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MINIMUM NUCLEAR DETERRENCE POSTURES IN SOUTH ASIA: AN OVERVIEW

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Minimum Nuclear Deterrence Postures in South Asia: An Overview

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This overview of India's and Pakistan's presumed minimal nuclear deterrence postures is part of ongoing research on nuclear strategies and defense postures involving relatively small numbers of nuclear weapons sponsored by the Defense Threat Reduction Agency, Advanced Systems and Concepts Office (DTRA/ASCO).

The segment on India and Pakistan was conceived by the sponsor as part of a preliminary compilation of open sources on the nuclear defense policies and capabilities of states subscribing to some form of minimal deterrence -- the others being the United Kingdom, France, and China. That project was inspired by the need to contribute background analyses for the US nuclear posture review. The aim was to have these analyses available for subsequent use by analysts at DTRA/ASCO and elsewhere. The South Asia segment here addresses what is currently known from public sources about Indian and Pakistani nuclear postures, policies, strategies, forces, command and control issues, delivery system acquisition trends, and plausible doctrinal evolution. It provides a basic framework of analysis, initial database, and preliminary bibliography, to be refined and updated over time. These elements will be accessible on DTRA/ASCO's public web site <http://www.dtra.mil/about/organization/ab-pubs.html>, to aid in the development of more detailed data and analyses.

Summary of Key Findings

- In testing nuclear weapons as de facto nuclear weapon states in May 1998, India and Pakistan both espoused nuclear restraint. Their senior officials soon embraced the language of "minimum credible deterrence." India declared a "no-first-use" nuclear posture soon after the tests. Pakistan declined to rule out first-use options for reasons explained below.

- India's official statements did not identify nuclear adversaries, leaving open which national arsenals or threats it would use as reference points to define its own nuclear deterrence requirements and nuclear force size. Indian Prime Minister Vajpayee's letter to US President Clinton, however, alluded to China as a neighboring nuclear threat. China and Pakistan are India's known rivals and probably Indian nuclear weapon planners' main reference points.

- Pakistani nuclear declaratory statements are clear that India is regarded as its sole nuclear adversary and thus the focus of its nuclear deterrent.

- Although the term "minimum" rapidly became a fixture of the public nuclear discourse in South Asia, neither India nor Pakistan officially clarified what the term "minimum" means, leaving this open to speculation. Does "minimum" imply the sufficiency of small numbers of nuclear weapons? Nuclear weapons held in reserve? Low readiness or alert rates of a nuclear force? Renunciation of nuclear war fighting? Mainly counter-value targeting? Or does the term "minimum" merely make a virtue of today's facts of life in the subcontinent – limited resources, scarce weapons material, unproved delivery systems, and still undeveloped technical military capabilities?

- Neither India nor Pakistan overtly *deployed* nuclear forces after the 1998 tests, nor was known to have done so by October 2001, when this assessment was prepared. By not deployed, we mean neither state was believed to have mated nuclear weapons with delivery systems on standby status, ready for immediate alert or use upon central command.

- Judging potential nuclear arsenal size even for a non-deployed force is feasible if enough is known about fissile material production. India's and Pakistan's "dedicated weapon facilities" continue to produce fissile material. Their outputs can be thought of as "nuclear weapon equivalents" (NWEs). Although the actual number of operational weapons in either's arsenal is not known, analysis suggests that India has, and probably will retain, a significant lead over Pakistan. We estimate India had over 100 NWEs from its dedicated facilities by 2000 -- at least twice and perhaps three times as many as Pakistan. India's NWEs from dedicated facilities are far fewer than China's estimated arsenal of about 450 weapons. By appropriating fissile material from its unsafeguarded civilian power reactors, however, India could reach a potential of several hundred NWEs, exceeding estimates of China's operational nuclear stockpile.

- The risk of nuclear war in South Asia is significant and not to be taken lightly. The potential for nuclear crisis instability is inherent in the conventional military imbalance between Pakistan and India. India's steadily growing conventional military superiority over Pakistan, coupled with Pakistan's geographic vulnerabilities to preemptive conventional air strikes and rapid invasion, and the fact that Pakistan's nuclear forces are smaller, means that Pakistan could be driven to use nuclear weapons during a conventional conflict India. Pakistan's posture which preserves a nuclear first-use option by default, reflects these military and geographic asymmetries.

- For bilateral deterrence, India and Pakistan both have nuclear-capable aircraft that could be put on alert and used for nuclear delivery on short notice. Both have acquired ballistic missile delivery systems, although the combat readiness of the missiles is not altogether clear. India's missile development program aims to develop an intermediate-range ballistic missile capable of reaching Chinese cities, but a ready force of such missiles does not now exist. If forced to improvise, India has a few long-range aircraft that could be used to reach China's interior with nuclear payloads. India's tactical strike aircraft could also be used, but only on a one-way flight profile.

- While Pakistan has no officially stated strategic or tactical nuclear doctrines, technical considerations and writings by experts suggest that its core nuclear strategy is to hold Indian cities hostage by countervalue targeting, against a conventional Indian invasion or preemptive air attack that could threaten Pakistan's defenses with collapse.

- India has declined to elaborate nuclear policy and doctrine beyond a second-strike retaliatory posture, evidently on the grounds that its capacity to retaliate with nuclear weapons should deter nuclear attack absolutely. But India's officially convened National Security Advisory Board (NSAB) recommended that India rely on a posture of *credible* minimum deterrence. The term *credible* is a much more demanding criterion than "minimum deterrence" might imply by itself. The NSAB recommended India procure a triad of air-, ground-, and sea-based nuclear delivery systems along with robust command and control and space assets to ensure the survivability of retaliatory forces and a capability for a rapid response after any imaginable nuclear first strike. It also recommended that India achieve the capacity for proactive conventional military response to nuclear threats. These recommendations stopped short only of a nuclear warfighting capability, strategic missile defense, and extended deterrence.

- While the Indian government declined to treat these Advisory Board recommendations as official policy, and experts acknowledged that they would be very costly to implement, the actual profile of Indian defense research and development and military technology acquisition closely parallels the Advisory Board's recommendations. This implies that India probably will follow the main recommendations in defining requirements and building nuclear forces, but do so gradually within its limited resources. Over time, this could lead to an expansive nuclear strategy and force structure, with a capacity to respond in a graduated or massive fashion to potential nuclear threats from all directions.

- If India's nuclear strategy and forces evolve along these ambitious lines, they would not constitute a "minimum deterrence" posture, as that term is generally understood.

- While it is unlikely that Pakistan could achieve or maintain nuclear parity with India, Pakistan probably will enlarge and diversify its nuclear inventory to make its own forces survivable, as prerequisites for confidence in a secure second-strike capability against India. This also implies that Pakistan will pursue a strategy and acquisitions in the near term that exceed what outsiders might believe is sufficient, based on a common sense understanding of "minimum deterrence." Outsiders tend to perceive India as a status quo power, but this is not the prevailing view in Pakistan.

- Indian and Pakistani officials profess that they expect to avoid nuclear arms racing. Once the facts are examined, however, it is hard to avoid the conclusion that they have been in an arms race that will continue, albeit with continued conditions of asymmetry and at a pace that is limited by resource constraints.

- On nuclear command and control systems, Pakistan and India followed different paths after declaring themselves nuclear weapon states in May 1998. In 1999, Pakistan set up a national command authority for decisions regarding the use of nuclear weapons, together with a joint-service command and control hierarchy for military planning, management, custody, development, and control of nuclear weapons, making this known in early 2000. While Pakistan thus served notice that it is militarily prepared to execute nuclear missions, the prevailing evidence is that its nuclear weapons and delivery systems still are not deployed in the field or ready for prompt use.

- India evidently left the articulation of a formal nuclear command and control system in abeyance after May 1998. Ultimate authority on decisions to use nuclear weapons probably resides with the Prime Minister in cabinet. Custody of nuclear weapons apparently stayed with the Department of Atomic Energy, under the nuclear scientific establishment that developed the weapons. Control was not transferred to the Indian military services. Nuclear-capable aircraft and short-range ballistic missiles, such as the Prithvi, are in service with the Indian Air Force and Army. India's longer-range nuclear-capable missiles such as the Agni, however, are still in the research and development process under the Defense Research and Development

Organization, are believed not to be in serial production, and secure deployment in silos or on rail-mobile launchers -- concepts that have been discussed -- probably is years away.

- India has had active programs in air defense and has been acquiring high-altitude Russian SAM systems that may have some tactical anti-ballistic missile capability. Pakistan has a less robust high-altitude air defense program but is seeking new capabilities in this area as well.

- Kargil was the first unambiguous case of crisis management between India and Pakistan as nuclear-armed rivals. It sobered Indian nuclear experts who had assumed India's "minimum nuclear deterrent" would contain Pakistan absolutely. Kargil indicated to the outside world that there is a high risk of nuclear conflict in the subcontinent. The experience may have strengthened Pakistani advocates of the view that the nuclear deterrent is an instrument only of last resort. Kargil clarified an Indian view that nuclear deterrence does not preclude conventional conflict.

I. Introduction

India and Pakistan are the only states to have publicly declared themselves to be nuclear weapon states since the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) was completed in 1968, four years after China became the fifth of the traditional nuclear weapon states.[1] India and Pakistan declared possession of nuclear weapons in May 1998, in conjunction with underground nuclear weapon tests that represented steps in nuclear weaponization. Both governments declared postures of "minimum nuclear deterrence," a concept made fashionable by China's declaratory "no-first use" (NFU) policy and limited nuclear retaliatory capabilities over the previous three decades. Neither India nor Pakistan is a party to the NPT, although both subscribed rhetorically to the principles of nuclear non-proliferation and today still accept certain elements of the nuclear non-proliferation regime, such as partial IAEA nuclear safeguards on a portion of their civilian nuclear power facilities.

India's and Pakistan's emergence as de facto nuclear weapon states could have a significant impact on the post-Cold War geopolitical landscape. Their nuclear weapons breakout has numerous ramifications for the viability of further nuclear arms control and threat reduction measures, as well as for the future effectiveness of non-proliferation regimes in stemming proliferation of weapons of mass destruction generally.

Their nuclear emergence also creates for the first time, in juxtaposition with nuclear China, a geographically contiguous, nuclear-armed triangle, stretching across most of Asia. Moreover, each member of this nuclear triangle has made war on at least one of the others -- China and India fighting over their disputed Himalayan boundaries in 1962, and India and Pakistan going to war thrice in 1948, 1965, and 1971.

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[1] One other state, the Republic of South Africa, announced by surprise on March 24, 1993, its former possession of a small number of nuclear weapons and the fact that they had also been dismantled and then eliminated in 1990-91, facts confirmed by the IAEA in 1994. South Africa had acceded to the NPT as a non-nuclear weapon state on July 10, 1991 and concluded a safeguards agreement with the IAEA in September. See chapter 9 on "South Africa" in Rodney W. Jones and Mark G. McDonough, et. al., *Tracking Nuclear Proliferation: A Guide in Maps and Charts, 1998*, Washington, DC: Carnegie Endowment for International Peace, 1998, pp. 243-50.

Centered on the dispute over Kashmir, the Indo-Pakistani rivalry remains particularly bitter, with recurring episodes of low-intensity or unconventional conflict. A recent example, the Kargil conflict across the Kashmir cease-fire line in May-July 1999, erupted under the nuclear shadow, thus challenging the conventional wisdom that nuclear deterrence would superimpose military restraint on the past Indo-Pakistani rivalry, and curb military risk-taking.

The three traditional nuclear powers associated with minimal deterrence -- the United Kingdom, France, and China -- have been nuclear weapon states for decades. By contrast, India and Pakistan asserted nuclear weapon status very recently, after denying for decades that they had nuclear weapon programs or intentions. There has been little transparency in their nuclear weapon programs since the tests in 1998. Hence, what can be said authoritatively about either country's actual nuclear forces or operational policies, not to speak of the evolution of nuclear doctrine, is very limited.

Both India and Pakistan reportedly have refrained from deploying nuclear weapons operationally. Neither has distributed weapons to operators ready for immediate use on aircraft or on ballistic missiles. In India's case, custody of nuclear weapons apparently has not yet been transferred physically to the military from the control of the atomic energy and defense research and development organizations. Both countries effectively maintain a high level of secrecy not only about the physical and numerical properties of their nuclear weapons, nuclear command and control organization, or operational plans for nuclear war, but even about their nuclear strategies and general force structure objectives.

While certain inferences can be made on the basis of Pakistan's and India's stated threat perceptions and technical capacities regarding their potential nuclear force structures, operational choices, and plausible doctrines, readers should be aware that there is scant evidence that either country has yet made durable decisions about these issues. If interim decisions on these matters have been made, they have not been disclosed. Much of the open literature is speculative and unreliable, and requires care in examination. Experts and publicists in India and Pakistan have written little on nuclear operational or doctrinal issues can be taken at face value as authoritative.[2]

Official Indian and Pakistani statements about nuclear capacity or defense posture are laden with political and public relations content, omit mention of strategic and operational issues, and reveal little about nuclear stability objectives. The repeated assertion of "minimum nuclear deterrence" itself is vague and not verifiable. The same must be said of any "no-first use" pledge. The mere fact that there seems to be a vibrant, open debate among defense experts and media figures in South Asia should not be confused by Western analysts with local military transparency or analytical objectivity -- in either country.[3]

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[2] See the bibliography on sources appended to this work.

[3] The secrecy of nuclear defense programs in South Asia is not unique, and the poor quality of public sources on them should not be surprising. Secrecy was and remains a priority of the nuclear defense programs of the traditional nuclear weapon states too, especially with respect to the characteristics of nuclear weapons themselves. The relative transparency on strategic nuclear capacity and delivery systems that prevails in the West today, and to some extent in Russia, is of quite recent origin. It was not characteristic of the Cold War period before Gorbachev's ascendancy in the Soviet Union, when serious negotiations began on the INF and START Treaties. Thereafter it still depended on well developed national technical means of intelligence, mutual acceptance of strategic parity and political imperatives of nuclear crisis stability. Successful negotiation of nuclear arms reduction agreements with provisions for on-site inspections depended fundamentally on declining tension due to evidence of new self-restraint in geostrategic competition, and lowered expectations of confrontation and war. Analogues to these conditions have not yet taken hold in China, and may not be easily achieved in South Asia. This is not to say that increased nuclear transparency in Asia would not be beneficial for stability. It is merely a caution to readers that it does not exist there today, despite prolific writing by regional experts.

