

## 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’ in relation to India. It is estimated that Pakistan possessed up to 140 warheads as of January 2017 (see table 11.8). Pakistan’s nuclear weapon arsenal is likely to expand significantly over the next decade, although estimates of the increase in warhead numbers vary considerably.<sup>1</sup>

Pakistan is believed to be gradually increasing its military fissile material holdings, which include both highly enriched uranium (HEU) and plutonium. Uranium enrichment takes place at the gas centrifuge plant at the Khan Research Laboratories (KRL) complex at Kahuta, Punjab Province, and at a smaller plant located at Gadwal, also in Punjab. According to reports in 2016, a new uranium enrichment centrifuge plant may be under construction at the KRL complex.<sup>2</sup>

Pakistan’s plutonium production complex is located at Khushab, Punjab Province. It consists of four heavy-water nuclear reactors, two of which have become operational since 2013, and a heavy-water production plant. Pakistan appears to be increasing its capacity to reprocess spent nuclear fuel, and a small reprocessing plant in the New Laboratories facility at the Pakistan Institute of Science and Technology (PINSTECH), near Rawalpindi, has been expanded. A larger reprocessing plant has been constructed at the Chashma Nuclear Power Complex in Punjab and may be operational.<sup>3</sup>

### Aircraft

The Pakistan Air Force (PAF) Mirage III/V combat aircraft are the aircraft most likely to have a nuclear-delivery role. Pakistan procured 40 F-16A/B combat aircraft from the United States in the mid-1980s. There has been considerable speculation that some of these aircraft were modified for a nuclear-weapon delivery role.<sup>4</sup>

<sup>1</sup> See 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.

<sup>2</sup> Cartwright, C. and Dewey, K., ‘Government spin uranium facility identified in Pakistan: quantum leap new technology challenges SIGINT collection’, *Jane’s Intelligence Review*, vol. 28, no. 11 (Nov. 2016), pp. 48–52.

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

<sup>4</sup> See e.g. 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’

**Table 11.8.** Pakistani nuclear forces, January 2017

Type (US/Pakistani designation)	Launchers deployed	Year first deployed	Range (km) <sup>a</sup>	Warheads x yield <sup>b</sup>	No. of warheads <sup>c</sup>
<i>Aircraft</i>	36				36
F-16A/B <sup>d</sup>	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>	92 <sup>e</sup>				92
Abdali (Hatf-2)	(10)	(2015)	180	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) <sup>f</sup>	..	(2017)	900	1 x 12 kt	..
Shaheen-II (Hatf-6)	12	2014	1 500	1 x 12 kt	12
Shaheen-III (Hatf-6) <sup>g</sup>	..	(2018)	2 750	1 x 12 kt	..
Ghauri (Hatf-5)	24	2003	1 250	1 x 12 kt	24
Nasr (Hatf-9)	24	(2013)	60	1 x 12 kt	24
Ababeel (Hatf-. .)	0	..	2 200	MIRV	0 <sup>h</sup>
<i>Cruise missiles</i>	12				12
Babur GLCM (Hatf-7)	12	(2014)	350 <sup>i</sup>	1 x 12 kt	12
Babur-2 GLCM (Hatf-. .)	..	.. <sup>j</sup>	700	1 x 12 kt	..
Babur-3 SLCM (Hatf-. .)	0	.. <sup>k</sup>	450	1 x 12 kt	0
Ra'ad ALCM (Hatf-8)	..	(2017)	350	1 x 12 kt	..
<b>Total</b>					<b>130-140</b>

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

<sup>a</sup> 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.

<sup>b</sup> 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.

<sup>c</sup> 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.

<sup>d</sup> 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-weapon delivery role.

<sup>e</sup> Some launchers might have 1 or more reloads of missiles.

<sup>f</sup> It is unclear whether the Shaheen-IA has the same designation as the Shaheen-I.

<sup>g</sup> It is unclear whether the Shaheen-III has the same designation as the Shaheen-II.

<sup>h</sup> According to the Pakistan armed forces, the missile is 'capable of delivering multiple warheads', using MIRV technology.

<sup>i</sup> 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).

