PAKISTAN'S NUCLEAR DELIVERY SYSTEMS

SHALINI CHAWLA

Pakistan's efforts to build the delivery systems for its nuclear weapons took off as early as in the 1970s when the Pakistani leadership seriously initiated its efforts to build the bomb. Pakistan's present nuclear dyad consists of nuclear capable combat aircraft and solid fuel and liquid fuel rockets for short range and long range ballistic missiles. Efforts for the acquisition of the combat aircraft like the F-16s (after the failed attempts to get the A-7s in the 1970s) materialised to some extent in the early 1980s, although Pakistan was unable to receive the desired number of F-16s following the US sanctions in 1990. However, Pakistan has focussed on building its nuclear delivery capabilities largely with the Chinese assistance since the 1980s.

Pakistan began its missile programme in the early 1980s as part of its nuclear programme which started in the 1960s. The Pakistani missile programme saw a major upswing in the 1990s that can very well be termed as the missile acquisition decade as in a very short period of time, the country was able to acquire long range potent missiles with nuclear delivery capabilities. Pakistan's missile programme has come into being totally with external assistance, mainly from China and, to a large extent, from North Korea.

Pakistan's nuclear delivery systems can be put under three categories:

- Land-based missiles.

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- Aircraft.
- Cruise missiles.

LAND-BASED MISSILES

Pakistan's Missile Development

Pakistan's deep interest and involvement in missile development can be traced back to as early as the 1960s when the Shah of Iran opened the Iran Electronics Industries (IEI) missile repair facility in Shiraz to Pakistan. [1] Pakistan's efforts towards launching the space programme also dates to 1961 when the Space and Upper Atmosphere Research Commission (SUPARCO) was formed. Although Pakistan's efforts to acquire nuclear weapons started in earnest in the early 1970s after Bhutto's announcement to build a bomb, its serious search and efforts for the missiles as a launch vehicle took place in the late 1980s when its nuclear weapon programme was nearly under completion.

Ballistic missiles in a loose sense are more advanced than manned aircraft and are easier to employ, relatively at a lower cost. The reasons why Pakistan has adopted an aggressive missile acquisition programme can be attributed to mainly the following factors.

First, Pakistan has always felt threatened by India's superior military build-up and has sought ways to stand at par with India's conventional military capability. In fact, Pakistan's openly stated objective behind going nuclear has been to neutralise India's defence capability. Pakistan tried to acquire the F-16s in the 1980s itself when it was getting close to the completion of its nuclear weapon programme. But after the delivery of 40 F-16s, the US sanctions designed to control Pakistan's growing nuclear weapon programme in the 1990s suspended the delivery of the remaining F-16s. Thus, the Pakistani leadership started to look into the alternatives and missiles came up as an easy option, especially with the growing military partnership it shared with China. Support from China has been

1 Ann Tibbitts Schulz, *Buying Security:Iran Under the Monarchy* (San Francisco: Westview Press, 1989) p.54, as cited in "Pakistan Profile: Missile Chronology", *NTI* at http://www.nti.org/e_research/profiles/Pakistan/Missile/3068_3069.html

at an accelerated pace after the 1965 India-Pakistan War and imports from China have gone up significantly starting in the early 1990s.

Secondly, while it tried hard to acquire the Mirage-2000 from France, Pakistan's economic conditions in the 1990s did not allow the acquisition of modern combat aircraft from any other source after the US sanctions were levied on Pakistan. Pakistan's Gross Domestic Product (GDP) growth in the 1990s went down to as low as 1.9 percent (in 1996). Also, there was severe pressure from the International Monetary Fund (IMF) to cut down defence expenditure. There was hardly any acquisition in the 1990s and the Pakistan Air Force (PAF) actually suffered lack of modernisation. In the 1990s, Islamabad saw missiles as a cheaper and more reliable option than the nuclear delivery systems.

Thirdly, Pakistan acquired nuclear capability in 1987 and already possessed F-16s to be used as the delivery vehicles for nuclear warheads. But the aircraft delivery systems have limitations in terms of both range of delivery of nuclear weapons and also penetration of India's air defence system. Ballistic missiles provide a much more credible deterrence, against which there is no credible defence. It is the vulnerability of a nation to a missile attack that lies at the heart of deterrence. This is why Pakistan has focussed on building up the longer range missiles. Missiles are increasingly being touted as the new currency of power. [2]

Lastly, during the Afghan War in the 1980s, Pakistan was exposed to the threat of conventionally armed short range missiles from the Soviet Union. The Soviet forces fired Scud missiles across the Durand Line targeting the Mujahideen camps inside the Pakistani territory. Added to this was the demonstrative threat of the missiles during the Iran-Iraq War in the 1980s. Thus, the evolving role of the missiles was sufficient to influence the Pakistani thinking for a missile development programme.

In the development of its missile programme, Pakistan has clearly followed a dual-strategy:

2. Brahma Chellaney, "Missile Muscle in the New Definition of World Power", *The Asian Age*, April 16, 1999.

Pakistan's missile development programme has been primarily carried out with the Chinese assistance and to some extent, North Korea, after the United States imposed sanctions on China.

1. Assembly of imported missiles in Pakistan from both the Semi-Knocked Down (SKD) kits and Completely Knocked Down (CKD) kits.[3] This would enable a quantitative jump in the Pakistani indigenous missile production expertise.
2. Indigenous fabrication of the above missiles sub-systems and propellants in a graduated manner. This was aimed to create self-reliance in missile capability over time. [4]

Ballistic Missiles

Pakistan's missile development programme has been primarily carried out with China's assistance and, to some extent, North Korea's, after the United States imposed sanctions on China. China had been willing to transfer nuclear weapons to Pakistan as early as 1965 itself, shortly after it became a nuclear power. [5] Bhutto had been arguing for the nuclear weapons in the late 1960s, but Ayub had turned down the proposal as it was not deemed necessary or affordable at that point of time for Pakistan. Since 1972, Pakistan sought Chinese assistance for its nuclear development programme and China has been Pakistan's predominant source of foreign technological support for its missile development efforts. Chinese missile assistance to Pakistan ranges from providing equipment and training to transferring the complete missiles. In 1989, Lt Gen Talat Masood, Chairman of Pakistan's Ordnance Factories (POF) Board (1981-1988) acknowledged China's active role in Pakistan's missile programme in an interview.[6] US Assistant Secretary of State Winston Lord was not wrong when he wrote a letter to Senator Robert F. Bennett stating, "The entire strategic weapons