II. Existing and Emerging Nuclear Force Capabilities

A. Asymmetries

Nuclear force size, technological capacity, and geographic vulnerability -- as these relate to plausible enemies and threat perceptions -- are natural starting points for this assessment of nuclear deterrence policies, postures, and strategies in South Asia. In this regard, the most basic point about the nuclear and conventional military capabilities of India and Pakistan are the large asymmetries in India's favor. India's nuclear superiority stands out on all levels, delivery systems, nuclear warhead stockpile capacity, and possibly design experience with early generation devices of thermonuclear yield.[4] This nuclear asymmetry is magnified by India's strategic depth and Pakistan's relative lack of geographic depth. In addition, India is far ahead of Pakistan in space surveillance, having begun to launch observation satellites on Soviet launch vehicles as early as 1988, and on its own space launch systems in the 1990s.[5] India also has a large variety of long-range airborne reconnaissance assets, while Pakistan's surveillance and early warning capabilities are comparatively rudimentary.[6] In deciphering Pakistan's likely nuclear strategy and minimum requirements, discussed later, this overwhelming asymmetry is the point to return to.

In considering Indian military strategy, China apparently is perceived as the principal nuclear threat. India's strategic managers measure India's prospective requirements against China's nuclear and military capacity, not Pakistan's alone. China's strategic depth is at least as great as India's, and greater in one respect -- China's biggest cities are well to the east, further from India's borders than the majority of India's are from China's southwestern territory. As a consequence, large Indian cities may fall within the range of Chinese short- and medium-range ballistic missiles -- if moved close to

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Analysts should approach unsubstantiated open source commentary that purports to deal with physical or operational realities with caution.

[4] India claimed one of its 3 nuclear explosive tests on May 11, 1998 detonated a thermonuclear device with a yield of about 43 kilotons (Kt), but external seismic analysis suggests that this claim is dubious. Seismic measurements of those tests are not necessarily inconsistent, however, with a "boosted" fission device. On the Indian claim, see "Joint Statement by Department of Atomic Energy and Defense Research and Development Organization," New Delhi, May 17, 1998, available at: http://www.fas.org/news/india/1998/05/prmay1798.htm. For an American technical analysis of external seismic measurements, see Terry C. Wallace, "The May 1998 India and Pakistan Nuclear Tests," a paper in *Seismic Research Letters*, Vol. 69, pp. 386-393, available at: http://www.geo.arizona.edu/geophysics/faculty/wallace/ind.pak/index.html. See also William J. Broad, "Analysis: Experts Greet India's H-Bomb with Suspicion," *New York Times*, May 19, 1998, available at: http://www.nytimes.com/library/national/science/051998sci-nuke-monitor.html.

[5] India's IRS-1C remote sensing satellite with a panchromatic (black & white) resolution of between 6 and 8 metres reportedly provided overhead "battlefield" pictures during India's Shiv Shakti exercise in the Rajasthan desert in December 1998. In this exercise, Indian armored vehicles simulated defense against battlefield nuclear effects. (The resolution was sufficient to see tanks but not troops, as demonstrated by India's unawareness of infiltration before the Kargil conflict in early 1999.) See R. Prasannan, "War Games," *The Week Magazine*, Dec. 13, 1998. The sources are found at http://www.fas.org/spp/guide/india/earth/irs.htm and http://www.the-week.com/98dec13/events1.htm. The resolution of TES is still limited to detecting vehicles and groups of personnel rather than details of armament or types of personnel. See R.K. Radhakrishnan, "Three satellites placed in orbit," *The Hindu*, October 23, 2001; and Manoj Joshi, "India puts its first spy in sky," *Times of India*, November 8, 2001.

[6] Pakistan's s first satellite, a low-earth observation package called Badr-A, was boosted into a month-long orbit by a Chinese space launch vehicle in July 1990. A more capable and longer-lived, multi-purpose satellite (including digital photography) has been under development since the early 1990s and was to be launched by a Russian Zenit vehicle from Kazakhstan's Baikonur launch site in March 2000 (see Nov. 24 announcement by President Rafiq Tahar, Associated Press of Pakistan (Islamabad), November 25, 1999, at: http://www.fas.org/spp/guide/pakistan/earth/991125-pak-app1.htm. Apparently this schedule has slipped.

common borders, whereas India has yet to fully develop a longer-range ballistic missile that could hold China's primary cities at risk. Thus, in a simple deliverable nuclear weapon count, the asymmetry today favors China against India. It is important not to overlook the fact, however, that China's nuclear inventory and delivery systems were acquired to deal with the former Soviet Union/Russia and the US overseas presence in Asia, not India. After subtracting Chinese withholds for these requirements, China's nuclear superiority over India is less substantial.

For a strategy of minimum nuclear deterrence, a state's objective requirements acutely depend upon which side of an asymmetry it falls. A more vulnerable state on the short end of the asymmetry may be hard put to maintain a second-strike retaliatory force. With a minimum standing force, Pakistan is on the weak end of the asymmetry with India today, and India likewise with China.

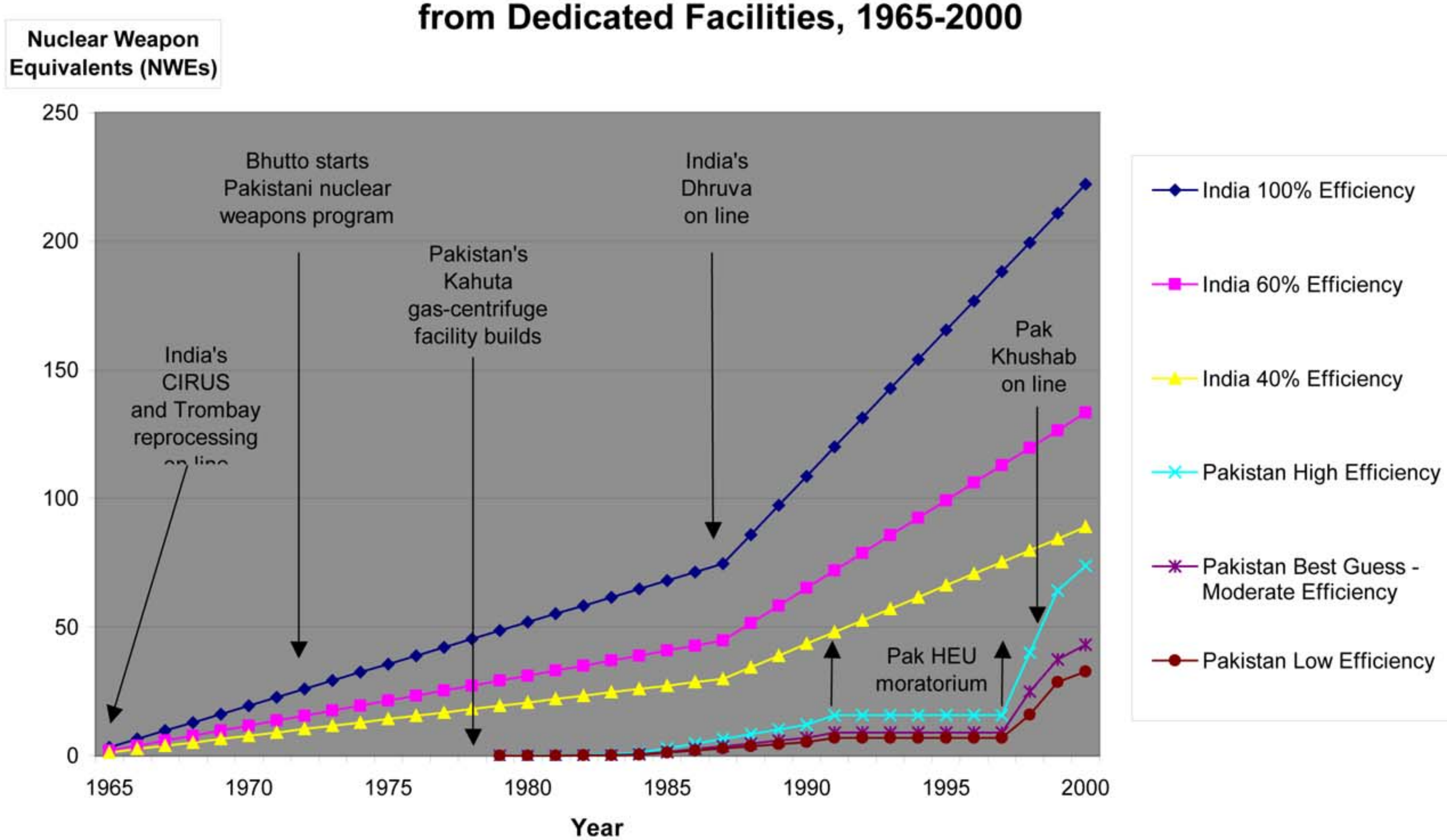
B. Nuclear Weapon Inventories

Nuclear weapon numbers and quantities of weapons-grade material in stockpiles in India and Pakistan are classified. Hence, no reliable public information exists on how many weapons either has manufactured or stockpiled. Some published estimates exist of accessible Indian and Pakistani weapons-grade material, based on information about their unsafeguarded fissile material production facilities. If the facility capacity and utilization estimates used here are roughly correct, and if all facilities have been identified and capacities properly estimated, this would place upper bounds on the numbers of nuclear weapons either could have manufactured over time. These bounds, discounted for presumed technical and operational limitations, can be used as an indicator of the possible nuclear force size for each country.

Chart 1 depicts high, low, and "best guess" estimates of the "nuclear weapon equivalents" (NWEs) of fissile material produced by India's and Pakistan's dedicated nuclear weapon facilities. (The sources and assumptions for the calculations supporting these estimates are set forth in Appendix A, on "Fissile Material Stocks and Nuclear Weapon Equivalents (NWEs) in India and Pakistan.") In general, these estimates favor India by a substantial margin, a ratio of more than 2:1. Ruling out the 100 per cent and 40 per cent efficiency plots for India (unrealistically high and implausibly low, but useful as limits for comparison), *the best guess plot* (60 per cent efficiency) *shows that India easily could have accumulated sufficient plutonium from dedicated facilities (the CIRUS and Dhruva reactors) for about 133 NWEs by 2000*. The projected annual rate of increase from these facilities, at the same assumed efficiency level, is about 6.8 NWEs.

Taking similar plots of high, low and moderate efficiency for Pakistan depicted in Chart 1, our *best guess is that Pakistan may have accumulated about 43 NWEs by 2000*, primarily using highly enriched uranium (HEU) from its gas centrifuge enrichment facilities, but with small additions beginning in 1999 of plutonium from the unsafeguarded Khushab heavy water reactor that it first started up in early 1998. These figures suggest that Pakistan, by year 2000, could have been adding NWEs from uranium *and* plutonium, respectively, at the rate of about 5.5 and 1.5 annually. Thus, by 2000, Pakistan's stockpile may have moved onto a growth path of approximately the same overall rate of NWE accumulation as India's at that time, when looking only at dedicated facilities.

Chart 1. India's and Pakistan's Estimated Nuclear Weapons Capacity from Dedicated Facilities, 1965-2000



These best guess figures in both cases may be discounted somewhat, at least by the quantities that would have been consumed in nuclear explosive tests, probably at least 2 but perhaps as many as 5 in Pakistan's case, and perhaps 6 in India's case, including the 1974 detonation.[7] India claims to have used some of its material for fueling other research reactors. If one therefore subtracts 6 test NWEs and also credits India with having removed as much as 27 NWEs (over 120 kg. of plutonium) from the dedicated stockpile irreversibly, it could still, by quite conservative assumptions have as many as 100 NWEs. Similarly, if one conservatively subtracts 5 nuclear explosive test quantities from Pakistan's "best guess" inventory of 43, the total would drop to about 38, a little more than three dozen. *This "best guess" comparison implies a 2.6:1 ratio of NWEs in India's favor -- exclusively from dedicated facilities*.

Chart 2 introduces estimates that are confined to India's *unsafeguarded* civilian heavy water power reactors (HWRs), which easily could be operated to produce high quality weapons-grade plutonium. (Pakistan has no unsafeguarded civilian power reactors, and therefore does not have a corresponding bar in Chart 2.) Even if these Indian power reactors have not all been operated optimally for the highest quality of plutonium for weapon purposes, their reactor-grade plutonium could be used for weapons, albeit weapons that each would require larger critical mass quantities of plutonium (see assumptions in Appendix A). In essence, Chart 2 shows Pakistan's and India's "best guess" NWE production profile from dedicated facilities along side India's potential NWE production of plutonium from its unsafeguarded power reactors -- with separate bars showing the NWE quantities that could be derived from the already separated (reprocessed) plutonium, and also from the thus far unreprocessed spent fuel.

These Chart 2 figures show that, as of 2000, India probably could derive up to 113 NWEs from the *separated* HWR plutonium alone. From the *unreprocessed* HWR spent fuel, India could, over time derive approximately 475 additional NWEs (the pacing being limited, perhaps, by installed reprocessing capacity). *Taken together, these Indian figures in Chart 2 suggest a notional capacity of about 700 weapons, as of 2000.* This is about half again as many NWEs as are estimated to be in China's operational nuclear arsenal (see second paragraph below). These Indian figures will continue to climb.

India's estimated 2.6:1 advantage over Pakistan strictly from dedicated facilities in 2000 actually could be larger if, as might be expected, India has also incrementally expanded its uranium centrifuge facilities to accumulate significant quantities of weapons-grade uranium, and if India will successfully operate its fast-breeder reactors to produce weapons-grade plutonium. India's established advantage over Pakistan almost certainly would remain, even if the Fissile Material Control Treaty (FMCT) comes into effect with both countries as parties.