<sup>j</sup> The Babur 2, which was first test launched on 14 Dec. 2016, is an improved version of the original Babur GLCM.

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

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 2016* (Routledge: London, 2016); 'Nuclear notebook', *Bulletin of the Atomic Scientists*, various issues; and authors' estimates.

Pakistan is acquiring the JF-17 Thunder aircraft, a low-cost multi-role lightweight fighter jointly developed with China, to replace its ageing Mirage aircraft. There are unconfirmed reports that the PAF intends to integrate the dual-capable Ra'ad air-launched cruise missile (ALCM), which is under development, on to the JF-17, although whether this signifies a nuclear-weapon delivery role for the aircraft is unclear.<sup>5</sup>

### Land-based missiles

Pakistan is expanding its nuclear-capable ballistic missile arsenal. Short-range missiles include 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, remains 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 kilometres; and the two-stage, solid-fuelled, road-mobile Shaheen-II (Hatf-6) with a range of 1500 km.<sup>6</sup> A longer-range variant, the Shaheen-III, is currently under development and was first test launched in March 2015.<sup>7</sup> The missile has a declared range of 2750 km, making it the longest-range system 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. Pakistan has also prioritized the development of nuclear-capable short-range missiles that appear to be intended for tactical nuclear roles and missions. In pursuing a '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

before the US House of Representatives, Committee on International Relations, 20 July 2006.

<sup>5</sup> 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.

<sup>6</sup> 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, 2013), p. 17.

<sup>7</sup> Pakistan Inter Services Public Relations, 'Shaheen 3 Missile test', Press Release PR-61/2015-ISPR, 9 Mar. 2015.

but limited conventional attacks on Pakistani territory using forward-deployed forces.<sup>8</sup>

The National Defence Complex is developing two land-based short-range ballistic missiles designed to deliver compact, low-yield nuclear warheads: the 180-km range, road-mobile Abdali (Hatf-2); and the 60-km range, road-mobile Nasr (Hatf-9).<sup>9</sup> 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.<sup>10</sup>

### Sea-based 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, the Babur-3, had been successfully carried out from 'an underwater, mobile platform' deployed in the Indian Ocean.<sup>11</sup> The missile was said to be a sea-based variant of the Babur-2 ground-launched cruise missile. It is most likely to be deployed on the Pakistan Navy's diesel-electric Agosta class submarines, which are currently in service.<sup>12</sup>

### Cruise missiles

Pakistan continues to develop two types of cruise missile as an integral part of its pursuit of a full-spectrum deterrence posture. The ground-launched, turbojet-powered Babur-2 was flight tested on 14 December 2016. According to the Pakistan armed forces press service, the missile was an 'enhanced version' of the Babur, allowing it to 'strike targets both at land and sea with high accuracy, at a range of 700 km'.<sup>13</sup> At least 10 prior tests had been conducted since 2005. There has been a wide range of estimates of the missile's range, and the US Air Force puts it at 350 km.<sup>14</sup>

<sup>8</sup> Ahmed, M., 'Pakistan's tactical nuclear weapons and their impact on stability', Regional Insight, Carnegie Endowment for International Peace, 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.

<sup>9</sup> Pakistani Inter Services Public Relations, Press Release PR-20/2013-ISPR, 15 Feb. 2013; and Pakistani Inter Services Public Relations, Press Release PR-94/2011-ISPR, 19 Apr. 2011.

<sup>10</sup> Ansari, U., 'Pakistan holds parade after 7-year break', *Defense News*, 24 Mar. 2015.

<sup>11</sup> Pakistani Inter Services Public Relations, Press Release PR-10/2017-ISPR, 9 Jan. 2017.

<sup>12</sup> See e.g. Khan, F. H., *Going Tactical: Pakistan's Nuclear Posture and Implications for Stability*, Proliferation Papers no. 53 (Institut Français des Relations Internationales, IFRI: Paris, Sep. 2015).

<sup>13</sup> Pakistani Inter Services Public Relations, Press Release PR-482/2016-ISPR, 14 Dec. 2016.

<sup>14</sup> US Air Force, NASIC (note 6), p. 30.