3. Dr Subhash Kapila "Pakistan's Ballistic Missile Arsenal: Development and Acquisition", South Asia Analysis Group Papers, at http://www.southasiaanalysis.org/%5Cpapers2%5Cpaper148.html
4. Ibid.
5. There is no doubt that this would have created a major rift between the US and Pakistan, which may have been Mao's real motive.
6. Roger Frost, "Pakistan's Procurement Chief on New Programs", *International Defence Review*, June 1989, p. 765.

program should be stamped 'Made in China'". [7]

Transfer of M-9 and M -11

The development of the Chinese M series of Short Range Ballistic Missiles (SRBMs) commenced in the early 1980s and the three versions are known as the M-9, M-11 and M-18. These designations were apparently used for the export versions. [8] All M series missiles use solid fuel, and have short operational preparation time. Also, they are transported by highly mobile cross-country transporters which have the capacity to launch the missiles.[9] Information from various sources indicates that Pakistan had negotiated the deal for the M-11 during Zia's regime. According to US officials, Pakistan agreed to pay China $15 million as partial payment on its 1988 contract with the state-owned China Precision Machinery Import-Export Corporation (CPMIEC) for an undetermined number of M-11 missiles, launchers, and support equipment.[10] China reportedly started discussing the transfer of M-11 missiles to Pakistan in the early 1990s. In the same period, the National Development Complex (NDC), a subsidiary of the Pakistan Atomic Energy Commission (PAEC), reportedly acquired complete though unassembled M-11s and possibly an undisclosed number of M-9 SRBMs from Beijing.[11]

Although Pakistani leaders have made conflicting statements regarding the receipt of the missiles, various reports provide enough evidence that Pakistan did receive the M-9 and M-11 missiles from China. The M-9 SRBMs, which are capable of carrying both nuclear and conventional warheads, were delivered to Pakistan in early 1991. The M-9 is reported to have a

7. Bill Gertz, "China Plays a Major Role in Expanding the Nuclear Club", *Washington Times,* May 29, 1998.
8. "Nuclear Weapons Database: Pakistan's Possible Nuclear Delivery Systems", at http://www.cdi.org/nuclear/database/panukes.html
9. "Weapons of Mass Destruction: DF-11 [CSS-7] , DF-11A", at http://www.globalsecurity.org/wmd/world/china/df-11.htm
10 Bill Gertz, *Washington Times*, October 4, 1994, p. A8; Barbara Starr, *Jane's Defence Weekly*, October 15, 1994, p. 6 as cited in "China's Missile Exports and Assistance to Pakistan –Statements and Developments" at http://cns.miis.edu/archive/country_india/china/mpakchr.htm
11. "Missile Overview", *NTI* at http://www.nti.org/e_research/profiles/Pakistan/Missile/index_3066.html

range of 600 km. It is a single stage missile with an inertial guidance system, which signifies that the missile is programmed before the launch and does not receive any external guidance after the launch. China has never openly admitted selling the M-9 missiles to Pakistan, but has indicated that it would sell missiles to "whoever can pay for them".[12]

Pakistan reportedly received the M-11 missile (which the Chinese refer to as the Dong Feng-11) in 1991, when US intelligence discovered their transfer along with the accompanying transporter-erector-launchers to Pakistan.[13] The M-11 is capable of carrying nuclear as well as conventional warheads. Pakistan received the M-11 variant as a single-stage, solid fuelled missile with a range of 300 km, carrying a 800 kg warhead.[14] Discussions on the possible sale of M-11 missiles and related technology to Pakistan started in the late 1980s and apparently the contract was signed in 1988. The US intelligence agencies reported in 1995 that the M-11 deal moved ahead after Pakistan apparently paid $15 million to China for the missiles, launchers and support equipment. The M-11s were shipped to Pakistan in 1993, but their assembly was not confirmed.[15] The US spy satellite photographs taken in April 1995 showed missile canisters at a facility in Sargodha, Pakistan. China also sent two teams of missile technicians to Pakistan to provide training, and unpack and assemble the M-11s. [16]

The United States' response has not been very consistent in its actions regarding proliferation of nuclear weapons from China to Pakistan and has been driven by its own strategic interests from time to time. The US

12. Bill Gertz, "China Can't Say No to Arms Buyers", *Washington Times,* May 28, 1991.
13. Bill Gertz, "Missile Deception," in *Betrayal: How the Clinton Administration Undermined American Security* (Washington, DC: Regnery Publishing, Inc., 1999), p. 159, as cited in "Pakistan Profile: Missile Overview", *NTI* at http://www.nti.org/e_research/profiles/Pakistan/Missile/index.html
14. "Although the DF-11 has a range of 300 km, the Chinese continued work on a version with a longer range. China's 50th anniversary military parade on October 1, 1999, marked the first public Chinese display of a new version of the M-11 short-range missile, the CSS-7 Mod 2, more commonly known as the M-11 follow-on. The new Mod 2 missile is about two metres longer than the Mod 1, and believed to have a longer range, a larger warhead and greater accuracy than the earlier M-11. The accuracy of these missiles will improve in the future if China is able to apply Global Positioning System (GPS) guidance technology to provide highly accurate location information for missile launchers or pre-surveyed launch sites." Cited in n. 9..
15. Bill Gertz, "Pakistan Deploys Chinese Missiles", *Washington Times,* June 12, 1996.
16. Ibid.

Administration took measures to dissuade China from transferring the missiles, components and missile related technology to Pakistan, and was engaged in series of negotiations seeking to obtain pledges for China to abide by the Missile Technology Control Regime (MTCR) guidelines (formulated in 1987) and also to become a member of the regime.[17] Washington offered economic incentives, took diplomatic measures and also imposed economic sanctions on China. Beijing made pledges in 1991 and 1994 when it signed the 31-nation MTCR as well as a 1994 US-China agreement not to deploy M-11s in Pakistan.[18] After Washington received the reports of the transfer of the M-11 to Pakistan, limited sanctions were imposed on China in 1993.[19] The sanctions, affecting an estimated $500 million in American sales, were lifted in October 1994 after Chinese Foreign Minister Qian Qichen and Secretary of State Warren Christopher signed an agreement halting the sale of the M-11 and similar missiles.[20] Various reports at the international level have claimed that China sold over 30 M-11 missiles to Pakistan, despite repeated denials by both governments. On May 8, 1993, the Chinese Foreign Ministry denied the news reports of sale of missile components to Pakistan and announced that the "news report on China shipping M-11 missiles is groundless."[21] At the same time, on May 21, 1993, Secretary General of Pakistan's Foreign Ministry Akram Zaki, denied that Pakistan had acquired M-11 missiles from China. He also termed the news reports of the transfer of the M-11 to Pakistan as "speculative stories and motivated allegations".[22] But, later in the same year, Pakistani Prime Minister Benazir Bhutto stated in Beijing that Pakistan has purchased Chinese M-11 missiles due to the threat posed by the Afghan Scuds and the Indian missile build-up.[23] Again, in 1996-97, there were reports of Chinese assistance in indigenous Pakistani