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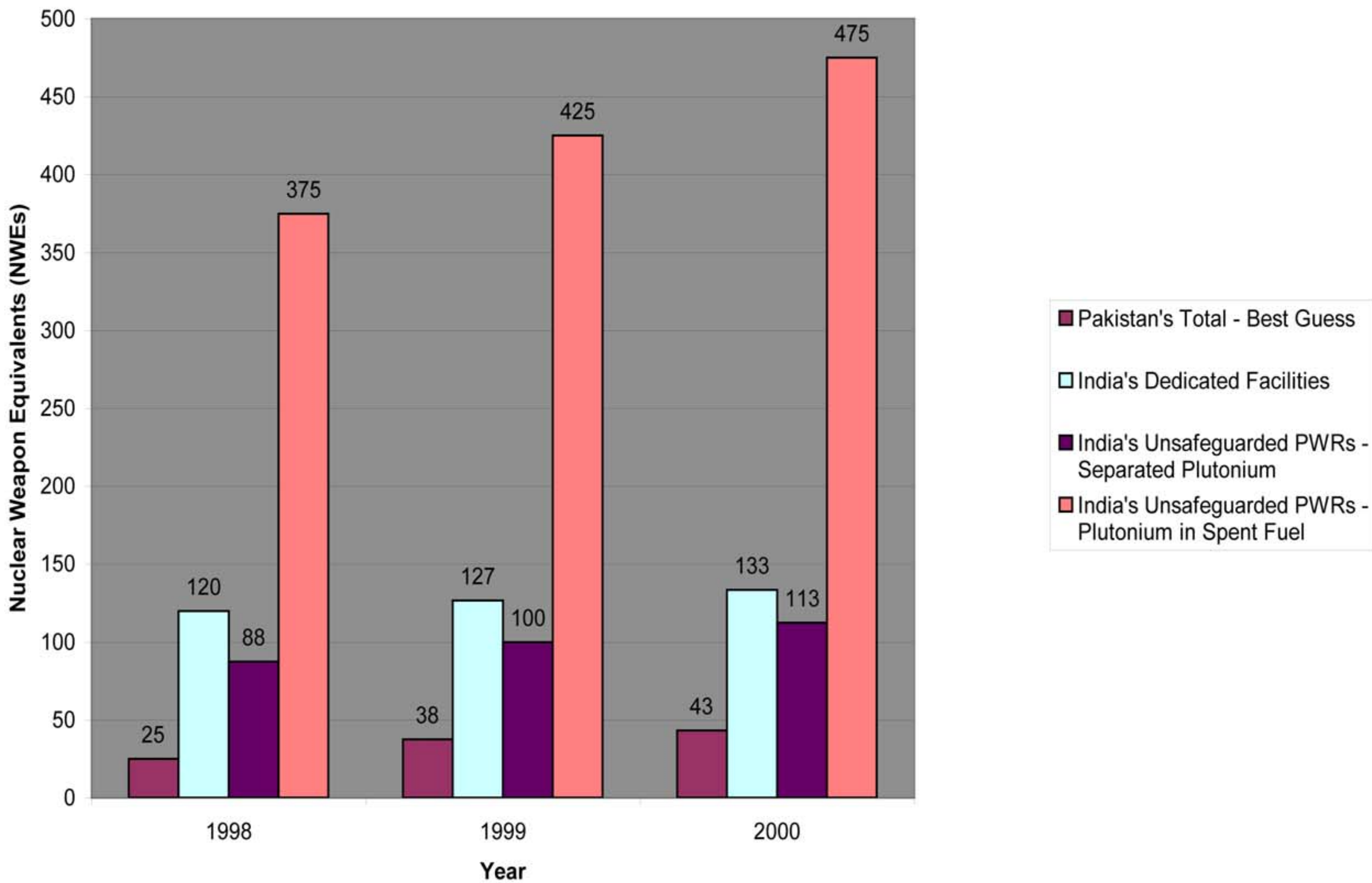
[7] Seismic analysis leaves considerable doubt as to whether Pakistan actually detonated more than two devices in its claimed series of 6 weapon tests on May 28 and 30, 1998, and similar doubts were raised regarding India's claimed number of 5 tests, and the actual character of Indian devices tested on May 11 and 13, 1998. See Terry C. Wallace, *op. cit*., and William J. Broad, *op. cit*. For a Pakistani account of its test preparations, see Rai Muhammad Saleh Azam, "When Mountains Move -- The Story of Chagai," found at: http://www.defencejournal.com/2000/june/chagai.htm. Additional sources on Pakistan's test and reactions to them may be found at: http://www.fas.org/news/pakistan/1998/05/index.html. Additional sources on India's tests and reactions to them may be found at: http://www.fas.org/news/india/1998/05/index.html.

Chart 2. India's and Pakistan's Potential NWEs: Material from All Unsafeguarded Facilities, 1998-2000



Unclassified estimates exist of China's residual fissile material capacity and of its existing warhead stockpile. While these stockpile estimates have a large range of uncertainty, China's stockpiles almost certainly exceed India's by substantial margins. A 1995 estimate by David Albright attributes China's residual fissile material stockpiles (after conducting some 45 nuclear explosive tests) with about 4 metric tonnes of plutonium and 23 metric tonnes of HEU, while Robert Norris and his colleagues believed China had approximately 450 strategic and tactical nuclear weapons in its active inventory in the early 1990s.[8]

Chart 1 has a number of visually interesting details. It shows the adjusted slopes of estimated average Indian and Pakistan production that resulted from bringing additional facilities on line. In India's case, bringing the Dhruva reactor to full operation in 1988 increased India's dedicated plutonium production rate more than twofold. About 1991, Pakistan installed additional centrifuges, raising its HEU production capacity roughly threefold. The graph also depicts a moratorium on HEU production that Pakistan reportedly pledged itself to from 1991 to 1998, which temporarily conceals the effect of tripling Pakistan's centrifuge capacity.

As explained in Appendix A, Pakistan continued between 1991 and 1998 to enrich uranium to low-enriched (LEU) levels. Since enrichment is an iterative process, most of the enrichment work would have been done already by raising the U-235 fraction to the maximum LEU level of 20 per cent. After the nuclear weapon tests in May 1998, Pakistan probably re-enriched the LEU rapidly in the course of a year or so, explaining the 7-year plateau in its graphs and much of the sudden jump in 1998-99. In that year, the effect of having tripled centrifuge capacity and rapidly re-enriching LEU to HEU levels, plus Khushab plutonium production coming on line, would have created a spike in Pakistan's NWE production. But much of this spike was a one-time event, due to sudden re-enrichment of LEU. After the 1998-99 spike, the Pakistani slope (annual rate of additional NWEs) returned to an average annual rate for dedicated facilities that is roughly on a par with India's -- assuming the best guess projection in each case.

It is interesting to ask in light of the estimates of India's NWEs what number of weapons India would be likely to settle on as sufficient for minimum deterrence, if India were indeed serious about that concept. Would the roughly 100 weapons (and growing) that are already embedded in its dedicated program be considered sufficient by Indian calculations, for example, to deter Pakistan and China respectively? Several Indian strategists, including former Indian Army Chief of Staff, General K. Sundarji, and India's best known strategic commentator, K. Subrahmanyam endorsed numbers of 100 or even less as sufficient for India's deterrence requirements well before the May 1998 watershed.

Reciprocally, suppose India were satisfied with 100 weapons, would just half of India's dedicated facility quotient be sufficient for Pakistan's arsenal, from Pakistan's point of view, to deter threats from India? Based on the "best guess" calculations presented here, each state may be fairly close to such a threshold now, just counting the output of its dedicated facilities. If these "best guess" production rates merely remained constant, by 2010 Pakistan's NWE quotient could grow to about 110, and India's (from dedicated facilities only) to about 200 (after discounting for testing and other uses, as mentioned earlier). There is no evidence in their behavior, however, that either state will be

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[8] See David Albright, Frans Berkhout, and William Walker, *Plutonium and Highly Enriched Uranium 1996: World Inventories, Capabilities and Policies*, New York: Oxford University Press for Stockholm International Peace Research Institute, 1997, p. 359; and Robert S. Norris, Andrew S. Burrows, and Richard W. Fieldhouse, *Nuclear Weapons Databook, Vol. V: British, French, and Chinese Weapons*, Washington, D.C.: Natural Resources Defense Council, 1994, p. 358.

satisfied with the present, relatively low numbers of NWEs as sufficient for its version of "minimum deterrence."

C. Nuclear-Capable Delivery Systems

Considerable ambiguity surrounds the nuclear-ready deployment status of both aircraft and ballistic missiles in India and Pakistan. Neither country has acknowledged actual deployment of nuclear-equipped aircraft or ballistic missiles, although both possess deployed dual-capable delivery systems.

India and Pakistan have had high-performance conventional aircraft since the 1970s that could be nuclear-capable, given limited modifications. Such modifications may have been carried out with certain aircraft, but this has never been officially acknowledged. Both states undertook nuclear-capable ballistic missile acquisition and development, India beginning in the 1970s, and Pakistan in the late 1980s. The presumptive capabilities of both countries' missile programs achieved a high profile in the 1990s, well before the nuclear tests of May 1998. India's and Pakistan's delivery system choices and their inherent technological limitations will shape each state's near term nuclear-capable force structures, and may provide clues to its strategic deterrence and employment policy objectives. These objectives in turn may influence strategic (and perhaps tactical) military doctrine.

(1) Aircraft:

Table 1 on "Nuclear-Capable Strike and Reconnaissance Aircraft" provides an overview of current Indian and Pakistani nuclear-capable aircraft delivery systems. In India's case, long-range "reconnaissance" aircraft that could be used for nuclear missions are included for illustrative purposes.

Asymmetry stands out in the relationship between India's and Pakistan's nuclear-capable aircraft, in numbers, performance, and range. Table 1 displays the balance of strike aircraft, but not that of fighter-interceptors. If interceptors were included, the overall air balance would appear even more lop-sided. Pakistan's fighter and ground-attack aircraft are aging, and sanctions have blocked new purchases -- except from China, whose aircraft are far from state of the art. Pakistan's approximately 100 nuclear-capable Mirage ground-attack and F-16A/Bs fighter-interceptor aircraft could, however, deliver gravity bombs to key cities and installations in north-central India, including the capital at New Delhi, but do not have the legs to reach southern or eastern India, except on one-way missions.

India's approximately 310 nuclear-capable ground-attack aircraft, on the other hand, hold all of industrialized Pakistan at risk. They include state-of-the-art types of attack aircraft: 40 Su-30MK (Flanker) and 64 MiG 29 (Fulcrum) -- among the most advanced Russian combat aircraft. In addition India deploys 88 highly capable Jaguar S (I) and 147 sturdy MiG-27 Flogger strike aircraft. Numerically, India's ratio of combat aircraft to Pakistan's is just a little over 2:1 overall, but the nuclear-capable ground-attack ratio is at least 3:1. If qualitative superiority were factored in, however, India's nuclear-capable (and conventional) air attack edge over Pakistan probably would have to be treated as 5:1 or 6:1 at least. India also has a nuclear-capable (Jaguar) *maritime* attack squadron.

Table 1. Nuclear-Capable Strike and Reconnaissance Aircraft India and Pakistan - 2000

	Aircraft Type	Operating Radius (km, unrefueled)	Inventory	Supplier
India				
	Modern			
	Su-30 MK	1,200	40	Russia
	Mirage 2000H/TH	1,475	35	France/UK
	Jaguar S(I)	900	88	France/UK
	MiG-29 (Fulcrum)	630	64	Russia
	Vintage			
	MiG-21 MF/PFMA	250	69	Russia
	MiG-23 BN/UM	350	53	Russia
	MiG-27 (Flogger)	390	147	Russia
	Strategic (Long-Range)			
	Tu-142 (Bear F) ASW	6,200	8	Russia
	Ilyushin-38 (marit recon)	3,600	5	Russia
	Tu-22M (Backfire)	4,430	4	Russia
	Total		***513***	
Pakistan				
	Modern			
	F-16 A/B	850	25	US
	Vintage			
	Mirage IIIEP	500	16	France
	Mirage 5	500	52	France
	Total		***93***	

Notes to Table 1

Nuclear-Capable Strike and Reconnaissance Aircraft - India and Pakistan, 2001

Sources: IISS, *The Military Balance, 2000 to 2001*, and earlier volumes in the series, sections on "Central and South Asia," pages on order of battle for India and Pakistan, tables on export deliveries to India and Pakistan, and -- for aircraft exported to India and Pakistan by Russia, France, the United Kingdom, China and the United States -- data from the annual *Military Balance* volumes that provide range, action radius, and other operational characteristics of particular aircraft types deployed by India and Pakistan.

The term "nuclear-capable strike" refers to tactical aircraft assigned to, or designed for, ground attack missions, and that are considered to be capable of carrying nuclear ordnance externally or internally, with modifications. Neither India nor Pakistan has identified aircraft or air force or naval units that have been, or will be, assigned nuclear attack missions. Hence, inclusion of aircraft in the table does not imply that they have necessarily been modified for nuclear carriage; it merely indicates that they could be.

The inclusion in India's case of Russian-origin, long-range reconnaissance and maritime strike aircraft (e.g., the Tu-22M *Backfire*) reflects the fact that such aircraft could be modified, if they are not already equipped, to carry gravity bombs in bomb bays or to mount nuclear-capable ballistic or cruise missiles externally and deliver them over great distances in Asia. Classifying aircraft types as "modern" (1970s and later) or "vintage" (1960s or earlier) refers to when they were introduced by their manufacturers and normally does imply qualitative limitations related to the technology of the period, but is not necessarily a description of their readiness status or serviceability in the Indian and Pakistani military forces. Older aircraft may be upgraded with new engines and more advanced avionics, as has been occurring with some of Pakistan's Mirages and India's Mig-21s and Mig-23s. However, the modern-vintage distinction has some utility in assessing the air offense/defense asymmetries between India and Pakistan. The table excludes Chinese tactical aircraft imported by Pakistan because they are based on vintage Russian airframe designs (mainly Mig-19/21). While the Chinese aircraft are deemed serviceable in fighter-interceptor roles, their range and speed limitations would argue against their being assigned to nuclear deterrent missions.

India's most up-to-date fighter-interceptors and ground-attack aircraft are also superior to the bulk of China's (the exceptions China's recent imports of Russian Su-27s and Su-30s). Indian planners believe their conventional forces, with the added advantage of shorter lines of communication, would greatly outmatch China's in any renewed Himalayan border confrontation. Most Indian nuclear-capable ground-attack aircraft, however, have not had the range to pose a threat to China's interior and eastern cities -- without heroic measures.[9]

Table 1 also shows that India has acquired small numbers of older but strategically capable Russian aircraft (8 Tu-142 Bear F with anti-submarine warfare capability along with 5 Il-38 maritime surveillance platforms), and India plans to lease at least 4 supersonic Russian Tu-22M Backfire bombers. These aircraft are equipped, ostensibly, to perform maritime and long-range surveillance missions. The Tu-142 Bear F, however, is based on essentially the same airframe and turboprop engines (and has much the same 8,000 km operating radius) as the Soviet Tu-95 Bear types, designated as "heavy bombers" under the 1991 START I Treaty. The Tu-22M Backfire, with a 4,430 km combat radius and large payload capacity, was narrowly excluded from the list of "strategic offensive arms" in the START Treaty, in exchange for a written Soviet commitment to the United States not to retrofit or practice air-to-air refueling -- so that the Backfire's combat radius would fall short of intercontinental range.[10]

These long-range aircraft provide India with putative nuclear delivery systems of strategic reach for contingencies related to China. They could become the nucleus of an imported strategic bomber force. Even in an exclusively maritime role, these aircraft further accentuate the overwhelming Indian conventional asymmetry vis-a-vis Pakistan. If reconfigured for nuclear delivery, these aircraft also could mitigate China's still large current nuclear advantage against India.

(2) Missiles:

The details in Table 2, "Nuclear-Capable Ballistic and Cruise Missiles" should be treated with caution. Missile characteristics are based in large part on public information from the countries concerned, and, in Pakistan's case also depend on sketchy information about Chinese and North Korean export missile types.

India has long displayed ambitions to become self-sufficient in all areas of modern science and high technology, including atomic energy, aerospace, and electronics. By the late 1970s, India had begun a dedicated military missile development program,[11] adapting imported space launch vehicle and air defense missile technology to surface-to-surface ballistic missile applications. Table 2 shows the nuclear-capable missile delivery systems that India has developed and tested.

A variety of Indian R&D programs exist for air-to-air, air-to-surface, anti-tank and air defense missiles, including unmanned air vehicles (UAVs) and cruise missiles. These are not all depicted

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[9] Special fuel tanks or air-to-air refueling and the possibilities of aircraft recovery in a country neighboring China (e.g., Vietnam) or, in extremis, one-way missions, are possibilities that may deserve further analysis in the future.

