multiple warheads', using MIRV technology.

ⁱ The Pakistani Government claims the range is 700 km, double the range reported by the US Air Force, National Air and Space Intelligence Center (NASIC).

^j The Babur-2, which was first test launched on 14 Dec. 2016, is an improved version of the original Babur GLCM.

^k The first test launch of a Babur-3 SLCM was carried out from an underwater platform on 9 Jan. 2017.

Sources: Pakistani Ministry of Defence; various documents; US Air Force, National Air and Space Intelligence Center (NASIC), *Ballistic and Cruise Missile Threat*, various years; International Institute for Strategic Studies, *The Military Balance 2018* (Routledge: London, 2018); 'Nuclear notebook', *Bulletin of the Atomic Scientists*, various issues; and authors' estimates.

Ra'ad air-launched cruise missile (ALCM), while the Mirage V is believed to have been given a strike role with nuclear gravity bombs.⁶

Pakistan is acquiring the JF-17 Thunder aircraft, a multi-role lightweight fighter jointly developed with China, to replace the ageing Mirage aircraft. There are reports that the PAF intends to integrate the dual-capable Ra'ad ALCM (see below) on to the JF-17, although whether this signifies a nuclear delivery role for the aircraft is unclear.⁷

Pakistan procured 40 F-16A/B combat aircraft from the United States in the mid-1980s. There are unconfirmed reports that some of these aircraft were modified by Pakistan for a nuclear delivery role.⁸

Land-based missiles

Pakistan is expanding its nuclear-capable ballistic missile arsenal, which consists of a series of short- and medium-range systems. 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 still in development.

Pakistan deploys two types of nuclear-capable medium-range ballistic missile (MRBM): the liquid-fuelled, road-mobile Ghauri (Hatf-5) with a range of 1250 kilometres; and the two-stage, solid-fuelled, road-mobile Shaheen-II (Hatf-6) with a range of 1500 km.⁹ A longer-range variant, the Shaheen-III, is currently in development and was first test launched in 2015.¹⁰ The missile has a declared range of 2750 km, making it the longest-range system to be tested by Pakistan to date.

Pakistan's National Defence Complex is developing a new MRBM, the nuclear-capable Ababeel, based on the Shaheen-III's airframe and solid-fuel motors.¹¹ On 24 January 2017 Pakistan announced that the first test launch

⁶ Kerr, P. and Nikitin, M. B., *Pakistan's Nuclear Weapons*, Congressional Research Service (CRS) Report for Congress RL3248 (US Congress, CRS: Washington, DC, 1 Aug. 2016), p. 7.

⁷ Fisher, R., 'JF-17 Block II advances with new refuelling probe', *Jane's Defence Weekly*, 27 Jan. 2016; and Ansari, U., 'Despite missile integration, nuke role unlikely for Pakistan's JF-17', *Defense News*, 7 Feb. 2013.

⁸ For further analysis on the role of the F-16 see Kristensen and Norris (note 1).

⁹ US Air Force, National Air and Space Intelligence Center (NASIC), *Ballistic and Cruise Missile Threat* (NASIC: Wright-Patterson Air Force Base, OH, July 2017), p. 25.

¹⁰ Pakistan Inter Services Public Relations, 'Shaheen 3 missile test', Press Release PR-61/2015-ISPR, 9 Mar. 2015.

¹¹ The National Defence Complex (also referred to as the National Development Complex or National Development Centre) and its supervisory organization, the National Engineering and Scientific Commission (NESCOM), are the principal bodies responsible for Pakistan's missile

of the Ababeel, aimed at ‘validating various design and technical parameters of the weapon system’, had been successfully carried out.¹² According to the armed forces’ press service, the missile is ‘capable of delivering multiple warheads, using Multiple Independent Re-entry Vehicle (MIRV) technology’ and is being developed to ‘[ensure the] survivability of Pakistan’s ballistic missiles in the growing regional Ballistic Missile Defence (BMD) environment’.¹³ Pakistan’s National Defence Complex is reportedly developing the technology to deploy MIRV-equipped missiles as a countermeasure to India’s prospective ballistic missile defence system.¹⁴

Pakistan has prioritized the development of nuclear-capable short-range missiles that appear to be intended for tactical nuclear roles and missions. In pursuing its ‘full-spectrum deterrence’ posture, Pakistan’s defence planners have given particular attention to nuclear options for responding to an Indian military doctrine that envisages carrying out rapid but limited conventional attacks on Pakistani territory using forward-deployed forces.¹⁵