17. "China's Missile Exports and Assistance to Pakistan", *NTI*, at http://www.nti.org/db/china/mpakpos.htm
18. Gertz, n.15.
19. Sanctions had a significant impact on the sales of high technology goods to China. Those goods were a major portion of the $12 billion US trade with China in the 1992.
20. Ibid.
21. Leon Hadar, "Report of Missile Export Deals Blow to China's Trade Status Extention," Bu*siness Times* (Singapore), May 8, 1993.
22. "Pakistan Denies Receiving Chinese M-11 Missiles," Agence France Presse, May 21, 1993.
23. Jeffery Parker, Reuters, December 1993.

Pakistan has a missile factory located in Rawalpindi for the manufacture of medium range ballistic missiles. In all likelihood, it is manufacturing the M-11 or a similar missile.

M-11 production. [24]

The M-11 is a road-mobile, single-stage, solid propellant, short-range ballistic missile. The basic variant of the M-11 termed Dong Feng in China has a range of 280-350km and delivers a single warhead of 500kg. The basic variant of the M-11 uses an inertial guidance plus terminal radar guidance, giving a Circular Error Probability (CEP) of 500-600 m. The improved M-11A (which Pakistan is reportedly producing) uses inertial/Global Positioning System (GPS) guidance system with optical correlation terminal targeting, resulting in a greater accuracy of below 200m CEP.[25]

Pakistan has a missile factory located in Rawalpindi for the manufacture of medium range ballistic missiles. In all likelihood, it is manufacturing the M-11 or a similar missile, it is unclear whether this facility has the capability to manufacture complete missiles or only some major components. However, there have been confirmed reports of the continued Chinese assistance during 1996-97, including the blueprints and the construction equipment.[26]

Hatf-1

Development of the Hatf-1 solid- propellent unguided rocket and ballistic missile programme started in the early 1980s and was revealed by Pakistan in early 1989. Although Islamabad claims it to be its indigenous production,

24. Statement by Gordon Oehler, Former Special Assistant to the Director, CIA and Director DCI's Nonproliferation Center; Hearing of the Senate Foreign Relations Committee on Proliferation of Chinese Missiles; Gary Milhollin, Director; Wisconsin Project on Nuclear Arms Control; June 11, 1998.
25. "DongFeng 11 (CSS-7) Short-Range Ballistic Missile", at http://www.sinodefence.com/strategic/missile/df11.as p
26. Office of the Secretary of Defense, Proliferation: Threat and Response, November 1997 (online version); US Department of State, Daily Press Briefing, August 26, 1996; R. Jeffrey Smith, "China Linked to Pakistani Missile Plant," *The Washington Post*, August 25, 1996, p. A1, A25; Tim Weiner, "US Suspects China is Giving Pakistan Help with Missiles," *New York Times*, August 26, 1996, p. A4 As cited in "China's Missile Exports and Assistance to Pakistan", at http://cns.miis.edu/archive/country_india/china/mpakpos.htm

there are enough reports which provide evidence of the Chinese assistance. Apart from China, certain European companies have also provided assistance to Pakistan.[27] There have been unconfirmed reports that the initial Hatf-1 and 2 project designs were both based upon a 1960s French sounding rocket design, known as Eridan.[28] Both Hatf missiles resemble the Chinese N series, so technical assistance from China cannot be denied.

Reports suggest that the Hatf-1 is a 70 km range unguided rocket, with a length of 6.0m, a body diameter of 0.56 m and a launch weight of approximately 1,500 kg. The rocket is a single stage solid propellant system, with a payload of 500 kg that could be conventional High Explosive (HE), chemical or submunitions.[29] There have been also reports of the development of the improved version Hatf-1A, 100-km range missile. The first launching of the Hatf-1A took place on February 7, 2000. Subsequent launching of the improved versions of Hatf-1 was reported to have taken place on May 28, 2002, March 26, 2003, March 31, 2005 and February 19, 2006. [30]

It is believed that the Hatf-1 entered into service in 1992 and the Hatf-1A in 1995. The guided Hatf-1B, a further improved version with an upgraded kit fitted to the existing missile, was reported flight tested in February 2000 and is believed to have entered operational service in 2004.[31]

Hatf-2 (Abdali)

The original version of the Hatf-1 SRBM was started in 1987, and was first deployed in 1989 as a two-stage version of the Hatf-1 missile. The Hatf-2 uses the Hatf-1 as a second stage, and has a range of 300 km with 500 kg payload. [32] There are unconfirmed reports that the Hatf-2 is an upgraded version of the Hatf-1B and was developed with Chinese aid and technical assistance. There was confusion regarding the name of the programme, and some reports suggest that it may have been referred to as Shadoz

27. *Jane's Strategic Weapon Systems*, Issue 48, 2008, p. 108.
28. Ibid.
29. Ibid.
30. S. Chandrashekar, Arvind Kumar and Rajaram Nagappa. "An Assessment of Pakistan's Ballistic Missile Programme: Technical and Strategic Capability", *NIAS* Study, 2006, p. 7.
31. n. 27, p. 109.
32. Ibid.

(King Hawk).[33] Although the production for the Hatf-2 started in 1987, the programme was reportedly delayed, in all probability due to the acquisition of the M-11 in the early 1990s. A new programme was later commenced in 1997 by the Pakistan National Development Complex (now NESCOM) with a reduced range of 180 km and was called the Hatf-2 or Abdali. [34] The Abdali missile was first flight tested in May 2002, and appears similar in size and shape to the Argentinean Alacran SRBM and the Chinese TY-3, TY-13 and TY-14 research rockets, which confirms the Chinese assistance in the build-up of the missile.[35] Due to their limited range, it is unlikely that the Abdali missiles can carry nuclear warheads. The missiles do not pose a significant strategic threat but their evolution does provide an insight into the development of Pakistan's missile programme and also missile technology transfer from China. [36]

Hatf-3 (Ghaznavi)