[10] On the Bear heavy bombers, see the "Memorandum of Understanding on the Establishment of the Data Base Relating to the Treaty," including Annex C on "Heavy Bombers and Former Heavy Bombers;" and for Backfire bombers, see "Declaration by the Union of Soviet Socialist Republics Concerning the Tu-22M Medium Bomber, July 31, 1991," in the "Declarations," in *The Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms, Signed in Moscow on July 31, 1991*, Washington, DC: US Arms Control and Disarmament Agency, 1991, pp. 120-125, 193-204, and 280.

[11] W.P.S. Sidhu, "Enhancing Indo-U.S. Strategic Cooperation," London: IISS, *Adelphi Paper No. 313*, 1997, p. 19.

Table 2. Nuclear-Capable Ballistic and Cruise Missiles - India and Pakistan, 2001

	Missile Type	Range (km)	Inventory	Status	Configuration	Payload (kg)	Supplier/Tech Source
India							
	Prithvi-1 (Army)	150	75	deployed	1-stg, liquid, mob	800	Russia/SA-2
	Prithvi-1 (Navy)	150	?	deployed	1-stg, liquid, mob	?	Russia/SA-2
	Prithvi-2 (Army)	250	25	on order	1-stg, liquid, mob	500	Russia/SA-2
	Prithvi-3 (Air Force)	350	0	R&D	1-stg, liquid, mob	?	Russia/SA-2
	Agni-1	1,200-1,500	?	tested	2-stg, solid/liquid	1,000	US/Fr/Ger/Russia
	Agni-2	2,500	6?	prototypes	2-stg, solid, rl-mob	1,000	US/Fr/Ger/Russia
	Agni-3	3,000-4,500	?	R&D testing	3-stg, 2 solid with liquid 3rd stg	500	US/Fr/Ger/Russia
	PJ-10, Yakhont/Brahmos	300	?	tested	ramjet cruise	?	joint-Russ/India
	Lakshya	600	?	development	cruise	450	Russia?
	Sagarika/Dhanush	250-300	N/A	R&D/purchase?	naval, ballistic/cruise?	450	Russia/SS-XN-27?
	Surya	12,000	N/A	SLV conversion	multi-stg, liquid	500-750	?
Pakistan							
	Hatf-2	280-300	30-50	product/storage	1-stg, solid, mob	500	PRC/M-11
	Hatf-3	600	?	production?	1-stg, solid, mob	500	PRC/M-9
	Hatf-4/Shaheen-1	750	?	production?	1-stg, solid, mob	500	PRC/M-9
	Shaheen-2	800-1,200	?	R&D testing	2-stg, solid	400-500	PRC/M-18/DF-11?
	Hatf-5/Ghauri-1	1,350-1,500	12?	R&D testing	1-stg, liquid	500-700	DPRK/No-dong-1
	Hatf-6/Ghauri-2	2,000-2,300	?	R&D testing	2-stg, liquid, stat	700-1,000	DPRK/Taepo-dong-1
	Ghauri-3 (Abdali?)	3,000	?	R&D	2-stg, liquid, stat	1,000	DPRK/Taepo-dong-2

Notes to Table 2

Nuclear-Capable Ballistic and Cruise Missiles - India and Pakistan, 2001

Sources: For historical and technical background: Aaron Karp, *Ballistic Missile Proliferation: The Politics and Technics*, Oxford University Press, SIPRI, 1996; and Rodney W. Jones and Mark G. McDonough (et. al.), *Tracking Nuclear Proliferation: A Guide in Maps and Charts, 1998*, *op. cit*., section 10, "Missile Proliferation," pp. 253-261. For US proliferation threat assessments, see *Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions*, January Through 30 June 2000, Sept. 7, 2001, available at: http://www.cia.gov/cia/publications/bian/bian_feb_2001.htm#15; *Proliferation: Threat and Response*, Washington, D.C.: Department of Defense, January 2001, available at: http://www.defenselink.mil

For compilations of data on missile types and characteristics, and technology suppliers: IISS, *The Military Balance 1999-2000*, Table 53, "Ballistic and Cruise Missiles," pp. 309-12, and Table, 19, "Arms Orders and Deliveries, Central and South Asia, 1997-1999," pp. 156-158; *Military Balance 2000-2001*, "Unmanned Aerial Vehicles," pp. 304-06, and Table 22, "Arms Orders and Deliveries, Central and South Asia, 1998-2000," pp. 163-65; *Military Balance 1995-1996*, "Missile Proliferation," pp. 281-284; and Jones and McDonough, *Tracking, 1998*, *op. cit*., section 10, "Missile Charts 1 to 3," pp. 263-269.

Note that official US and IISS classifications of ballistic missiles by range differ:

Class of Missile	United States	IISS
SRBM (short-range ballistic missile)	under 1,000 km	under 500 km
MRBM (medium-range ballistic missile)	1,000 - 3,000 km	--
IRBM (intermediate-range ballistic missile)	3,000 - 5,500 km	500 - 5,000 km
ICBM (intercontinental ballistic missile)	over 5,500 km	over 5,000 km

Under the original Missile Technology Control Regime (MTCR) guidelines, a ballistic or cruise missile was considered nuclear-capable (and of direct proliferation concern) if it had the capability to deliver a 500 kg warhead (threshold assumed for a rudimentary nuclear warhead) to a range of 300 km. The newer MTCR threshold of concern is over the capability to deliver chemical or biological weapons and naturally assumes a lighter payload. China has claimed that the range of the M-11 export missile reportedly now in Pakistan's inventory is less than 300 km and does not trigger the guideline. The US view has been that adherence to the MTCR guidelines would preclude transfer of the M-11. Interestingly, Russia advertises that both the range (250-300 km) and the payload (450 kg) of the SS-NX-27 (P-900 Alfa) ship-launched missile it is exporting to India fall outside the MTCR guidelines, but not by much. Having tested several nuclear explosive devices, it would be surprising if India were unable to package a nuclear warhead under 450 kg. In any case, given the range/payload tradeoff, a slightly heavier warhead may require merely a sacrifice in maximum range.

This export version of the Alfa (3M51E1) missile is a hybrid that uses a solid rocket to launch and then operates a turbojet motor as a subsonic cruise missile. Russia's more powerful M54E version has another solid stage that is designed to fire after the missile has acquired its target and to drive the missile to its aimpoint at hypersonic speed. Versions of Alfa exist for submarine and surface ships, as well as for land-attack. This Russian SS-NX-27 Alfa export may be used instead of India's shrouded Dhanush and Sagarika development missiles, on Russian-supplied Indian Navy vessels -- both the Krivak class frigates and Kilo class submarines. The Alfa may also be used as by India in the R&D process as a test-bed for developing the longer-range and unmistakably nuclear-capable Lakhshya cruise missile. Although most attention to the nuclear military balance in South Asia has focused on shorter-range tactical aircraft and ballistic missiles, this table illustrates, at least in India's case, the increasing regional representation of sea-launched, nuclear ballistic and cruise missile capabilities. Air-launched, strategic versions of the SS-NX-27 Alfa and Lakhshya could be imagined at some point in the future.

Russia and India reportedly have jointly developed a missile, the PJ-10, a variant of the Yakhont, which India plans to market as the BrahMos, a ramjet-powered, supersonic, anti-ship cruise missile of about 300 km range, payload not known. See "Russia to Unveil PJ-10 Missile," *The Hindu*, June 28, 2001.

Key to Abbreviations: stat = static launch; mob = road-mobile; rl-mob = rail-mobile; stg = propulsion stage. Use of question mark indicates no data or unreliable data.

here, because their program aims are largely conventional rather than nuclear, or, as in the case of cruise missiles, because they are in early stages of research and development. It should be noted, however, that India's acquisition of Russian airborne, naval, and submarine missile systems and related military technologies includes some dual-capable ballistic and cruise missile systems -- such as the SS-NX-27 (P-900 Alfa), a hybrid cruise and ballistic missile.[12]

India's first indigenously developed and currently operational surface-to-surface ballistic missile (SSM) is the Prithvi. The Prithvi was derived from reengineering the SA-2, an old Soviet single-stage, liquid-fueled, high-altitude, surface-to-air missile (SAM). India began a form of deployment of the mobile Prithvi-1 launchers and missiles near the border with Pakistan in the summer of 1997, lodged in shelters.[13] These deployed Prithvi missiles probably are conventionally armed. The conventional warhead suite reportedly includes canisterized submunitions for airfield bombardment. Prithvi's main mission appears to be to suppress Pakistani air defenses.[14]

Due to the Prithvi's severely limited range (Prithvi-1 is rated for 150 km, and later versions would not exceed 350 km) and extremely cumbersome operational requirements, [15] the Prithvi has no obvious military utility against China. It has the range to strike vital industrial areas in Pakistan, however. Equipped with nuclear warheads, the Prithvi could be used not only against airfields but also against a variety of other wide-area, unhardened military targets, and thus could serve, together with nuclear-equipped aircraft, in nuclear counterforce and retaliatory missions.[16]

India's Agni ballistic missile evidently was planned as the basis for demonstrating India's initial capability to deliver nuclear weapons rapidly to distances that could include China's interior.[17] According to a reputable American researcher, Agni-1utilized the U.S.-origin Scout solid rocket for one propulsion stage and the same Russian SA-2 technology as the Prithvi for the other stage of a

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[12] See notes to Table 2. Also, Neil Joeck, "Maintaining Nuclear Stability in South Asia," London: IISS, *Adelphi Paper No. 313*, 1997, p. 69.

[13] Raj Chengappa, "Boosting the Arsenal," *India Today*, February 29, 1996, pp. 98-99; R. Jeffrey Smith, "India Moves Missiles Near Pakistani Border," *Washington Post*, June 3, 1997, p. A15; and the analysis in Rodney W. Jones, "Pakistan's Nuclear Posture: Arms Race Instabilities in South Asia, *Asian Affairs: An American Review*, Vol. 25, No. 2, Summer 1998, p. 72.

[14] Eric Arnett, "Nuclear Stability and Arms Sales to India: Implications for U.S. Policy," *Arms Control Today*, Vol. 27, No. 5, August 1997, p. 8.

[15] On close analysis, serious military observers may be tempted to conclude that the Army's Prithvi-1 is virtually a "theatrical prop." Although described as a road-mobile missile system, each four-missile Prithvi battery appears to require upwards of a dozen support vehicles to carry, erect, fuel, and arm the missile, and to establish electric power, acquire target data, fire, and command-guide the liquid-fueled missile to a target. Preparatory procedures prior to launch readiness evidently would be many hours, even after missiles and fuel have been brought separately to a pre-surveyed launch site. If detected, such a battery with its logistics tail is also an inviting soft target for aircraft or long-range field artillery. In this respect, if nuclear-equipped, it clearly would fall into the most destabilizing category of "use them or lose them" offensive arms. See the *Bharat Rakshak* ("Indian Security") description at: http://www.bharat-rakshak.com/MISSILES/Images/Prithvi3.jpg.

[16] Joeck, "Maintaining Nuclear Stability," *op. cit*., p. 68. While official Indian positions disclaim that the Prithvi has any nuclear role, the media announcements and advocacy writings that emerged during development, production and deployment during the 1980s and 1990s emphasized Prithvi's nuclear potential. A respected former defense bureaucrat, K. Subrahmanyam, for example, advocated this approach. See his "Nuclear Force Design and Minimum Deterrence Strategy for India," in Bharat Karnad, ed., *Future Imperilled*, New Delhi: Viking, 1994. Moreover, Prithvi inaccuracy suggests that the system would not be militarily effective without nuclear payloads. Probably reflecting this judgment, an unclassified CIA publication indicates that the Prithvi could have a nuclear role: See National Intelligence Council, "Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015," Washington, D.C., September 1999, available at <http://www.cia.gov/cia/publications/nie/nie99msl.html#rtoc4>.

[17] See Government of India, *The Missile Development Programme, Backgrounder*, New Delhi: Public Information Bureau,, June 25, 1992.

hybrid system.[18] For Agni-2, however, India adjusted the design, using solid rocket motors for both stages. According to an Indian official interviewed for a news report right after the first successful test of an Agni-2 prototype in April 1999, India's May 1998 series of nuclear tests "proved" (weaponized) a warhead that could be mated with Agni-2.[19] Agni-2 is believed capable of delivering a 1,000-kg payload to a range of about 2,500-km. Several Agni-2 prototypes may have been built for testing, and theoretically could provide a latent nuclear retaliatory capability from launch pads at the Wheeler Island missile test site in Orissa against the closest cities in southwestern China. India may also be developing a rail-mobile launch platform for the Agni missile system.[20]

As rough metrics, coastal Orissa (where the Agni has been tested) is about 2,900 km from Wuhan in central China, and slightly under 4,000 km. from Beijing or Shanghai. The distance from the easternmost tip of India in Arunachal Pradesh (north of Assam) to Beijing is much shorter, about 2,500-km. But this Indian extremity falls in a remote but populated territory unsettled by severe ethnic and tribal conflict -- an exceptionally dangerous location for the installation of any nuclear weapons, and without the infrastructure for rail-mobile systems, if they are even feasible. Moreover, India's connecting corridor along the northern boundary of Bangla Desh is very narrow. India's eastern extremity, therefore, would seem to be an unlikely area for strategic missile basing, at least for the foreseeable future.

Agni-3, which has not yet been developed and tested, is projected to have a range of 3,000 to 3,500 km. with a 500-kg payload. If this program is successful, India would have a nuclear-capable missile that might be able to reach the central and southwestern part of urban China from northeastern Orissa. To translate this developing capability into a small, but securely based, fully tested, operational force of 20 or 30 missiles probably would take the rest of this decade, however, even with a stepped up effort. RAND Corporation analysts believe that the Agni missile system is too limited, technologically, to be used as a reliable, mobile, medium- or intermediate-range missile for stable nuclear deterrence against China.[21]

India has acquired modern diesel-powered submarines from Germany and Russia and has been attempting to design and build nuclear-powered submarines.[22] There have been long-standing reports

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[18] Gary Milhollin, "India's Missiles -- With a Little Help from Our Friends," *Bulletin of the Atomic Scientists*, November 1989, pp. 31-35.

[19] Following a successful launch of Agni-2 from the Wheeler Island test site off the coast of Orissa (albeit to a range of only 2,000 km.), A.J.P. Kalam, head of India's missile development program, gave interviews to journalists. He was said to have replied to the question "Have you mated nuclear warheads that were tested in Pokhran [in May 1998] with the Agni?" in the following terms: "Yes, Agni-2 is designed to carry a nuclear warhead if required. In any case, we had already tested an Agni-class payload at Pokhran last year." See Raj C. Chengappa, "Missiles: Boom for Boom," *India Today International*, April 26, 1999, pp. 28-30.

[20] A.J.P. Kalam reportedly claimed that the Agni-2 was "combat ready," and that rail-cars to "house" Agni [hinting at rail-mobile launchers] had been ordered from the Coach Factory in Kapurthala three years earlier. *Ibid*.