Pakistan has deployed two land-based, single-stage ballistic missiles capable of delivering compact, low-yield nuclear warheads as well as conventional warheads: the 200-km range, road-mobile Abdali (Hatf-2); and the 60-km range, road-mobile Nasr (Hatf-9). The Nasr system was initially tested in 2011 using a single-tube launcher but has subsequently appeared with a mobile multi-tube launcher that can fire a four-missile salvo.¹⁶ An improved 70-km range version was test launched on 5 July 2017.¹⁷

Sea-based cruise missiles

As part of its efforts to achieve a secure second-strike capability, Pakistan is seeking to match India’s nuclear triad by developing a sea-based nuclear force. On 9 January 2017 Pakistan announced that the first test launch of a submarine-launched cruise missile (SLCM), the Babur-3, had been successfully carried out from ‘an underwater, mobile platform’ deployed in the Indian Ocean.¹⁸ The missile was said to be a sea-based variant of the

development programmes. Nuclear Threat Initiative, ‘National Defence Complex’, updated 27 Sep. 2011.

¹² Pakistan Inter Services Public Relations, Press Release PR-34/2017-ISPR, 24 Jan. 2017.

¹³ Pakistan Inter Services Public Relations (note 12).

¹⁴ Tasleem, S., ‘No Indian BMD for no Pakistani MIRVs’, Stimson Center, Off Ramps Initiative, Paper, 2 Oct. 2017.

¹⁵ Ahmed, M., ‘Pakistan’s tactical nuclear weapons and their impact on stability’, Carnegie Endowment for International Peace, Regional Insight, 30 June 2016; 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. 118–51.

¹⁶ Ansari, U., ‘Pakistan holds parade after 7-year break’, *Defense News*, 24 Mar. 2015; and Haroon, A., ‘Pakistan test fires Hatf-IX’, Dispatch News Desk, 26 Sep. 2014.

¹⁷ Pakistan Inter Services Public Relations, Press Release PR-344/2017-ISPR, 5 July 2017.

¹⁸ Pakistan Inter Services Public Relations, Press Release PR-10/2017-ISPR, 9 Jan. 2017.

Babur-2 ground-launched cruise missile (GLCM) and to have a range of 450 km (see below). It is most likely to be deployed on the Pakistan Navy's diesel-electric Agosta class submarines, which are currently in service.¹⁹

In 2012 Pakistan established a Naval Strategic Force Command as the 'custodian of the nation's second-strike capability'.²⁰ It is unclear whether the Pakistan Navy has developed a command and control infrastructure to manage a submarine-based nuclear force or custodial arrangements for nuclear warheads deployed on patrol.²¹

Ground- and air-launched cruise missiles

In addition to the sea-based Babur-3 SLCM, Pakistan continues to develop two types of nuclear-capable cruise missile as an integral part of its pursuit of a full-spectrum deterrence posture. The 700-km range Babur-2 is an improved version of the Babur (Hatf-7) GLCM that incorporates stealth design features. It was first test launched in 2016.²² The Ra'ad (Hatf-8) ALCM, which Pakistan claims can carry either conventional or nuclear warheads to a range of over 350 km, has been flight tested seven times since 2007.²³ Although the initial tests were conducted using a PAF Mirage III combat aircraft, some reports indicate that the missile may have been integrated with the JF-17 aircraft.²⁴ In 2017 Pakistan revealed an improved version, the Ra'ad-2 ALCM, which reportedly has an extended range.²⁵

¹⁹ See e.g. Khan, F. H., 'Going tactical: Pakistan's nuclear posture and implications for stability', Institut Français des Relations Internationales (IFRI), *Proliferation Papers*, no. 53, Sep. 2015, p. 41.

²⁰ Iskander, R., *Murky Waters: Naval Nuclear Dynamics in the Indian Ocean* (Carnegie Endowment for International Peace: Washington, DC, Mar. 2015), p. 17.

²¹ Panda, A. and Narang, V., 'Pakistan tests new sub-launched nuclear-capable cruise missile: what now?', *The Diplomat*, 10 Jan. 2017.

²² Pakistan Inter Services Public Relations, Press Release PR-482/2016-ISPR, 14 Dec. 2016.

²³ Pakistan Inter Services Public Relations, Press Release PR-16/2016-ISPR, 19 Jan. 2016.

²⁴ Fisher (note 7).

²⁵ Khan, B., 'Pakistan officially unveils extended range Ra'ad 2 air-launched cruise missile', *Quwa Defence News and Analysis Group*, 23 Mar. 2017.