There has been much speculation about the origin of the Hatf-3 Ghaznavi missiles. The original plan for the development of the Hatf-3 started in 1987. The original version was a two stage missile using the design of Hatf-2 which was planned to be modified to give it an extended range of 800 km. The programme for the development of the Hatf-3 was terminated after Pakistan received the M-11 from China. The technology for the M-11 was used to develop future missiles – the Shaheen-1 and Shaheen-2 – in Pakistan. But, as a low priority, the programme for the Hatf-3 - Ghaznavi was initiated in 1997 in Pakistan by NESCOM. The first flight test was made in May 2002. [37] The other three test flights for the Ghaznavi-3 took place in October 2004, November 2004 and December 2006. [38] There are reports suggesting that these missiles are operational. Technical evaluation of the missile images suggests that the Hatf-3 is a version of the M-11 or may even

33. "Nuclear Weapons Database: Pakistan's Possible Nuclear Delivery Systems," at http:www.cdi/nuclear/database/panukes.html
34. n. 27, p. 109.
35. Ibid.
36. Chandrashekar et. al., n.30, 9
37. n. 27, p. 111.
38. Chandrashekar et. al., n.30 p.10.

be a repainted M-11. Reportedly, the production facilities of these missiles have been set up with Chinese assistance. [39]

The Ghaznavi missile is 8.5 m long, has a body diameter of 0.8 m, and a launch weight of 4,650 kg. The missile has a single stage solid propellant motor providing it a minimum range of approximately 50 km, a maximum range of 280 km, and it can carry single warhead of 700 kg. [40] The M-11 Chinese missile now has a range of 350 km and, thus, there are apprehensions that perhaps the Ghaznavi also has a range of up to 350 km. [41] The Ghaznavi can carry two kinds of warheads – a longer nuclear warhead and a shorter conventional warhead. Studies suggest that the warhead dimensions closely match the warheads of the Chinese M-11missiles. [42]

Hatf-4 (Shaheen-1)

The Hatf-4 or Shaheen-1 is believed to be a scaled up version of the M-11 missiles supplied to Pakistan in 1993. Since 1996, there have been suggestions that a solid propellant missile was being developed by Pakistan (obviously with Chinese assistance). Ground tests of the motor for this missile were reported in 1997 and 1998, and it was first displayed in 1999.[43] Reportedly, the Shaheen-1 was developed by the Pakistan National Development Complex (PNDC) possibly with assistance from SUPARCO and the PAEC[44].

The Shaheen is a single stage, solid propellant missile with an inertial guided system and a maximum range of 750 km.[45] Two flight tests were made in October 2002, two in October 2003, one in December 2004, and one in November 2006. The Shaheen-1 was officially handed over to the Pakistan Army Strategic Missile Group in March 2003. [46] Reportedly, the warheads of the M-9 and Shaheen-1 are similar and a comparison of

39. Ibid.
40. Ibid.
41. Ibid.
42. Ibid, p. 13.
43. n.27, p. 112.
44. Ibid
45. Ibid.
46. "Pakistan Conducts Third Missile Test in 3 Weeks", *Rediff NEWS*, at http://in.rediff.com/news/2006/dec/09hatf.htm

While Pakistan's clandestine missile transactions with China have been closely monitored by the US, the same does not stand true for its clandestine missile technology transfer from North Korea which has enjoyed greater leverage.

the warhead parts of the two missiles confirms a common origin.[47]

Hatf-5 (Ghauri)

Pakistan's second most crucial partner in the missile development programme has been North Korea, while Pakistan, has been extending military assistance to North Korea in return. B. Raman has aptly said: "North Korea's assistance to Pakistan in the development of its missile capability has been as a *quid pro quo* for the latter's assistance to North Korea in the development of its military nuclear capability."[48]

It is believed that one of the nuclear devices tested in 1998 at Chagai was of North Korean origin. [49] Pakistan's link with North Korea was established in 1993 during the second tenure of Benazir Bhutto. The Pakistani Prime Minister visited Pyongyang after having talks with North Korean President Kim I1 Sung. She was accompanied by Foreign Minister Sardar Asef Ahmad Ali and Minister of Defence Aftab Shaban Mirani, which clearly indicated the agenda for the visit. According to Pakistani officials, the Pakistani delegation went with plans for North Korea's Nodong missile.[50] While Pakistan's clandestine missile transactions with China have been closely monitored by the US, the same does not stand true for its clandestine missile technology transfer from North Korea which has enjoyed greater leverage. The US intelligence community has been warning the US Administration about the North Korea–Pakistan

47. Chandrashekar, et. al. n. 30, p. 24.
48. "Pakistan and the North Korea Connection", *Asia Times Online*, at http://www.atimes.com/atimes/South_Asia/DJ22Df01.html
49. Ibid.
50 "Bhutto Ends Visit to North Korea", Agence France Presse, December 30, 1993, International News; in Lexis-Nexis Academic Universe, December 30, 1993, web.lexis-nexis.com, at "NTI: Country Overview: Pakistan Missile Chronology" at, http://www.nti.org/e_research/profiles/Pakistan/Missile/chronology_1992_1993.html

links related to missile transfer since 1997.[51]

The development programme for the Hatf-5 or Ghauri commenced in 1993 at the Khan Research Laboratories and was publicly announced in 1997. An engine test was carried out in January 1998, and the first flight test was made in April 1998, although several motor tests were carried out in North Korea in 1997 that might have been connected with the Ghauri.[52] Although North Korea has consistently denied providing assistance, the US intelligence sources did monitor the North Korean flights to Pakistan. The flights mostly involved IL-76 transports; the transports apparently carried technical experts, including telemetry crews. [53] The number of North Korean flights increased and this was followed by the visit of North Korean Chief of Staff and head of the strategic forces, which was indicative of the reported fact that the two nations have entered into an agreement which allowed North Korea access to Pakistan's range facilities in exchange for military technology.[54]

Reportedly, the 5-10 No dong missiles assembly sets were sent to Pakistan between 1994 to 1997 for trials and to set up a manufacturing capability. [55] The Ghauri missile, which resembles the shape of the Russian 'Scud B' is an outcome of coordinated inputs from both North Korea and China. There were reports regarding an arrangement among Pakistan, China and North Korea whereby China would provide the soft technology and engineering for the Ghauri, and North Korea would act as an agent for the transfer of Chinese technology and provide the hardware and components from its Nodong missile programme.[56] It has been reported that China provided Pakistan with a nuclear warhead design with a weight of 500 kg in the