[21] Gregory Jones, "From Testing to Deploying Nuclear Forces: The Hard Choices Facing India and Pakistan," RAND Issue Paper -192, 2000, p. 4, who argues that: "... no upgrade of the Agni-2 is likely to produce a missile with a 3,500-5,000 km range. Thus India would have to produce a whole new missile [for effective deterrence range against urban China]." See also Ashley Tellis, *India's Emerging Nuclear Posture: Between Recessed Deterrent and Ready Arsenal*, Santa Monica, CA: RAND, 2001, pp. 567. The underlying reasoning appears to be that the diameter of the solid-fuel staging of the Agni is too narrow to support additional stages and develop the cumulative thrust (specific impulse) required to deliver nuclear payloads beyond about 3,000 km. Tellis also discusses technical obstacles to urgent proposals by certain Indian experts to harness the heavy lift assets of the Indian space program directly to *mobile* strategic missile applications. Tellis's observations are compelling on the obstacles of adapting space launch assets to mobile missile requirements, but do not carry the same force as hurdles to adapting space launchers to silo-based missile purposes. *Ibid*., pp. 567-69.

[22] Tellis, *op. cit*., pp. 573-82, provides the best recent overview of India's progress, shortcomings, and dilemmas in nuclear missile submarine programs as a third leg of a deterrent force structure. It is difficult to be sure of the veracity of the report he

of Indian efforts to nail down Russian assistance in developing an Indian submarine nuclear reactor.[23] India reportedly is acquiring various types of ship-launched missiles, as well as submarine-launched cruise missiles, from Russia, and has a program to develop short-range, submarine-launched ballistic missiles (SLBMs). It probably will be many years before India can successfully build, test and deploy strategic SLBMs on nuclear-powered submarines with on-station, blue-water capabilities against China, but shorter-range naval missiles being purchased from Russia may already affect the balance with Pakistan.

Pakistan's military missile development program today has achieved some degree of self-sufficiency in production of solid-fueled short-range ballistic missiles.[24] But in efforts to keep pace with India's Prithvi and Agni program milestones, Pakistan became more heavily dependent during the late 1980s and early 1990s on imports of off-the-shelf ballistic military technologies from China and North Korea.[25] Table 2 on "Nuclear-Capable Ballistic and Cruise Missiles" shows the series of reported solid and liquid fueled missile systems that Pakistan is believed to have acquired or aims to develop.

Pakistan's missile program objectives have been nuclear-capable missiles that could reach deeply into India, using mobile launchers for dispersal and concealment. The Hatf-2 is believed to be based on the solid-fuel Chinese M-11 with a range just under 300 km., and the Hatf-3 on the solid-fuel Chinese M-9 with a range of about 600 km. The Shaheen (Hatf-4) may also be based on M-9 technology, but with a slightly longer range. Both the Hatf-3 and Shaheen (Hatf-4) would bring Delhi within reach as a target. The Chinese M-11 and M-9 systems were designed for road-mobile deployment on transporter-erector-launchers (TELs). Pakistan probably is capable of producing TELs on its own.

The somewhat longer-range Ghauri-1, -2 and -3 are reported by Western sources to be derivatives of North Korean, liquid-fueled, Nodong and Taepodong missiles. The North Korean missiles, in turn, are derivatives of widely exported Soviet Scud missiles. If successfully constructed and deployed, the Ghauri-3, reported to have a range of about 3,000-km, would be able to reach targets throughout India. The Ghauri missiles apparently also can be deployed as mobile missiles mounted on TELs.[26]

Under the inventory column, Table 3 shows 30-50 Hatf-3 and possibly 12 Ghauri-1. These are unverified numbers listed by the IISS, *Military Balance, 2000-2001* (see notes to Table 3). Pakistan

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quotes that India's atomic energy "scientists, after years of struggle, have finally developed a land-based prototype of the submarine's propulsion plant, a 90-MW pressurized water reactor (PWR) with turbines and propoellers, and are testing it at a secret location in southern India," in T.S. Gopi Rethinaraj, "ATV: All at Sea Before It Hits the Water," *Jane's Intelligence Review*, June 1998. ATV refers to "advanced technology vessel," the code name for India's nuclear submarine project.

[23] For digests of Russian media reports on Indian solicitation and evidence of Russian cooperation with India on nuclear-powered submarines, see Igor Kudrik, "Russia helps India build nuclear submarine," Oslo, Norway: Belonna Foundation, Sept. 17, 1998; Thomas Nilsen, "Despite three years leasing of Charlie-class submarine: Indian submarine-reactor will be no blueprint of Russian design," *Ibid*.., Sept. 22, 1998; Igor Kudrik, " India shops Russia for submarine technology, " *Ibid*., March 24, 1999. The Soviet Union leased a Charlie-class nuclear-powered, cruise-missile submarine to Indian in 1988, for three years. There have also been reports that Russia has trained Indian submarine crews at Severodvinsk.

[24] Brig. Naeem Ahmad Salik, "Pakistan's Ballistic Missile Development Programme -- Security Imperatives, Rationale and Objectives," Islamabad, Institute of Strategic Studies, *Strategic Studies*, Vol. XXI, No. 1, Spring, 2000.

[25] See chapters on Pakistan and China in Jones and McDonough, *Tracking Nuclear Proliferation, 1998*, *op.cit*., especially pp. 53-54, 131-133, and 136-137.

[26] For an assessment of Pakistan's acquisition and testing of the Ghauri-1 missile, including a technical comparison based on what is known on an unclassified basis about the Nodong, see David C. Wright, "An Analysis of the Pakistani Ghauri Missile Test of 6 April 1998," Cambridge, MA: MIT Security Studies Program, May 12, 1998, available at: http://www.fas.org/news/pakistan/1998/05/980512-ghauri.htm. See also Federation of American Scientists, "Ghauri [Hatf-5]," available at: http://www.fas.org/nuke/guide/pakistan/missile/hatf-5.htm.

has not officially disclosed an inventory of these systems. There is a presumption but no reliable public information that Pakistan has developed nuclear warheads that could be mounted on these ballistic missiles, and reports but no convincing evidence that these missile types have been deployed as operational weapons. According to one report in the mid-1990s, Hatf-2 (M-11) import shipping containers received by Pakistan in the early 1990s were still unopened (the consignment had been left in storage near Sargodha), but by that time a factory had been built in Pakistan to produce solid-fuel ballistic missiles based on Chinese M-11 design and technology.[27]

D. Nuclear Force Structure

Aircraft and missile acquisitions suggest that India and Pakistan both will employ nuclear-equipped strike aircraft and short- to medium-range, land-based missile delivery systems in their nuclear force structures. Neither is known to have physically deployed nuclear warheads at air bases ready for loading on aircraft or mated nuclear weapons with missile delivery systems in the field for prompt action. Both are presumed, however, to have at least small numbers of nuclear weapons stockpiled for potential airborne missions. In Pakistan, nuclear weapons are believed to be under military custody, but in India they remain under the control of the civilians in the atomic energy and defense research and development agencies.

The pattern of delivery system diversification and emphasis on road- or rail-mobile missile configurations suggests an interest on both sides in ensuring nuclear forces are survivable under attack, even in small numbers. Deployment may be restrained by political inhibitions as well as by resource constraints. Diplomatic efforts to dissuade either country from actually deploying ready-to-use nuclear systems, and China's deliberately low key diplomatic and military responses to India's declaration of nuclear weapons, may have had inhibiting effects.

Pakistan finds it useful to highlight how its own nuclear measures are responses to Indian actions and may believe that it will suffer fewer sanctions if it refrains from getting out ahead of India in visible deployment activities. India is not really capable of deploying a significant or secure nuclear retaliatory capability against China today, due to resource constraints and technological limitations, and may consider it prudent to limit China's perceived provocation and reactive Chinese nuclear deployments.

An incremental approach also better preserves India's negotiating capital in international disarmament fora. Resource constraints stand in the way of rapidly accelerating quantitative expansion of nuclear components and acquisition or production of additional delivery systems -- especially as these relate to how India might seek to structure a nuclear balance with China.

Theoretically, India's and Pakistan's current nuclear force capabilities could still be consistent with minimal deterrent postures and deployment patterns, i.e., small numbers of deliverable weapons, withheld in storage, usable only in extremis, and programmed only for retaliation against nuclear or overwhelming conventional attack. A recessed posture might continue to be plausible for Pakistan if it could reassure itself that its small arsenal is highly survivable against India's conventional military preemptive means. This conclusion will be hard for Pakistani defense planners to reach, however, given India's military superiority and offensive air strike doctrine, coupled with Pakistan's geographic vulnerabilities, lack of meaningful strategic early warning capabilities, and stringently limited opportunities for conventional military modernization.

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[27] See Jeffrey Smith, "China Linked to Pakistani Missile Plant," *Washington Post*, August 25, 1996.

Whatever words it chooses, India is likely to pursue a more ambitious force structure than minimal deterrence would imply, although it may do so over a protracted period at a pace of its own choice, as long as there is no pressing threat and its resources remain constrained.[28] Indeed, a more ambitious nuclear posture is strongly implied by the wide array of military technologies India is already attempting to acquire or develop, many of which are inherently dual-use. Technology acquisition and scientific prestige have always been key drivers behind India's nuclear and high technology military programs.

In due course, political events almost certainly will open the way to India's program managers to stake additional claims. A future rise in tension between India and China, given China's asymmetric nuclear advantages, would strengthen the political hand of India's military R&D program leaders in arguments over whether to spend more rapidly or extensively to compensate for capability gaps. Classic strategic vulnerability, feared technical failure, and hedging against crisis instability almost certainly will resolve arguments in favor of advanced capability and push beyond minimal deterrence. India's rhetorical commitment to minimum deterrence may be no more than a pacifier for the international community, which is concerned about the spread of nuclear weapons and increased risks of their use.

III. Emerging Nuclear Policies, Postures, Strategies, and Doctrines

The following sections address several questions: What has been said publicly and authoritatively by Indian and Pakistani officials since May 1998 about their reasons for acquiring nuclear weapons and becoming nuclear weapon states? In what respects are their rationales for nuclear weapons political rather than military? What plausible security threats that could warrant nuclear response are postulated? To what extent have the two governments and military establishments defined coherent nuclear military strategies and objectives, and to what degree have these taken operational form -- in nuclear force structure, targeting plans, command and control, and operational doctrine? Have strategic and tactical nuclear issues been differentiated? In what respects are the writings of non-government experts and publicists indicative or misleading on likely government choices on nuclear defense posture, strategy, force structure, and military operational approaches to nuclear deterrence, crisis-management or actual military conflict?

To date, the public and apparent operational approaches to these nuclear defense issues have differed considerably between the two countries. Both governments have adopted declaratory nuclear policies of "minimum credible deterrence," but beyond that, each has tightly controlled what is and is not asserted or disclosed. Both have self-consciously maintained a high level of opacity in matters of nuclear capacity, readiness, and actual military arrangements. The one important Pakistani exception was its announcement in February 2000 that a formal nuclear command authority and inter-service organization had been established in early 1999.[29]

On the domestic scene, Pakistan's defense establishment has discouraged serious public debate of nuclear defense posture and plans. In contrast, top Indian officials have been permissive and even

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[28] This appears to be the main thesis of Ashley Tellis' *India's Emerging Nuclear Posture*, *op. cit*.

[29] See February 2, 2000 announcement, "National Command Authority Established," Associated Press of Pakistan, February 3, 2000; "National Command Authority Formed," *Dawn*, February 3, 2000; Amit Baruah, "Pak Signal to U.S. on N-command," *The Hindu*, February 3, 2000.

proactive in enabling and managing expert debate on nuclear weapons, to legitimize "going nuclear" politically, and to enhance India's international visibility and political weight. The floating of the attention-getting "Draft Report of [the] National Security Advisory Board on Indian Nuclear Doctrine" on August 17, 1999 is a case in point.[30] Thus, there has been a torrent of media discussion and expert writing in India, but comparatively little in Pakistan. Both governments have encouraged high profile media coverage of their ballistic missile testing; a controlled form of transparency that heightens domestic awareness of capability but further stimulates arms race competition.

A. Declaratory Policy and Nuclear Posture:

India declared itself a nuclear weapons state in May 1998 in statements following the tests. The most elaborate statements were those Prime Minister Vajpayee made before parliament on May 27, asserting that India's security environment had deteriorated and it needed nuclear weapons to prevent coercion or blackmail.[31] Vajpayee emphasized India's self-restraint but his early statements did not use the term "minimum deterrence." He first endorsed this concept explicitly before parliament late that year, saying that India would seek only a "minimum, but credible, nuclear deterrent," the term "credible" being an important qualifier.[32]

India also announced a qualified policy of no first use (NFU) of nuclear weapons.[33] The Prime Minister in a statement on the floor of Parliament, and again, much later elaborated this formula, by the Foreign Minister in press briefings.[34]

The dual rationale Vajpayee put forth for India's going nuclear was more political than military. It asserted that India needed nuclear weapons to immunize itself from potential nuclear blackmail in world in which nuclear threats were growing, but attributed that deterioration to the traditional nuclear weapon states, claiming that those states maintained a discriminatory regime that protected their nuclear status, impeding nuclear disarmament. Foreign Minister Jaswant Singh elaborated on this in an article entitled "Against Nuclear Apartheid" in the U.S. Council on Foreign Relations journal.[35]

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[30] See full text in Appendix B. Hereafter cited in brief as "NSAB Draft Report."

[31] See Prime Minister Vajpayee's May 15, 1998 press interview and statement that "India is now a nuclear weapons state," available at: http://www.indianembassy.org/pic/nuclear/pm(interview).htm. The term "minimum deterrence" was not in the first official statements that appeared after the May 1998 nuclear tests, nor in the May 27, 1998, paper laid on the table of the Lok Sabha (lower house of Parliament) on "Evolution of India's Nuclear Policy," see text at: http://www.indianembassy.org/pic/nuclearpolicy.htm.

[32] C. Raja Mohan, "India Committed to Minimum N-Deterrence," *The Hindu*, December 7, 1998.

[33] Earlier statements by Prime Minister Vajpayee (see previous note) merely offered to negotiate a NFU pledge with Pakistan or collectively with other nations. But on June 9, 1998, in a press interview at the UN, Jaswant Singh (later to become India's Foreign Minister) was reported to have said: "'India had made several assurances and offered displaying restraint in the use of the nuclear weapons,' Mr. Singh said. 'India had made it clear that it would not be the first to use nuclear weapons.'" See Press Conference by Jaswant Singh, Deputy Chairman, Planning Commission of India at the United Nations, New York - June 9, 1998, available at: http://www.indianembassy.org/pic/js/js(un).htm.

