VIII. Pakistani nuclear forces

The estimate presented here—that Pakistan possesses approximately 60 nuclear weapons—is conservative. On the basis of recent estimates of the size of Pakistan's military inventory of HEU and separated plutonium, the country could theoretically produce up to 100 nuclear weapons.[117] However, Pakistan is believed to have used only part of this inventory to manufacture warheads, and thus the actual number of warheads is likely to be lower than this maximum. Pakistani officials claim that the country has already produced more warheads than needed to satisfy its 'minimum deterrence requirement' but note that this requirement is subject to review 'according to situation'.[118]

Pakistan's current nuclear arsenal is based primarily on HEU, which is produced by a gas centrifuge uranium enrichment facility at the Kahuta Research Laboratories (also called the A. Q. Khan Research Laboratories), Punjab. There is evidence that Pakistan is moving towards a plutonium-based arsenal.[119] The 50-megawatt thermal (MW(t)) Khushab I reactor, completed in 1998, is capable of producing about 10–12 kg of weapon-grade plutonium annually.[120] Pakistan is building two additional plutonium production reactors at the nuclear complex at Khushab, Punjab; commercial satellite images taken during 2008 indicated that the second reactor was nearing completion.[121] According to one estimate, the power of the new reactors will be approximately 100 MW(t). This will increase Pakistan's plutonium production capability several-fold, provided that the country has sufficient spent fuel-reprocessing capacity.[122] Plutonium separation takes place at the pilot- scale New Labs reprocessing plant at Rawalpindi, Punjab. A new chemical separation facility appears to be nearing completion at Chashma, Punjab.[123]

widely assumed to be a ballistic missile submarine, but some media reports have indicated that it is an attack submarine.

[117] Pakistan possesses *c.* 2.0 tonnes of HEU and *c.* 90 kg of separated plutonium. See appendix 8A.

[118] Ehsan ul-Haq (Gen.), Chairman of the Joint Chiefs of Staff Committee, Interview, *Today with Kamran Khan*, Karachi Geo News TV, 24 Nov. 2006, Translation from Urdu, World News Connection.

[119] Plutonium-based nuclear warheads would normally be lighter and more compact than those using HEU to achieve the same yield. Such warheads could either be fitted onto smaller missiles, possibly including cruise missiles, or give already deployed ballistic missiles longer ranges.

[120] Mian, Z. et al., *Fissile Materials in South Asia: The Implications of the U.S.–India Nuclear Deal*, International Panel on Fissile Materials (IPFM) Research Report no. 1 (IPFM: Princeton, NJ, Sep. 2006).

[121] Albright, D. and Brannan, P., 'Second Khushab plutonium production reactor nears completion', Institute for Science and International Security (ISIS) Report, 18 Sep. 2008, <http://www.isis-online.org/publications/southasia/>.

[122] Albright and Brannan (note 121).

[123] Albright, D. and Brannan, P., 'Chashma nuclear site in Pakistan with possible reprocessing plant', Institute for Science and International Security (ISIS) Report, 18 Jan. 2007, <http://www.isis-online.org/publications/southasia/>.

Strike aircraft

The aircraft of the Pakistani Air Force that is most likely to be used in the nuclear weapon delivery role is the US-produced F-16 (see table 8.8). Other aircraft, such as the French-produced Mirage V or the Chinese-produced A-5, could also be used.

Pakistan currently maintains 32 F-16A/B aircraft in service, deployed in three squadrons. As part of a $5.1 billion deal agreed in 2006, the USA delivered the final 4 of 14 refurbished F-16 aircraft to the Pakistani Air Force on 28 July 2008.[124] The deal also includes the purchase of 18 Block 52 F-16C/D aircraft, with an option for 18 more and the midlife update of the F-16s already in Pakistani service.[125]

Land-based missiles

Pakistan has begun deployment of two types of short-range ballistic missiles (SRBMs) which are believed to have nuclear delivery roles. The Ghaznavi (Hatf-3) is a single-stage, solid-propellant, road-mobile SRBM which was formally inducted into service in 2004. The Pakistani Army test-launched a Ghaznavi missile on 13 February 2008.[126] The other SRBM, the Shaheen I (Hatf-4), entered into service with the Pakistani Army in 2003. It was most recently test-launched on 25 January 2008 during a troop training exercise conducted by the Army Strategic Force Command (ASFC).[127]

Pakistan's only MRBM currently in service is the Ghauri I (Hatf-5), which is a road-mobile, liquid-propellant, single-warhead missile. Pakistani military officials said that it has a nuclear delivery role. In addition, Pakistan continues to develop the two-stage, road-mobile, solid-propellant Shaheen II (Hatf-6) MRBM. On 19 April 2008 the Pakistani military announced that a Shaheen II missile had been successfully test-launched to a range of 2000 km.[128] Another Shaheen II was test-launched on 21 April 2008 at the end of the first 'operational readiness' field training exercise with the missile.[129] The Shaheen II's range of 2000–2500 km means that it can reach targets across India. Pakistani officials have denied that the

[124] US Embassy in Pakistan, 'U.S. delivers four F-16 aircraft to Pakistan Air Force', Press release, 28 July 2008, <http://islamabad.usembassy.gov/pr-08072801.html>. The value of the deal was lowered to $3.1 billion when Pakistan reduced its order of new F-16s by half.

[125] Schanz, M. V., 'US and Pakistan hammer out new F-16 deal', *Air Force Magazine*, vol. 90, no. 12 (Dec. 2006); and Grevall, J., 'Pakistan agrees deal with US for F-16s', *Jane's Defense Weekly*, 11 Oct. 2006. The agreement stipulated that Pakistan would not equip the F-16s with systems to penetrate air defences and would seek advance US approval for any F-16 flights out of Pakistani airspace.