51. In 1997, *Jane's Defence Weekly* reported that Gordon Oehler, former Director of the CIA's Nonproliferation Center said that Pakistan has recently announced the development of a 1,500km range missile called Ghauri. Even though Pakistan claims the Ghauri to be an indigenously produced missile, US analysts believed that China and North Korea provided the necessary technical advice.
52. n. 27, p. 113.
53. "Pakistan's Missile 'Was a Nodong'", *Jane's Missiles &Rockets* (Coulsdon, Surrey), vol. 2, no. 5, May 1998, pp.1-2.
54. Ibid.
55. Ibid.
56. Joseph Bermudez, "A Salient Partner", *Janes Defence Weekly* (Coulsdon, Surrey), May 20, 1998.

early 1980s, and this design was used to provide the warhead for the Ghauri missile. Also, there have been unconfirmed reports that the Chinese guidance systems have been used, which could have been passed through North Korea to Pakistan. [57]

The first flight test of the Ghauri, single stage, liquid propellant missile, with a range of 800-1,200 km, was in April 1998. An improved version, known as the Ghauri-2, was reportedly under development in 1998, with a enhanced range of 1,500 to 1,800 km, and was first flight tested in April 1999. The Ghauri-3 programme has been under development since 1994, with a range of 3,000 km and the first stage motor tests were reportedly done in July and September 1999. [58]

Hatf-6 (Shaheen-2)

There were unconfirmed reports regarding the development of the Shaheen-2, also designated as Hatf-6, which is a two-stage solid propellant ballistic missile. Some reports also suggested that it was ready for testing in June 1999. [59] However, two Shaheen-2 missiles were displayed during the Pakistan Day Parade in Islamabad on March 23, 2000. [60] One of the missiles was carried on a 12-wheel transporter erector launcher, while the other Shaheen was carried on a missile transporter. These vehicles are apparently much larger in size than the 8 wheel launcher used by the Shaheen-1.[61]

On March 9, 2004, Pakistan test- fired the nuclear capable Shaheen-2 ballistic missile. Samar Mubarakmand, Chairman, National Engineering and Science Commission made a statement that the missile was a two-stage rocket weighing 25 tons with a diameter of 1.4 m, length of 17.5 m, and a range of 2,500 km.[62] The Shaheen-2 is believed to be based upon the earlier Chinese two-stage solid propellant missile M-18, which was demonstrated in 1988. The maximum range of the Shaheen-2 missile was 2,000 km, which

57. n. 27, p. 113.
58. Ibid., pp. 113-114
59. Ibid., p115.
60. "Shaheen-II / Eagle-I / Hatf-6 / Ghaznavi, Weapons of Mass Destruction (WMD)," at http://www.globalsecurity.org/wmd/world/pakistan/shaheen-2.htm
61. Ibid.
62. Ibid.

has now been increased to 2,500 km, sufficient to target any important part of India. [63] The Shaheen-1 and 2 have been developed by the PNDC with the assistance of SUPARCO and PAEC. There are unconfirmed reports that a three-stage Shaheen-3 missile, with a range of 4,000 km, might be under development in Pakistan for dual use, as a ballistic missile as well as a satellite launch vehicle.[64]

CRUISE MISSILES

The importance of cruise missiles is growing in the inventory of modern military forces. The US obviously pioneered the development of cruise missiles. The effectiveness of these missiles was demonstrated for the first time during the Persian Gulf War in 1991. Cruise missiles do have distinct advantages over ballistic missiles and combat aircraft and, thus, the Pakistani leadership was keen to acquire these when they saw a window of opportunity with North Korea.

The small size of a cruise missile makes it possible to launch it from a ship or even a truck and this is a major advantage over other weapons. Secondly, a cruise missile can fly at an extremely low altitudes, achieve high accuracy even at long ranges and evade air defences, which increases its survivability. It might not be incorrect to say that in the current scenario, cruise missiles pose the gravest delivery system proliferation threat. They are inexpensive to build and can, therefore, overwhelm current defences by sheer numbers. Moreover, they can be designed to be small with low-thrust engines and can penetrate radar and infrared-detection networks. Thirdly, cruise missile technology is simple and can be available with a country that builds even rudimentary aircraft. The fourth factor which makes the option of cruise missiles attractive is that since cruise missiles are unmanned, they require no flight crew training, expensive upkeep programmes, special hangars for housing, or large air bases for basing.[65]

63. n. 27, p. 115.
64. Ibid.
65. "Cruise Missiles", Federation of American Scientists, at http://www.fas.org/nuke/intro/cm/index.html

Hatf-7 (Babur)

Pakistan conducted a test-firing of its latest domestically manufactured (as it claims) cruise missile, known as Babur (or Babar, Hatf-7), exactly at the time President Asif Zardari was in Washington and due to meet US President Barack Obama, in May 2009.[66] This test has been the latest in the series of flight tests which commenced in August 2005, followed by more in 2006 and later in 2007.

Development of the Babur, also designated as Hatf-7, which is an air, ground, ship and submarine launched short range, turbojet powered, single warhead cruise missile, commenced reportedly in 1990 itself, given Islamabad's quest for enhancing its options of delivery systems. In July and August 1998, two US RGM/UGM-109 Tomahawk cruise missiles were recovered almost intact in southern Pakistan, and it is believed that these may have been used for reverse engineering or even to contribute basic technology for the development of the Babur. [67] But this does not deny the Chinese technical input in the development of the Babur, as the missile looks similar to the Chinese Hong Niao-3, the US RGM-109 and also has similarities with the Russian SS-N-27 Club (3M14 version) cruise missile. [68] The total length of the missile, including the boost motor assembly, is believed to be 6.2 m, with the launch weight being around 1,200 kg; the payload is probably 450 kg, range 500 km and the warheads can be HE, either unitary or submunitions, or nuclear with a yield between 10 and 35 kT. [69] Although the first flight test was reported in August 2005, the production with NESCOM in all probability started in 2006. [70]

Various reports indicate that Pakistan is seriously undertaking efforts to upgrade the Babur and develop a new variant of this missile, the Babur-2, which would enhance its payload and range. It is developing an air-launched version of the Babur, which will reportedly be carried by F-16

66. "Pakistan Test-fires Babur Cruise Missile" at http://forum.pakistanidefence.com/lofiversion/index.php/t82549.html
67. n. 27, p. 117.
68. Ibid.
69. Ibid.
70. Ibid., p. 118

and JF-17 aircraft and a sea launched version for deployment on the Agosta submarine.[71]

Hatf-8 – Ra'ad

In May 8, 2008, Pakistan tested a nuclear-capable, air launched cruise missile, the Hatf-8 – Ra'ad, with a range of 350 km. The first test-launch for the Ra'ad was carried on in 2007. The Hatf-8 missile has been developed exclusively for launch from aerial platforms, enabling Pakistan to achieve a greater strategic capability on land and at sea.[72] Reports suggests that the Hatf-8, has special stealth capabilities and is a low altitude terrain following missile with high manoeuvrability, and can deliver all types of warheads, with high accuracy.[73] Although the missile was initially launched from a Pakistan Air Force (PAF) Dassault Mirage III combat aircraft, it is planned to be integrated with, and launched from, other PAF platforms like the JF-17 and may be the J-10s.