[34] It was not till August that Vajpayee publicly clarified that NFU was India's policy, irrespective of the success of negotiation with Pakistan or other states, and applicable to India's relations with nuclear weapon as well as non-nuclear weapon states. See "India Evolves Nuclear Doctrine," *Times of India*, August 5, 1998; "PM Declares No-First Strike," *Indian Express*, August 5, 1998. The Foreign Minister's later unequivocal clarification that the NSAB Draft Report reformulation of NFU (to *exclude* from the pledge non-nuclear states allied to nuclear weapon states) was *not* Indian policy, is reported in "India Not to Engage in a N-Arms Race:Jaswant," *The Hindu*, November 29, 1999.

[35] *Foreign Affairs,* Vol. 77, No. 5, Sept/Oct., 1998, pp. 41-52.

Early official statements did not assert a nuclear threat to India from specific state adversaries.[36] Prime Minister Vajpayee wrote privately to President Clinton on May 11, 1998, however, asserting that India's action was motivated by the threat from China: "We have an overt nuclear-weapon state on our borders ... a state which committed armed aggression against India in 1962."[37] India attempted at the public diplomatic level, nevertheless, to justify its actions as a response to a generalized global nuclear threat, not to the threat to India from a specific country.

Otherwise, India's new nuclear posture was left by top level Indian officials to speak for itself as a self-evidently defensive and non-provocative posture, with little additional explicit formulation of nuclear defense posture or supporting military strategy. Instead of directive policy statements calling for military implementation, high elected officials continued to use the vague language of "inducting nuclear weapons," words used earlier by the Bharatiya Janata Party (BJP), the new ruling coalition's leading political party, in its national election campaign. No nuclear military command system or custody procedure was declared. Nothing was said about budgetary allocations specifically for a new nuclear defense posture. The Indian military services by and large kept their traditional silence on nuclear issues. Development of nuclear operational strategy, military service guidance, and doctrine, if any, were subterranean matters.

The Indian media, former officials with knowledge of defense issues, and national security experts in research centers and academic institutions had fairly free rein to fill in the blanks as they chose. Although opponents and skeptics remained, nuclear weapon proponents overshadowed them. Most proponents adopted the official minimum deterrence formula and dual political and security rationale as the framework of their own thinking, but also attempted to justify India's nuclear decisions as a response to threats from Pakistan and China. Some sought to spell out the implications of a minimum nuclear deterrence posture for Indian military strategy, force structure, and acquisition. Others began to advocate a more expansive strategy of nuclear deterrence and force structure. The resulting debate among Indian nuclear weapon proponents thus ran the spectrum between minimalists and maximalists.[38]

In dealing with the rest of the world, India's officials and most national security experts close to the government exuded reassurance, typically arguing: (1) India's leadership is responsible and non-

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[36] Newly appointed Indian Defense Minister, George Fernandes, had called China the "potential threat number one" a week before India's May 11 nuclear tests, just after the visit to India of China's Army chief. This was an unauthorized *faux pas* that was unconnected with the forthcoming tests -- about which Fernandes had been kept in the dark -- but reflected discussion in private then common among BJP and allied politicians. Fernandes rhetoric was virtually retracted by officials in the Ministry of External Affairs. See account in George Perkovich, *India's Nuclear Bomb: The Impact on Global Proliferation*, Berkeley: University of California Press, 1999, pp. 415ff.

[37] Quoted in Perkovich, *Ibid*., p. 417, citing text from the Vajpayee letter to Clinton that had been leaked to the press. India thus tried to play the perceived China threat issue both ways, with a soothing approach to China that publicly avoided mentioning it as a threat, while seeking Washington's understanding secretly that India's action was justified by the Chinese nuclear threat.

[38] The "minimum deterrence" rationale has been subscribed to, among others, by: former Chief of Army Staff, Gen. (retd.) K. Sundarji, "Imperatives of Indian Minimum Nuclear Deterrence," *Agni*, Vol. 2, No. 1, May 1996; K. Subrahmanyam, "A Credible Deterrent: Logic of the Nuclear Doctrine," *The Times of India*, October 4, 1999, and K. Subrahmanyam, "Nuclear Force Design and Minimum Deterrence Strategy for India," in Bharat Karnad (ed.), *Future Imperilled*, New Delhi: Viking, 1994; Air Cmdr (retd.) Jasjit Singh, "A Nuclear Strategy for India," in Jasjit Singh (ed.) *Nuclear India*, New Delhi: Knowledge World, 1998; and Maj-Gen. (retd.) Ashok K. Mehta, "Case for a Nuclear Doctrine with Minimum Deterrence," *India Abroad*, August 28, 1998.

On the side of an expansive or maximalist nuclear strategy and force structure, see Bharat Karnad, "A Thermonuclear Deterrent," in Amitabh Mattoo (ed.) *India's Nuclear Deterrent*, New Delhi: Har-Anand Publications, 1999; Adm. (retd.) Raja Menon, *A Nuclear Strategy for India*, New Delhi: Sage Publications, 2000; V.P. Naib, "The Nuclear Threat," *Indian Defense Review*, Vol 8, No. 1, January 1993; and Brig. (retd.) Vijai K. Nair, *Nuclear India*, New Delhi: Lancer International, 1992. K. Subrahmanyam, India's most prolific strategist, also played a key role in developing the August 1999 "NSAB Draft Report on ... India's Nuclear Doctrine," (see below, and Appendix B), and therefore can also be counted among the maximalists.

provocative, understands the dangers of nuclear weapons, and would not let matters go out of control; (2) India's national aims are strictly defensive (implicitly status quo); (3) India's minimum deterrence (a relatively small number of nuclear weapons) will be sufficient to neutralize opponents' nuclear threats or aggressive inclinations (presuming that opponents were rational state actors); (4) consciousness of the horrors of actual use of nuclear weapons is widespread and makes them unusable for anything but deterrence; and (4) Indian leaders are consciously opposed to massive nuclear arsenals and have no intention of becoming trapped in what they claimed were delusional Western and Soviet nuclear warfighting doctrines that drove the strategic arms race.

Pakistan's reaction to India's May 1998 nuclear breakout and declarations was to assert its own national deterrent against Indian nuclear coercion and blackmail, while expressing language similar to India's on self-restraint. Pakistan's formulations left no doubt about two important differences in underlying approach. First, while Indian officials largely skirted the identification of adversaries posing nuclear threat, Pakistan made it clear that it was solely the Indian military threat to Pakistan that had to be contained by nuclear weapons. Second, Pakistan chose silence on the issue of nuclear NFU, rather than mimicking India's NFU declaration. Pakistan's official adoption of the "minimum deterrence" language came later, in a speech by Prime Minister Nawaz Sharif to the National Defence College a year after the nuclear tests, on May 20, 1999.[39] Pakistan's response to India's "NSAB Draft Report" was given by the Defense Committee of the Cabinet in cryptic terms, indicating that Pakistan's nuclear weapons development would be "determined solely by the requirement of our minimum deterrent capability, which is now an indispensable part of our security doctrine."[40]

Given India's large military superiority and Pakistan's inherent vulnerabilities, Pakistan's silence on NFU was no surprise. It meant that Pakistan would reserve judgment on whether to hold back nuclear weapons use in the face of an Indian attack, whether India used nuclear weapons or not. It left open the possibility, as in NATO, of initiating nuclear use against conventional aggression. Pakistan made no pretence that it had any unique solutions for classical nuclear deterrence dilemmas. Like India, however, Pakistani officials left unstated what a "mimimum deterrent" posture might call for in force structure or operational terms.[41] Nothing was said about deploying nuclear weapons. In reaction to rumors of Indian plans to attack Pakistan's uranium enrichment facilities, some Pakistani defense program officials had referred to weaponizing and deploying the Ghauri, one of their own ballistic missiles,[42] but this was never substantiated. Somewhat later, Pakistan announced, in contrast to India, that a formal nuclear chain of command setup, integrating representatives of the three military services, had been institutionalized.[43]

Quietly and on a smaller scale than India, Pakistani officials, former officials and some national security experts close to the government adopted the same posture as was seen in India, of reassuring their contacts in the West that Pakistanis would be responsible stewards of nuclear weapons, took

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[39] Nawaz Sharif stated: "In maintaining the nuclear deterrence, we remain acutely conscious of the risks and responsibilities arising from the possession of nuclear weapons. ... Nuclear restraint, stabilization and minimum credible deterrence constitute the basic elements of Pakistan's nuclear policy. ...," in *Remarks of the Prime Minister of Pakistan, Nawaz Sharif, on Nuclear Policies and the CTBT*, at the National Defence College, Islamabad, May 20, 1999. Sharif also used this occasion to mention that Pakistan was "adopting appropriate measures, to put in place an effective command and control system."

[40] "Pakistan Says Indian Nuclear Plan Threatens Global Stability," *The News*, August 26, 1999.

[41] Foreign Minister Abdul Sattar stated in November 1999 that "Minimum deterrence will remain the guiding principle of our nuclear strategy. ... [As Indian capabilities grow] Pakistan will have to maintain, preserve and upgrade its capability in order to ensure survivability and credibility of the deterrent." See "Pakistan to Upgrade Nuclear Deterrent," *Dawn*, November 25, 1999.

[42] See "Indian Preemptive Threat," *The Nation*, May 28, 1998.

[43] *Ibid*., also see note 29, above.

minimum deterrence criteria seriously, understood the risks, and would not let matters run out of control. While Pakistan's nuclear declaratory policy, like India's, was unilateral and ostensibly self-sufficient in thrust, Pakistan's international approach also sought to ensure the understanding of former allies, friends, and supporters of its defense needs, including China.[44]

B. Political Reasons for Strategic Obscurity

The formulation of a nuclear posture of "minimum deterrence" could be specified in ways that give it concrete, operational meaning. That in turn would provide some content to the concept of military strategy. But neither India nor Pakistan has chosen specificity of strategic language. Several reasons could be adduced.

Among the more obvious is that current resource and delivery system limitations make it politically awkward to define strategy in specific terms. Gaps and inconsistencies then would be more easily noticed, invite criticism, and escalate domestic political and budgetary pressures, a problem even under stable governments. In the near term, "minimum deterrence" probably makes a virtue of necessity. It tends to shunt off a felt need for further public clarification, and neutralizes those who fear a large diversion of resources.

A second obstacle to military specificity may be the slippery slope that leads to greater transparency about organization and the capability of weapons systems to support the posture. From a military point of view, this may risk disclosure of vulnerabilities and invite adversaries to exploit them. From a political point of view, domestic debates that clarify technical or resource shortcomings in a chosen strategy can limit government freedom of maneuver or even unseat weak governments. In India, for instance, it is likely to increase the political influence of the military vis-a-vis the existing vested interests.

A third factor that may be important in explaining why both India and Pakistan have left strategic concepts obscure is the potential diplomatic influence they may exert over foreign interlocutors, who engage to dissuade nuclear arming, military competition, and instability, in hopes of reducing the risks of nuclear war. Removing the veil over nuclear activities in a deliberate, step by step fashion can be used to exert negotiating leverage to satisfy unmet needs.

C. Nuclear Strategy and Doctrine

Notwithstanding official reticence about nuclear strategy and decisions thus far to refrain from overt nuclear weapons deployment, inferences can be made about the nuclear strategies and operational concepts that India and Pakistan would be likely to adopt as time marches on and current resource limitations are overcome.

For the near term, India conceivably could be satisfied with a minimal, ready nuclear force -- or perhaps a recessed force that is stored, but not deployed and that can be utilized only as a delayed-response, retaliatory mechanism. There was, after all, no urgent nuclear threat being brandished against India before the May 1998 tests, and, except for Pakistan, still is none today. But over time India seems likely to go through a gradual process of developing an expansive, multi-dimensional

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[44] See, for example, Statement by Ambassador Munir Akram at the Special Session of the Conference on Disarmament on 2 June 1998, available at: http://www.fas.org/news/pakistan/1998/06/980602-pak-cd.htm.

nuclear strategy and supporting force structure. This strategy would stipulate the requirements for, and seek to acquire, flexible, survivable nuclear forces intended to deter nuclear and conventional threats from China and Pakistan as well as currently hypothetical nuclear threats from sea-faring powers.

The force structure that India probably will evolve would be intended to have the capacity, if deterrence fails, to unleash "punitive retaliation with nuclear weapons to inflict damage unacceptable to the aggressor." Such a force structure is prefigured in the August 1999 "Draft Report of National Security Advisory Board on Indian Nuclear Doctrine," which speaks of "*credible* minimum nuclear deterrence" (para 2.3) against "*any State or entity*" (para 2.4). It advocates a comprehensive strategic nuclear force structure -- with a classical triad of air, naval and land-based nuclear force components (para 3). It further states in paragraph (4)(i) that *India's nuclear forces* and their command and control *shall be organised for very high survivability against surprise attacks and for rapid punitive response*. [See Appendix B, which contains the full statement with italicized highlights.]

In this advocacy document, the call for "rapid punitive response" clearly precludes a view of minimum deterrence that relies on a recessed force, i.e., one that would have to be constituted after a first strike, and that could only offer delayed response.

On its face, the "NSAB Draft Report" purports to be a statement of nuclear deterrence principles to guide India's development, deployment, and employment of strategic nuclear forces. It postulates no numbers, but the call for a triad would imply at least low hundreds of nuclear weapons, not a handful or few dozen that some imagine when they use the term "minimum deterrence." In contrast to formulaic Indian criticism of Western strategic concepts, the "NSAB Draft Report" adopts the classical elements of Western nuclear deterrence theory, including survivability, rapid response, and capability to inflict unacceptable damage. It is nearly as ambitious, conceptually, as any Western or Soviet scheme, except for its NFU provision. Contrary to Indian declaratory policy, it would also undercut the unconditional NFU by the italicized caveat: "India will not resort to the use or threat of use of nuclear weapons against States which do not possess nuclear weapons *or are not aligned with nuclear weapons powers*" (para 2.5).

There is a huge stretch between India's currently resource-constrained, non-deployed nuclear weapons posture and the deployed force structure called for in the "NSAB Draft Report." India may never fully traverse that distance, and if it does, it is likely to be an uneven process that takes several decades. The strategic vision may or may not be palatable to future Indian governments. The "NSAB Draft Report" was not adopted as official policy, and policy makers took pains to rebut its NFU caveat and maximalist tone as inconsistent with current policy.

That said, one cannot dismiss this "NSAB Draft Report" as a mere trial balloon. The government invited its preparation as a confidential document. The Indian Prime Minister's principal secretary, Brajesh Mishra, who also serves today as India's national security advisor, participated in the panel's deliberations and personally released the report to the press. It is an internally consistent and strategically coherent document. It calls for nothing technologically that has not been used or written about in nuclear defense postures somewhere else in the world.

Thus, while the "NSAB Draft Report" cannot be treated as a description of current Indian strategic force plans and employment policy, it is a pretty good road map to the kind of nuclear arsenal that would be deployed if the authors and their supporters have their way. It appears to be a faithful indicator of the strategic thought process of that segment of the Indian elite, which has long aspired, to nuclear weapons. It happens to be congruent with the patterns of Indian arms and military technology acquisition, and with its research and development programs. Hence it may well be an authentic preview of India's future nuclear defense principles and force structure.