[126] 'Ghaznavi missile launched', *Dawn* (Karachi), 14 Feb. 2008.

[127] 'Pakistan tests ballistic missile', BBC News, 25 Jan. 2008, <http://news.bbc.co.uk/2/7208416.stm>.

[128] 'Pak successfully test fires Hataf-6 Shaheen-2 missile', *The Nation* (Lahore), 19 Apr. 2008.

[129] 'First training launch of Hatf VI', *Dawn* (Karachi), 22 Apr. 2008.

Table 8.8. Pakistani nuclear forces, January 2009

Type	Range (km)[a]	Payload (kg)	Status
Aircraft			
F-16A/B	1 600	4 500	32 aircraft, deployed in 3 squadrons; most likely aircraft to have a nuclear delivery role
Ballistic missiles			
Ghaznavi (Hatf-3)	~400	500	Entered service with Pakistani Army in 2004; fewer than 50 launchers deployed; last test-launched 13 Feb. 2008; believed to be a copy of M-11 missile acquired from China in 1990s
Shaheen I (Hatf-4)	>450[b]	750–1 000	Entered service with Pakistani Army in 2003; fewer than 50 launchers deployed; last test-launched 25 Jan. 2008
Shaheen II	2 000	~1 000?	First Army operational readiness launch on 19 Apr. 2008; second on 21 Apr. 2008[c]
Ghauri I (Hatf-5)	>1 200	700–1 000	Entered service with Pakistani Army in 2003; fewer than 50 launchers deployed; test-launched in 1 Feb. 2008
Cruise missiles			
Babur (Hatf-7)	700[d]	. .	Under development. Ground-launched version tested three times in 2007 (Mar., Jun. and Dec). Sea- and air-launched versions under development too
Ra'ad (Hatf-8)	350	. .	Under development; air-launched; first test-launch Aug. 2007; second 8 May 2008

[a] Missile payloads may have to be reduced in order to achieve maximum range. Aircraft range is for illustrative purposes only; actual mission range will vary according to flight profile and weapon loading.

[b] Some unofficial sources claim a range of 600–1500 km.

[c] The twin operational readiness tests suggest that the Shaheen II may be operational.

[d] Since 2006 the range of flight tests has increased from 500 to 700 km, and the goal is now 1000 km.

Sources: US Air Force, National Air and Space Intelligence Center (NASIC), *Ballistic and Cruise Missile Threat* (NAIC: Wright-Patterson Air Force Base, Ohio, Aug. 2003); 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 developments and the ballistic missile threat through 2015' (unclassified summary), Dec. 2001, <http://www.dni.gov/nic/special_missile threat2001.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.

country was seeking to develop longer-range ballistic missiles that could strike targets outside the region.[130]

Pakistan is continuing to develop its arsenal of cruise missiles. In December 2007 Pakistan conducted the fourth test flight since 2005 of a nuclear-capable cruise missile, designated the Babur (Hatf-7). Efforts are under way to increase the range of the subsonic cruise missile from 700 km to 1000 km.[131] Pakistan is developing an air-launched version of the Babur, which will reportedly be carried by F-16 and JF-17 aircraft.[132] It is also developing a sea-launched version, rumoured to be for deployment on the Agosta submarine.[133]

Pakistan is developing a nuclear-capable air-launched cruise missile, known as the Ra'ad (Hatf-8), which will have a range of 350 km. On 8 May 2008 Pakistan conducted the second test launch of the Ra'ad as part of a 'continuing process of validating the design parameters'.[134] The missile, which was previously test-fired in August 2007 from a Mirage fighter, was described by Pakistan's military press service as having 'special stealth capabilities'.[135]

IX. Israeli nuclear forces

Israel continues to maintain its long-standing policy of nuclear ambiguity, neither officially confirming nor denying that it possesses nuclear weapons. In 2006 the Israeli Prime Minister, Ehud Olmert, made a remark that was widely interpreted as tacitly acknowledging that Israel possesses a nuclear arsenal. Israeli officials quickly disavowed the remark and reiterated that Israel 'will not be the first country that introduces nuclear weapons to the Middle East'.[136]

The size of the Israeli nuclear weapon stockpile is unknown but it is widely believed to consist of roughly 100 plutonium warheads. According to one estimate, Israel possessed 0.6 tonnes of military plutonium as of December 2007;[137] this is the equivalent of 120 warheads, assuming that each contains 5 kg of plutonium. Only part of this plutonium may have been used to produce weapons. It is estimated here that Israel has approximately 80 intact nuclear warheads, of which 50 are re-entry vehicles for

[130] Ehsan ul Haq (note 118).

[131] President of the Islamic Republic of Pakistan, Office of the Press Secretary, 'Government has prepared comprehensive plan to equip armed forces: Musharraf', Press release, 30 May 2007.

[132] 'Pakistan successfully test-fires Hataf-VII missile', *PakTribune*, 26 July 2007.

[133] Hali, S., 'Second strike capability', *The Nation* (Islamabad), 16 Aug. 2006.

[134] Khan, I. A., 'Cruise missile fired from an aerial platform', *Dawn* (Karachi), 9 May 2008.

[135] Pakistani Inter Services Public Relations (ISPR), 'Pakistan test fires nuclear capable Hatf-VIII', Press release, 8 May 2008, <http://www.ispr.gov.pk/front/main.asp?o=t-press_release&date=2008/5/8>.

[136] Boudreaux, R., 'Fallout rains on Olmert after nuclear remark', *Los Angeles Times*, 13 Dec. 2006.

[137] See appendix 8A.