AIRCRAFT

In the 1980s, Pakistan was in full swing with its nuclear development programme, and saw aircraft as the chief means of delivering nuclear weapons. The main sources of its aircraft have been the United States, France and China. Pakistan's desire for strategic support from, and alliance with, the West to acquire high technology weapons to match the conventional military superiority of India has driven it towards the US. Nevertheless, Pakistan's alliance with Washington over the last 60 years has been shaped more by the American strategic requirements than the Pakistani needs and desires.

Acquisition of the F-16s

Pakistan openly announced its nuclear weapon capability in 1987 and, it can be presumed that in the early 1980s, it was clearly exploring

71. "Pakistan Successfully Test-Fires Hatf-VII Missile", *Pak Tribune*, July 26, 2007. Hali, "Second Strike Capability", *The Nation* (Islamabad), August 16, 2006, as cited in *SIPRI Yearbook 2009*, (Oxford: Oxford University Press, 2009), p. 375.
72. Iftikhar A. Khan"Cruise Missile Fired from Aerial Platform", *Dawn*, May 9, 2008, at http://www.dawn.com/2008/05/09/top4.htm
73. Ibid.

However, post 9/11, the US aid and weapons sales were restarted following Pakistan's role as the chief ally in the global war against terrorism.

opportunities to acquire the delivery systems when it had entered into an alliance with the US in the war against Communism. Gen Zia-ul-Haq managed to negotiate a generous aid package of $3.2 billion (the military component of the aid package was worth $1.6 billion) Military assistance programmes from the US included the sale of 40 F-16s Falcon fighters/interceptors, one of the most advanced military aircraft in the world. In December 1981, Pakistan signed an agreement with the US for the purchase of 40 F-16s and according to the agreement, the deal would be split into two batches, one of 6 aircraft and the other of 34.[74] Pakistan did receive 34 and 6 F-16A and F-16B from the US by the end of 1987 (Table 1) . [75]

The second US aid package worth $4.02 billion for a period of six years, commenced in 1987, but was suspended in 1990 due to the arms embargo imposed under the Pressler Amendment. This was highly disappointing for Pakistan as it dried up the American supply of equipment to Pakistan. Although the Brown Amendment passed in 1995 permitted Pakistan to take possession of the military equipment frozen in the United States, it excluded the F-16s. What was even extremely disturbing for Pakistan was that the US refused to export 28 F-16s which Pakistan had paid for (and which were also manufactured) against the 1988 order for the 110 F-16s. The US agreed to try and sell them to a third country and return the money to Pakistan and, thus, there were efforts to sell them to Indonesia in 1996, but the economic crisis stopped that plan. The Clinton Administration did face problems with respect to these 28 F-16s as President Clinton had pledged to the Pakistan Prime Minister, Ms Benazir Bhutto, that the money paid for the F-16s by Islamabad would be reimbursed in case the equipment was not delivered to Pakistan. [76] Reportedly,

74. "Pakistan Fiza'ya Pakistan Air Force-PAF", F-16.net The Ultimate F-16 Reference at, http://www.f-16_users_articles14html
75. Ibid.
76. Ibid.

a number of countries, including Phillipines and New Zealand seriously tried to acquire these aircraft but the final deal did not work out.

However, post 9/11, the US aid and weapons sales were restarted following Pakistan's role as the chief ally in the global war against terrorism, which led to removal of US sanctions on Pakistan. Pakistan's alliance with the US helped in the recovery of Pakistan's economy and opened up the supply of the long desired defence equipment from Washington, including the much awaited F-16s. Pakistan received the first two F-16s in 2005 and currently the total number of F-16s with the PAF stands at 59 (46 F-16A/F-16B + 1F-16C/D +12 on order).[77] However, certain unconfirmed sources report 30 plus aircraft on order. Pakistan has been extremely keen to acquire the F-16s partly because of the political/psychological reasons, and partly because it has been familiar with multi-role combat aircraft since the early 1980s. The issue has apparently been the cost and the level of upgradation of the aircraft which Pakistan would receive. Pakistan would aim to receive its original plan of 110 F-16s in its inventory, but much more capable ones.

The F-16 is a flexible design, capable of high performance in both the air superiority and ground attack roles. The flight controls are digital computer-controlled fly-by- wire, complemented by advanced navigation and avionics systems. The PAF deploys its F-16s with Squadrons 9, 11 and 4 at Sargodha Air Base, located 160 km northwest of Lahore.[78] The F-16 can carry up to 5,450 kg externally on one underfuselage centreline pylon and six underwing stations and has a refuelled range of more than 1,600 km. Given that the F-16 is undoubtedly the most capable Pakistani attack aircraft, it would likely be tasked with the delivery of nuclear air-to-ground munitions.

The JF- 17s and the J-10s

Sino-Pakistan defence collaboration flourished under the umbrella of the

77. *The Military Balance 2010,* IISS (London: Routledge, 2010), p. 369.
78. For details, see "PAF Mushaf / PAF Sargodha 32° 03′ 09″N 72° 40′ 07″E" at, http://www.globalsecurity.org/military/world/pakistan/sargodha-ab.htm

Pakistan is also positioning itself to buy up to two squadrons of Chinese J-10 which, along with the JF 17, would form the backbone of the PAF, according to the Pakistan Air Force Chief.

US sanctions (particularly in the 1990s) and, in the process, the two nations entered into deals for the co-development of a fourth generation fighter aircraft, the JF-17 (earlier called the FC-1). China delivered 12 Joint Fighter (JF-17) Thunder advanced jets to the Pakistan Air Force between 2007 -09 for flight tests and evaluation. The JF-17 is designated to be a low cost, high multi-role combat aircraft to meet the tactical and strategic requirements of the Pakistan Air Force, thereby reducing the country's reliance on imports. The JF-17 is co-developed by Pakistan and China and is being built by China's Chengdu Aircraft Industry Corporation (CAC) and Pakistan Aeronautical Complex (PAC), Kamra. There have been reports that the design was developed by the MiG complex in Russia and transferred to China after the Russian Air Force cancelled procurements. Pakistan has also increased its initial target of buying 150 JF-17s to acquiring up to 250 aircraft.[79] This represents a quantum jump in the Pakistani aircraft industry. The PAC in Kamra is expected to commence manufacturing the JF-17 by 2010, and with this, Pakistan will join the exclusive club of the few nations manufacturing fighter aircraft.