The "NSAB Draft Report" does not spell out targeting philosophy or identify targets in the territory of presumed adversaries. Few Indian experts have written about targeting. But state size, geography, and technology suggest that India today would adopt a targeting policy vis-a-vis China that holds other military targets and critical economic infrastructure at risk, in and around key cities -- a mixed counterforce/countervalue targeting policy.[45] Should sufficient delivery system accuracy be achieved at some point in the future, India might also target fixed site strategic delivery systems, and perhaps submarines in port, to support damage-limiting objectives, even on a second-strike basis. It may well be that India will never consider it vital for credible deterrence to spell this out in public formulations. Similarly, Indian doctrinal assumptions about the required damage expectancy from its retaliatory forces may be considerably more relaxed than those that were once deemed appropriate during the Cold War.

Indian nuclear targeting philosophy against Pakistan, where the ranges are short and aircraft can be used with some precision, probably will be -- initially if not exclusively -- counter-force and against other military targets.[46] Indian air force doctrine emphasizes conventional preemption of air defense and this undoubtedly has its parallels in attacking nuclear-capable air bases, nuclear missiles in storage facilities or after they have been moved to pre-surveyed sites, fixed nuclear weapon storage sites, and nuclear weapons infrastructure. Most observers believe it is unlikely that the Indian military would use nuclear weapons first in a preemptive strike, but some may regard it plausible that India would respond to any Pakistani nuclear use, even a highly localized tactical use, with a preemptive attack on nuclear production and storage facilities.

Few Indian civilian experts who deal with nuclear weapons issues dwell on tactical weapons employment scenarios and the "NSAB Draft Report" does not mention tactical nuclear weapons as a distinct category. A few books and articles published by military or former military officers over the years have considered tactical nuclear weapons uses as plausible, e.g., to obstruct military movement through Himalayan mountain passes, or to disrupt massed armor and infantry on the battlefield.[47] Military education for commissioned officers naturally includes readings and instruction on basic issues of survival in a nuclear battlefield environment. There may be some awareness that Pakistan might consider the option of using tactical nuclear weapon barriers against Indian force concentrations poised in the Rajasthan desert to invade Pakistan, or against Indian ships blocking access to Karachi harbor. It would not be surprising, however, if part of the "minimum" in the Indian language on nuclear deterrence is explained eventually as avoidance of dedicated tactical nuclear offensive weapons.

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[45] See Brig. (retd.) Vijai K. Nair, *Nuclear India*, New Delhi: Lancer International, 1992; Adm. (retd.) Raja Menon, *A Nuclear Strategy for India*, New Delhi: Sage Publications, 2000; Gen. (retd.) K. Sundarji, "Changing Military Equations in Asia: The Role of Nuclear Weapons," in Francine Frankel (ed.), *Bridging the Nonproliferation Divide*, Lanham, MD: University Press of America, 1995; Gurmeet Kanwal, "Nuclear Targeting Philosophy for India," *Strategic Analysis*, Vol. 24, No. 3, June 2000.

[46] Ashley Tellis takes a different view, arguing that India is likely to adopt a counter-value or counter-population strategy not only against China but also against Pakistan. He concedes, however, that India would have more targeting flexibility in Pakistan and might develop a requirement for countermilitary targeting of Pakistan for limited war scenarios. *India's Emerging Nuclear Posture, op. cit*., p. 357.

[47] D. Som Dutt, *The Defense of India's Northern Borders*, London: IISS, *Adelphi Paper No. 25*, 1966; K. Sundarji, "Effects of Nuclear Asymmetry on Conventional Deterrence," Mhow, MP (India): College of Combat, *Combat Paper No. 1*, 1981; Arun Sahgal and Tejinder Singh, "Nuclear Threat from China: An Appraisal," *Trishul*, Vol 6, No. 2, 1993; Maj-Gen. (retd.) D. K. Palit and P.K.S. Namboodiri, *Pakistan's Islamic Bomb*, New Delhi: Vikas Publishing House, 1979, pp. 115ff.

Pakistan's nuclear strategy and operational planning is embedded almost exclusively in the military and has been kept under tight wraps.[48] Civilian and military officials have espoused the "minimum nuclear deterrence" formula, since it clearly satisfies Pakistani needs for vagueness and fits the picture of constrained resources.[49] In its narrow defense space, Pakistani defense planners undoubtedly give priority attention to both conventional air and nuclear force survivability issues.[50] They may recognize that a sustained Indian conventional air bombardment campaign for more than ten days or two weeks could degrade the Pakistani mix of airborne and mobile missile delivery systems (naval nuclear capabilities apparently are not part of the nuclear planning picture in Pakistan yet) and open the door to invasion.[51]

While the Pakistani military do not seem to fear a surprise Indian *nuclear* attack on Pakistani defense forces, they understand their most credible nuclear deterrent position is to leave open the possibility of a punitive nuclear response to conventional invasion by India, especially invasion on a scale that threatens Pakistan's conventional military defenses with collapse, but possibly limited war actions such as a conventional attack on Pakistan's nuclear infrastructure. Pakistan does not benefit, needless to say, from U.S. or Chinese extended nuclear deterrence. Thus, Pakistan is not likely to join India in a NFU pledge, or not at least until Pakistan can assure the survival of its retaliatory forces against any crippling form of Indian attack. [52]

Pakistani nuclear targeting philosophy may not yet have ruled out tactical uses of nuclear weapons. However, the development of long-range nuclear missile capabilities makes it clear that Pakistani

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[48] Zafar Iqbal Cheema, "Pakistan's Nuclear Use Doctrine and Command and Control," in Peter R. Lavoy, Scott D. Sagan, and James J. Wirtz (eds.) *Planning the Unthinkable: How New Powers Will Use Nuclear, Biological, and Chemical Weapons*, Ithaca, NY: Cornell University Press, pp. 158-81.

[49] A quasi-authoritative discussion of Pakistan's rationale for and approach to a minimum nuclear deterrent, in the context of the publication in India of the "NSAB Draft Report ... on Indian Nuclear Doctrine," is Agha Shahi, Zulfiqar Ali Khan and Abdul Sattar, "Securing Nuclear Peace," *The News International*, October 5, 1999. Agha Shahi formerly was Foreign Minister and Abdul Sattar is currently Foreign Minister of Pakistan, and Air Marshall Zulfiqar Ali Khan formerly was Pakistan's Air Force Commander in Chief.

[50] President Pervez Musharraf's Oct. 19, 2001 address to the nation, explaining his decision to join the United States in the coalition against terrorists and their protectors in Afghanistan, alluding to a perceived danger that coalition air forces operating from Indian bases and overflying Pakistan might be used as cover for an Indian preemptive strike against Pakistan's nuclear military infrastructure. As translated from Urdu, Musharraf said: "Pakistan is facing a very critical situation ... The negative consequences can endanger Pakistan's integrity and solidarity. Our critical concerns, our important concerns can come under threat. When I say critical concerns, I mean our strategic assets and the cause of Kashmir. If these come under threat it would be a worse situation for us. ... take a look at the designs of [India] our neighbouring country. They offered all their military facilities to the United States. They have offered without hesitation, all their facilities, all their bases and full logistic support. They want to enter into any alliance with the Unites States and get Pakistan declared a terrorist state. ... Pakistan's armed forces and every Pakistani citizen is ready to offer any sacrifice in order to defend Pakistan and secure its strategic assets. Make no mistake and entertain no misunderstanding. At this very moment our Air Force is at high alert; and they are ready for "Do or die" Missions ... In such a situation, a wrong decision can lead to unbearable losses.
What are our critical concerns and priorities? These are four;

1. First of all is the security of the country and external threat.
2. Second is our economy and its revival.
3. Third are our strategic nuclear and missile assets.
4. And Kashmir cause.

The four are our critical concerns. Any wrong judgement on our part can damage all our interests. Available from Government of Pakistan at: http://www.pakistan-embassy.com/pages/main.asp?file=../News/Press-Release.

[51] See Rodney W. Jones, "Pakistan's Nuclear Posture: Quest for Assured Nuclear Deterrence -- A Conjecture," Islamabad: Institute of Regional Studies, *Spotlight on Regional Affairs*, Vol. XIX, No. 1, January 2000; reprinted in *Regional Studies*, (Islamabad) Vol. XVIII, No. 2, Spring 2000, pp. 3-39. Also, in a much briefer form, Rodney W. Jones, "Pakistan's Nuclear Posture," *Dawn*, September 14, 1999, and "Pakistan's Nuclear Posture, Part Two - Arms Control," *Dawn*, September 15, 1999.

[52] Shireen M. Mazari, "Formulating a Rational Strategic Doctrine," Pakistan Institute for Air Defense Studies, 1998.

planners believe they must have the ability to threaten urban-industrial installations deep in India. In the early stages, low missile accuracy and other factors may limit Pakistan to a countervalue targeting plan. Targeting other military forces may have little utility for Pakistan's scarce nuclear weapons.[53]

As the stockpile increases, and if early warning or other measures increase confidence in force survivability, and if the accuracy of long-range missile delivery systems can be radically improved, and if the conventional imbalance does not become even more lopsided, it is conceivable that Pakistan could eventually satisfy itself with a second-strike retaliatory posture and employment plans. Over time, Pakistan almost certainly will attempt to further diversify its nuclear delivery mechanisms, with naval platforms and cruise missiles.

D. Nuclear Command and Control

India's August 1999 "NSAB Draft Report" indicates unofficial interest in developing a robust and highly survivable command and control system. It notes that the Prime Minister is the source of authority for release of nuclear weapons in the Indian system, but implies by default that the nuclear command authority below that level has yet to be defined. Nuclear weapons do not appear to have passed into the custody of the Indian military organizations, and there has been no indication whether or when they will. The Indian Air Force and Navy may have favored nuclear weapons roles and missions in the event nuclear weapons are, later, operationally deployed. Since nuclear weapons were tested in May 1998, it seems highly likely that the military services have undertaken their own secret studies, discussions, and development of procedures and doctrine for nuclear weapons employment and logistical support. But these may not have been approved formally and have not come to light.

Pakistan's defense authorities began organizing a formal nuclear employment planning system and inter-service chain of command in early 1999. General Pervez Musharraf, now President of Pakistan, announced on February 2, 2000, that the National Security Council had approved a National Command Authority (NCA) for nuclear weapons.[54] This arrangement gives ultimate responsibility for decisions on nuclear use to the "head of government." Under the Constitution, this is nominally the Prime Minister. But it may prove ambiguous as a practical matter, given Pakistan's shifts between parliamentary and military heads of government, and because the incumbents in the indirectly elected position of President ("head of state") also have acted in the past to usurp the chief executive role of the Prime Minister.

The NCA has two master committees, supported by the Strategic Plans Division, which provides a secretariat and coordinating mechanism among the services. First, the Employment Control Committee (ECC) sets nuclear employment policy and presumably would convene in a crisis to decide on responses. The ECC is chaired by the "political" head of government, and includes the

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[53] *Ibid.*

[54] See notes 29 and 39, above. For Pakistani commentaries on this development, see Tanvir Ahmad Khan, "Command and Control: A Pakistani Perspective," Agha Shahi, "Command and Control of Nuclear Weapons in South Asia," and Shaun Gregory, "Nuclear Command and Control in South Asia," all found in Islamabad's Institute of Strategic Studies journal, *Strategic Issues*, No. 3, March 2000, available at: http://www.issi.org.pk/Nuclear%20Issues/N_NCA.htm. Prime Minister Nawaz Sharif announced the decision to establish a nuclear command in his May 20, 1999 speech to the National Defence College in Islamabad. "National Command Authority Formed," Dawn (Internet Edition), February 3, 2000. Also see Zafar Iqbal Cheema, "Pakistan's Nuclear Use Doctrine," *op. cit*. Cheema's essay reflects how little has been revealed officially about Pakistan's nuclear command and control or operational nuclear doctrine. Evidently, it also was written before the formal announcement of Pakistan's National (Nuclear) Command Authority in February 2000.

cabinet ministers in charge of foreign affairs, defense, and interior, as well as the chairman of the joint chiefs of staff committee (CJCSC), the three military service chiefs, the director-general of the NCA's Strategic Plans Division (the incumbent is a two-star Army officer, Gen. Khalid Kidwai, who also runs the secretariat), and scientific and technical advisors chosen by the head of government.

The other committee is the Development Control Committee (DCC) which apparently is responsible for the development and acquisition of nuclear weapons, delivery systems, and other equipment. It too is chaired by the political head of government, but does not include other cabinet officials. It is predominantly military in makeup, with the CJCSC, the service chiefs, the director-general of the Strategic Plans Division, and representatives of government's strategic (R&D and production) organizations, some of whom are also representatives of the scientific community.

In addition to its secretariat functions, the Strategic Plans Division (SPD) reportedly has responsibility for establishing a reliable command, control, communication, computers and intelligence (C^4I) network for the NCA. The SPD has four Directorates which bring representatives from each of the three military services together in functional areas: (1) the Operations and Strategic Plans Directorate, (2) the Strategic Weapons Development Directorate, (3) the C^4I Directorate, and (4) the Arms Control and Disarmament Directorate.

Elaborate though this bureaucratic setup may be, it is not clear whether it actually supervises or regulates *deployed* nuclear weapons. Presumably it is developing procedures and communications links for that purpose, in the event nuclear weapons are actually deployed. In contrast to India where the military have been kept at arms length from ultimate policy decisions, this setup makes it formally clear that the Pakistani military high command is intimately involved at the apex of decision-making on any matters of nuclear use. The arrangement suggests that there is next to no civilian involvement in nuclear planning, certainly not in operational or service matters.

E. Offense-Defense Trends

India has exhibited a strong interest in acquiring air defense and missile defense systems, chiefly systems of Soviet and Russian origin, although Israel may now lining up as a supplier of a version of the Arrow system. India has also utilized high-altitude Russian air defense technology for surface to surface missiles, as in the case of the Prithvi. India is actively working on its own air and missile defense programs. During 2001, India also expressed a more positive attitude towards President George W. Bush's missile defense initiatives than most other foreign powers.

India has a lead over Pakistan in missile defense technology that is unlikely to be narrowed in the foreseeable future. Pakistan has no high-altitude indigenous air defense missile program, and therefore no missile defense technological base to speak of. China is unlikely to be able to provide significant support to Pakistan in this area, at least not in the near term. Pakistani officials say little or nothing about this area, but presumably are concerned about the implications of India's technological lead. This situation also helps to explain Pakistan's assiduous efforts to develop a strong, ballistic missile-based nuclear offensive capability.

The offense-defense dynamic could have important stability and instability implications in South Asia that has not been addressed in any serious way in the open literature.