The FC-1 (JF-17) is fairly flexible in terms of avionics and weapon configurations. The JF-17 in service in the PAF is presumably fitted with the Italian Grifo S-7 fire-control radar. The radar has 25 working modes and a non-breakdown time of 200 hours. Further capabilities include look-down, shoot-down and ground strike abilities.[80] The aircraft is fitted with PL-12 or SD-10 radar homing Medium-Range Air-to-Air Missiles (MRAAM), anti-ship missiles, anti-radiation missiles, unguided bombs rocket launchers and

79. Interview, Air Chief Marshal, Tanvir Mahmood Ahmed, Pakistan's Chief of Air Staff, *Jane's Defence Weekly*, April 4, 2007, p.34.
80. "FC-1 Xiaolong/JF-17 thunder, China/Pakistan", at http://www.airforce-technology.com/projects/fc1xiaolongjf17thund/

a laser guided pod. [81] The aircraft is equipped with AIM-9L/M, PL-5E, PL-9C short range air-to-air missiles. It can carry up to 3,700 kg payload and the range and service ceiling of the aircraft are 2,037 km and 15,240m respectively. The FC-1 being produced for the PAF will be fitted with Inflight Refuelling (IFR) probes.[82]

Pakistan is also positioning itself to buy up to two squadrons of Chinese J-10 which, along with the JF 17, would form the backbone of the PAF, according to the Pakistan Air Force Chief. The J-10 (Jianji-10, or Jian-10) is an all-weather multi-role fighter aircraft designed for both air-to-air and air-to-ground missions.[83] The J-10 was designed by the Chengdu Aircraft Design Institute (611 Institute) and built by the Chengdu Aircraft Corporation (CAC) and has been operational with the PLA Air Force (PLAAF) since 2003. [84] The J-10 programme began in the mid-1980s as an air-superiority fighter to rival the then emerging fourth generation fighters such as the F-16 and MiG-29. However, the end of the Cold War and the changing requirements shifted the development towards a multi-role fighter with both air-to-air and ground attack capabilities.[85] The programme was assisted by Israel, which apparently provided the "technologies for its IAI Lavi lightweight fighter including the aerodynamic design and the software for the fly-by-wire flight control system." [86] In the early 1990s, the development programme faced several difficulties due to the arms embargo on China, imposed by the United States and European Union. In the mid-1990s, Russia got involved in the development programme and China received the Russian Al-31F turbofan jet engine to power the aircraft. Thus, the Chinese benefitted from both the Israeli and the Russian technology in the development of the J-10.[87]

81. Ibid.
82. Ibid.
83. "Jian-10 Multirole Fighter Aircraft", at http://www.sinodefence.com/airforce/fighter/j10.asp
84. Ibid.
85. Ibid.
86. Ibid.
87. Ibid.

The J-10 marks one of the most significant achievements of the Chinese aviation industry in the 1990s. For air-superiority missions, the aircraft can carry a mix of MRAAM and Short-Range Air-to-Air Missiles (SRAAM).The J-10 was designed with the surface attack capability right from inception.[88] The J-10 programme was kept under tight security and high secrecy. The Chinese state media only announced the J-10 in November 2006, nearly two years after it entered service. Despite the huge publicity the J-10 has enjoyed in the Chinese media, no official data has been provided regarding the actual capabilities and performance of the aircraft. Both the JF- 17 and J-10 are believed to carry nuclear warheads.

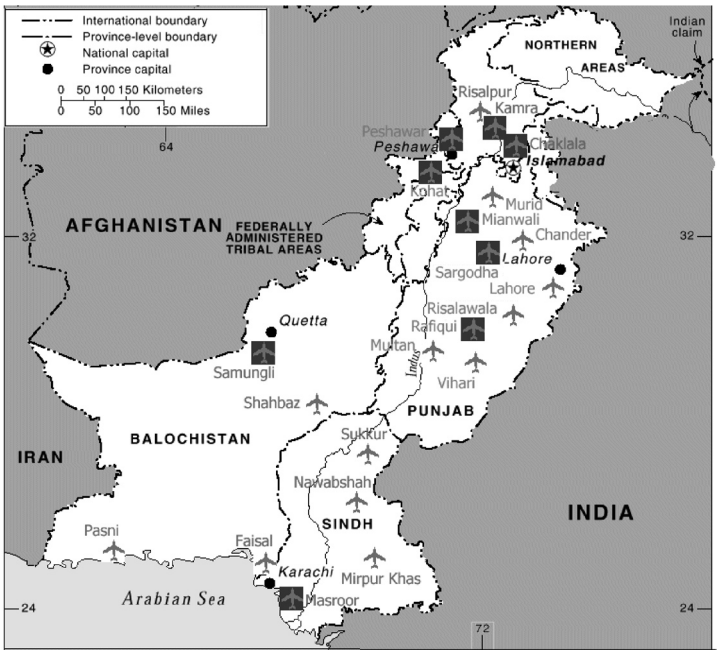
A-5s and French Mirage Vs

Pakistan acquired 60 A-5s from China, and as of mid-1999, only 49 remained in service. Reportedly, some of the A-5s are capable of carrying nuclear bombs. But given their payload capability, the bomb would have to be quite small. The aircraft offers enhanced combat performance, particularly at low and super-low altitude. [89]

Pakistan could also potentially use the French Mirage Vs for the nuclear-strike mission. Technically speaking, the Mirage Vs could be deployed as part of the 8th (Haider) Squadron of the 32nd Fighter Wing at the Masroor Air Base, located about 8 km west of Karachi.[90] They could also be deployed as part of the 25th (Eagles) Squadron of the 33rd Fighter Wing of Kamra Air Base located 65 km west of Islamabad.[91] The nuclear capable cruise missile Raad–Hatf-8 could be potentially deployed to the Mirage V squadrons in the future.

88. Ibid.
89. "Fantan a-5, Q-5 (NANCHANG)" at http://www.globalsecurity.org/military/world/pakistan/a-5.htm
90. Robert S. Norris and Hans Kristensen, "Nuclear Notebook: Pakistani Nuclear Forces, 2009", *Bulletin of the Atomic Scientists*, September/October 2009, pp 82-88.
91. Ibid.

Pakistan Air Force Bases



Source: http://www.globalsecurity.org

Table 1: Pakistan's Nuclear Delivery Systems

Type	Range (km)	Payload (kg)
Ballistic Missiles		
M-9	600 km	
M-11	300 km	800 kg
Hatf-3 (Ghaznavi)	280-350 km	700 kg
Hatf-4 (Shaheen 1)	750 km	
Hatf-5 (Ghauri)	1,500-1,800 km	
Hatf-6 (Shaheen 2)	2,500 km	
Cruise Missiles		
Hatf-7 (Babur)	500 km	450 kg
Hatf-8 (Ra'ad)	350 km	
Aircraft		
F-16A/B	1,600 km	1 bomb
F-16C/D		
Mirage V	2,100 km	1 bomb
A-5		
JF-17		
J-10		

Source: *Jane's Strategic Weapon Systems,* Issue 48, 2008; *Jane's All the World's Aircraft*, various issues.

Pakistan's build-up of the delivery systems and specifically, the missile build-up, like the nuclear build-up, is India-centric.

IMPLICATIONS FOR INDIA

Pakistan's missile delivery systems have been developed significantly, and it is in the process of rapid modernisation of its combat fleet, with a clear focus on building up the numbers as well as the quality of the aircraft. Thus, it might not be incorrect to state that Pakistan is capable of a nuclear exchange if the situation arises.

Pakistan's build-up of the delivery systems and specifically, the missile build-up, like the nuclear build-up, is India-centric. Pakistan has consistently claimed that it has been forced into the missile build-up given India's growing missile muscle, but the reality is that India's strategic requirements are far more complex and demanding as compared to Pakistan's. India needs to take the consistent China threat into consideration in its strategic and defence planning, which does not exist for Pakistan. On the other hand, for Pakistan, China is the most trusted ally and has offered it military and diplomatic assistance against India in the previous wars. In fact, in any future conflict between India and Pakistan, there is no reason for India to presume that China would stay neutral. India strongly feels the need to prepare itself for a possible two-front war and, therefore, Indian defence requirements are far more complex.

Pakistan's belief in deterrence and increasing the options of delivery systems provide it with enhanced deterrence. There is a clear linkage between nuclear deterrence and ballistic missile capability. For Pakistan, the ballistic missile capability enhances its deterrence, and also its choices for the preemptive strikes, given its "first use" nuclear doctrine.

The Chairman, Joint Chiefs of Staff Committee (CJCSC), Gen Tariq Majid, while addressing the convocation ceremony at the National Defence University, Islamabad said, "Our nuclear weapons are the cornerstone of Pakistan's deterrence doctrine and we are determined to retain it at all costs. No amount of coercion, direct or indirect, can force us to compromise on

this core interest."[92]

Lt Gen F. S. Lodhi has spoken on the same lines:

> In the modern defence concept, the missile system is the most essential element. In fact, it is now the core of any viable defence structure and the cutting edge of an adequate defence capability of any nation. It cannot, therefore, be ignored by the defence planners. In Pakistan's security environment, an adequate missile defence will prove an effective and reliable deterrent. The essence of deterrence worldwide, is a country's power to retaliate in kind. It was, after all, the power of deterrence that prevented a third World War between the Western allies and the Soviet empire for over 50 years. [93]

For Pakistan, the ballistic missile capability enhances its deterrence, and also its choices for the preemptive strikes, given its "first use" nuclear doctrine.

Pakistan has been focussed on acquiring missiles with increasing range to diversify its targets. Pakistan's initially developed the SRBMs Hatf-1, Hatf-2, Hatf-3 which can be used against military targets such as bases or airfields. These carry relatively smaller warheads and, thus, it would not be practical for Pakistan to deploy these against civilian population centres. The Hatf-5, which is an Intermediate Range Ballistic Missile (IRBM), has a range of up to 1,800 km (the improved version would have a range of approximately 3,000 km) and can carry a 750 kg payload. Its main drawback is its limited accuracy and, thus, its effective use would be striking civilian targets. The Hatf-5, according to the Pakistani leadership, would give them an advantage over India's strategic assets as some of the important Indian cities, power plants, water purifiers would fall in this range. According to Maj Gen F.S. Lodhi (Retd):[94]

When Hatf V (Ghauri) missile is deployed in Pakistan, it will cover most

92. "Nuclear Weapons are the Cornerstone of Pakistan's Deterrence Doctrine", Islamabad, June 18, 2009, *Pakistan Defence,* at http://www.defence.pk/forums/wmd-missiles/28455
93. Lt Gen Sardar F. S. Lodi(Retd), "Pakistan's Missile Technology", *Defence Journal,* May 1998, at http://www.defencejournal.com/may98/pakmissiletech.htm
94. Ibid.

"When Hatf V (Ghauri) missile is deployed in Pakistan, it will cover most of India except its eastern and southern portion and the coast, along the Bay of Bengal. It will deprive India of the advantage of strategic depth that it enjoys at present in relation to Pakistan".

of India except its eastern and southern portion and the coast, along the Bay of Bengal. It will deprive India of the advantage of strategic depth that it enjoys at present in relation to Pakistan. It will, therefore, give Pakistan a degree of defence parity that has been reducing in the last few years. Pakistan will now be in a position to hit back effectively if subjected to aggression by India and inflict unacceptable damage to India's important and vulnerable areas and particularly those areas which were hitherto considered safe, owing to the distance from the Pakistan border.

The growing missile muscle and also the enhanced number of nuclear capable combat aircraft would increase Pakistan's offensive capabilities against India. In the previous decades, Pakistan has been deterred by India's superior conventional military build-up and has consistently used it as an excuse for demanding high technology weapons from the West. With the current acquisitions plans, the Pakistan Air Force would grow tremendously in the next 5-15 years and the multi-role combat aircraft which comprised 11 percent of the PAF inventory, would go up to as much as 42 percent, with more F-16s, the JF-17s and the J-10 coming in. The Chief of the PAF, in March 2009, said, "We have made the whole of PAF a nuclear force", with the aim of giving it the status of real deterrent force. [95]

Fear of risk and punishment is central to the concept of deterrence and with this growing nuclear arsenal, Pakistan will eventually lose the fear. In fact, it might not be incorrect to say that post Parakaram, Pakistan by and large believes it would not face Indian retaliation, and can continue the terrorism on Indian soil.

95. "Whole of PAF Made Nuclear: Chief of Air Staff Air Chief Marshal Tanvir Mehmood Ahmed", *Asian Defence*, March 17, 2009, at http://theasiandefence.blogspot.com/2009/03/whole-of-paf-made-nuclear-of-air.html