F. Kargil and Crisis Management

Most observers believed at the time that the short-lived Kargil conflict across the line of control in Kashmir in May-July 1999 was conducted under the "nuclear shadow," generating risks of nuclear confrontation that President Clinton's diplomatic intervention defused.[55] Some believe this was the first time Pakistan and India had to manage a real nuclear crisis.[56]

Previously, many nuclear theorists believed that nuclear-armed rival states would not dare attack each other in open armed conflict. In that light, it was noteworthy that India's and Pakistan's possession of nuclear weapons failed to deter the outbreak of a localized but intense conventional conflict that could have escalated further. Moreover, India's nuclear weapons did not deter the covert military intrusion from Pakistan that triggered the conflict. Nor did Pakistani nuclear weapons deter India's fairly large-scale conventional reaction in the Kargil sector. India did take pains, however, not to enlarge the war within Kashmir by launching a deep offensive across the line-of-control (with minor exceptions, involving brief aircraft intrusions over the local battle areas).

Many observers inferred from the Kargil conflict that Pakistani military decision-makers assumed that the advent of nuclear weapons in South Asia deterred either side opening a major conventional war and therefore reduced the risk to Pakistan of conducting unconventional war in Kashmir to change the local status quo.[57] If so, was this belief sustainable after Pakistan withdrew forces under pressure from Kargil? Indeed, did either side elaborate its nuclear strategic and doctrinal positions as a result of this episode of real fighting, however localized?

Was the timing of the release of the "NSAB Draft Doctrine" and the sharpness of its reference to proactive "measures to counter the threat" a quasi-official Indian response to its bitter experience at Kargil -- where India initially was taken by surprise, ill-prepared to respond, and temporarily humiliated?[58] Subsequently, Indian statements appeared to warn Pakistan that India would be prepared to initiate "limited" conventional war against Pakistan, if necessary, notwithstanding Pakistani nuclear capability, although these statements also suggested India would consciously stay below a nuclear threshold.[59]

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[55] See discussion of the Kargil conflict in Rodney W. Jones, "Pakistan's Nuclear Posture: Quest for Assured Nuclear Deterrence -- A Conjecture," op. cit.

[56] Others believe that Pakistan and India had undeclared nuclear weapons dating back to the early or mid-1980s and that the large Indian Brasstacks military exercise in the winter of 1986 precipitated the first nuclear-cum-conventional crisis, and that another occurred in 1990, after the insurgency in Kashmir, beginning in 1989, had taken off.

[57] Statements by the hawkish Lt.-Gen. (retd.) Asad Durrani, a former Director-General of the Interservices Intelligence Agency (ISI), lent some credence to this view. For example, just weeks before the Kargil infiltration was detected by India, Durrani wrote: "If nuclearisation has made war between India and Pakistan a remote possibility, as asserted by our COAS [Chief of Army Staff, i.e., Pervez Musharraf], then we need not be intimidated by the recent war threats that the Indian army chief has so eloquently meted out." See his article, "Nuking our way to Kashmir," *The News*, February 13, 1999. Earlier, he had written: "A general war between India and Pakistan is now less likely than ever before. That does not however by itself reduce tension or use of other methods like subversion to pursue our own objectives." See his "Whither with the Nukes," *Margala Papers*, Rawalpindi: National Defence College, 1999.

[58] There terms imply conventional "first use" or preemption against a "nuclear threat," even a vague threat that just not materialize. See Appendix B, para 2.3.

[59] Indian Minister of Defence, George Fernandes said in his speech to the "Challenges of Limited War" Seminar on January 5, 2000: "There was a perception in Pakistan that the overt nuclear status had ensured that a covert war could continue and aggression across the Line of Control could be carried out while India would be deterred by the nuclear factor. ... Nuclearization ... can deter only the use of nuclear weapons, but not all and any war. ... India can beat Pakistan anytime anywhere. ... We need, therefore, to ensure that conventional war, whenever imposed upon us in the future, is kept below the nuclear threshold." Reported as "Fernandes dos not rule out conventional war with Pak," in *The Hindu*, January 6, 2000, and available at: http://www.idsa-india.org/defmin5-2000.html. Gen. V.P. Malik, Indian COAS during Kargil, wrote for the same conference:

In Pakistan's case, statements by experts during and in the aftermath of Kargil advanced two quite different propositions. One was that Pakistan needed to overcome its nuclear force deficiencies and vulnerabilities to enhance the credibility of its deterrence against India.[60] The other was that Pakistan's employment of it nuclear deterrent should be understood, finally, as an instrument of "last resort."[61] Left unstated, the flip side of this proposition is, however, that nuclear deterrence does not necessarily provide much cover for low-level covert or conventional provocations against a militarily superior neighbor who is prepared to expand a conventional conflict while staying under the nuclear threshold.

In effect, those who might have drawn the conclusion that nuclear weapons possession, even in small numbers, makes it safe to pursue low-intensity conventional warfare in an effort to change the status quo were forced to think again. In a highly asymmetrical conventional military balance, Indian superiority could provide opportunities to exploit conventional military power without crossing the nuclear threshold, and presumably without pressing Pakistan to the point that its leadership would feel compelled to initiate the use of nuclear weapons in retaliation. This judgment assumes, however, that India is manifestly defending a status quo. It is much less clear whether India, despite its conventional military superiority, could pursue conventional offensive actions against Pakistan that by definition alters the status quo without running a significant risk of nuclear exchange.

Kargil was a sobering experience for many Indian nuclear advocates who had assumed Indian acquisition of a "minimum nuclear deterrent" would contain Pakistan absolutely. Kargil made it clear to the outside world that there is a high risk of nuclear conflict in the subcontinent, and seemed to belie the assurances of local officials and experts that they invariably would handle nuclear capabilities with responsibility. The ultimately unsatisfying outcome of Kargil for Pakistan may have opened the way for a more cautious view to be propagated there, namely, that Pakistan's nuclear weapons are best reserved for ultimate use -- in the event the survival of the nation is at stake.

"We were able to keep Kargil war limited primarily due to nuclear as well as conventional deterrence. ... In fact war may well remain limited because of credible deterrence. ... The escalation ladder would be carefully climbed in a carefully controlled ascent by both protagonists. ... Limited war is the trend since all out war seems unlikely." See "Challenges of Limited War," January 6, 2000, reported in *Deccan Herald*, January 7, 2000, and available at: http://www.idsa-india.org/chief6-2000.html.

[60] Abdul Sattar, currently Pakistan's Foreign Minister, said at about the same time the Kargil operation surfaced, "If air bases or launch platforms are in danger of being destroyed, it becomes necessary to develop mobile missiles." *The News*, May 5, 1999. After Kargil and in reaction to the August publication of the "NSAD Draft Doctrine" in India, Pakistan's then Foreign Secretary, Shamshad Ahmad said: "The development of such a large nuclear arsenal by India will oblige Pakistan to take appropriate action to preserve the credibility of its nuclear deterrence posture ... Pakistan can and will find ways and means to maintain credible nuclear deterrence against India without the need to match it -- bomb for bomb, missile for missile. ... The growing imbalance in conventional capabilities will accentuate Pakistan's reliance on nuclear deterrence. This will have the consequence of lowering, not raising, the 'threshold' of possible use of nuclear weapons in South Asia." In "Indian Nuclear Doctrine: Implications for Regional and Global Peace and Security," statement at Institute of Strategic Studies, Islamabad, September 7, 1999.

[61] Pakistan's Chief Executive, General Pervez Musharraf said: "Our basic strategy is the strategy of minimum deterrence and our nuclear potential is meant as nuclear deterrence and a deterrence in the conventional as well as in the non-conventional field. ... It will be used as an [sic] absolutely the last resort when the security and integrity of Pakistan is at stake." In "Pakistan leader says he's trained for war but can talk peace," *CNN.com*, January 19, 2000. Later that year, Pakistan's Foreign Secretary, Inamul Haq, said: "There is no way Pakistan can hold out any assurance that it will not use any nuclear weapons *if its existence is threatened*." [emphasis added] See "Pakistan reserves nuclear option if attacked," *Dawn*, July 21, 2000.

IV. Key Findings and Conclusions

- In testing nuclear weapons as de facto nuclear weapon states in May 1998, India and Pakistan both espoused nuclear restraint. Their senior officials soon embraced the language of "minimum credible deterrence." India declared a "no-first-use" nuclear posture soon after the tests. Pakistan declined to rule out first-use options for reasons explained below.

- India's official statements did not identify nuclear adversaries, leaving open which national arsenals or threats it would use as reference points to define its own nuclear deterrence requirements and nuclear force size. Indian Prime Minister Vajpayee's letter to US President Clinton, however, alluded to China as a neighboring nuclear threat. China and Pakistan are India's known rivals and probably Indian nuclear weapon planners' main reference points.

- Pakistani nuclear declaratory statements are clear that India is regarded as its sole nuclear adversary and thus the focus of its nuclear deterrent.

- Although the term "minimum" rapidly became a fixture of the public nuclear discourse in South Asia, neither India nor Pakistan officially clarified what the term "minimum" means, leaving this open to speculation. Does "minimum" imply the sufficiency of small numbers of nuclear weapons? Nuclear weapons held in reserve? Low readiness or alert rates of a nuclear force? Renunciation of nuclear war fighting? Mainly counter-value targeting? Or does the term "minimum" merely make a virtue of today's facts of life in the subcontinent – limited resources, scarce weapons material, unproved delivery systems, and still undeveloped technical military capabilities?

- Neither India nor Pakistan overtly *deployed* nuclear forces after the 1998 tests, nor was known to have done so by October 2001, when this assessment was prepared. By not deployed, we mean neither state was believed to have mated nuclear weapons with delivery systems on standby status, ready for immediate alert or use upon central command.

- Judging potential nuclear arsenal size even for a non-deployed force is feasible if enough is known about fissile material production. India's and Pakistan's "dedicated weapon facilities" continue to produce fissile material. Their outputs can be thought of as "nuclear weapon equivalents" (NWEs). Although the actual number of operational weapons in either's arsenal is not known, analysis suggests that India has, and probably will retain, a significant lead over Pakistan. We estimate India had over 100 NWEs from its dedicated facilities by 2000 -- at least twice and perhaps three times as many as Pakistan. India's NWEs from dedicated facilities are far fewer than China's estimated arsenal of about 450 weapons. By appropriating fissile material from its unsafeguarded civilian power reactors, however, India could reach a potential of several hundred NWEs, exceeding estimates of China's operational nuclear stockpile.

- The risk of nuclear war in South Asia is significant and not to be taken lightly. The potential for nuclear crisis instability is inherent in the conventional military imbalance between Pakistan and India. India's steadily growing conventional military superiority over Pakistan, coupled with Pakistan's geographic vulnerabilities to preemptive conventional air strikes and rapid invasion, and the fact that Pakistan's nuclear forces are smaller, means that Pakistan could be driven to use nuclear weapons during a conventional conflict India. Pakistan's nuclear posture preserves a nuclear first-use option by default and therefore reflects these military and geographic asymmetries.

- For bilateral deterrence, India and Pakistan both have nuclear-capable aircraft that could be put on alert and used for nuclear delivery on short notice. Both have acquired ballistic missile delivery systems, although the combat readiness of the missiles is not altogether clear. India's missile development program aims to develop an intermediate-range ballistic missile capable of reaching Chinese cities, but a ready force of such missiles does not now exist. If forced to improvise, India has a few long-range aircraft that could be used to reach China's interior with nuclear payloads. India's tactical strike aircraft could also be used, but only on a one-way flight profile.

- While Pakistan has no officially stated strategic or tactical nuclear doctrines, technical considerations and writings by experts suggest that its core nuclear strategy is to hold Indian cities hostage by countervalue targeting, against a conventional Indian invasion or preemptive air attack that could threaten Pakistan's defenses with collapse.

- India has declined to elaborate nuclear policy and doctrine beyond a second-strike retaliatory posture, evidently on the grounds that its capacity to retaliate with nuclear weapons should deter nuclear attack absolutely. But India's officially convened National Security Advisory Board (NSAB) recommended that India rely on a posture of *credible* minimum deterrence. The term *credible* is a much more demanding criterion than "minimum deterrence" might imply by itself. The NSAB recommended India procure a triad of air-, ground-, and sea-based nuclear delivery systems along with robust command and control and space assets to ensure the survivability of retaliatory forces and a capability for a rapid response after any imaginable nuclear first strike. It also recommended that India achieve the capacity for proactive conventional military response to nuclear threats. These recommendations stopped short only of a nuclear warfighting capability, strategic missile defense, and extended deterrence.

- While the Indian government declined to treat these Advisory Board recommendations as official policy, and experts acknowledged that they would be very costly to implement, the actual profile of Indian defense research and development and military technology acquisition closely parallels the Advisory Board's recommendations. This implies that India probably will follow the main recommendations in defining requirements and building nuclear forces, but do so gradually within its limited resources. Over time, this could lead to an expansive nuclear strategy and force structure, with a capacity to respond in a graduated or massive fashion to potential nuclear threats from all directions.

- If India's nuclear strategy and forces evolve along these ambitious lines, they would not constitute a "minimum deterrence" posture, as that term is generally understood.

- While it is unlikely that Pakistan could achieve or maintain nuclear parity with India, Pakistan probably will enlarge and diversify its nuclear inventory to make its own forces survivable, as prerequisites for confidence in a secure second-strike capability against India. This also implies that Pakistan will pursue a strategy and acquisitions in the near term that exceed what outsiders might believe is sufficient, based on a common sense understanding of "minimum deterrence."

Outsiders tend to perceive India as a status quo power, but this is not the prevailing view in Pakistan.

- Indian and Pakistani officials profess that they expect to avoid nuclear arms racing. Once the facts are examined, however, it is hard to avoid the conclusion that they have been in an arms race that will continue, albeit with continued conditions of asymmetry and at a pace that is limited by resource constraints.

- On nuclear command and control systems, Pakistan and India followed different paths after declaring themselves nuclear weapon states in May 1998. In 1999, Pakistan set up a national command authority for decisions regarding the use of nuclear weapons, together with a joint-service command and control hierarchy for military planning, management, custody, development, and control of nuclear weapons, making this known in early 2000. While Pakistan thus served notice that it is militarily prepared to execute nuclear missions, the prevailing evidence is that its nuclear weapons and delivery systems still are not deployed in the field or ready for prompt use.

- India evidently left the articulation of a formal nuclear command and control system in abeyance after May 1998. Ultimate authority on decisions to use nuclear weapons probably resides with the Prime Minister in cabinet. Custody of nuclear weapons apparently stayed with the Department of Atomic Energy, under the nuclear scientific establishment that developed the weapons. Control was not transferred to the Indian military services. Nuclear-capable aircraft and short-range ballistic missiles, such as the Prithvi, are in service with the Indian Air Force and Army. India's longer-range nuclear-capable missiles such as the Agni, however, are still in the research and development process under the Defense Research and Development Organization, are believed not to be in serial production, and secure deployment in silos or on rail-mobile launchers -- concepts that have been discussed -- probably is years away.

- India has had active programs in air defense and has been acquiring high-altitude Russian SAM systems that may have some tactical anti-ballistic missile capability. Pakistan has a less robust high-altitude air defense program but is seeking new capabilities in this area as well.

- Kargil was the first unambiguous case of crisis management between India and Pakistan as nuclear-armed rivals. It sobered Indian nuclear experts who had assumed India's "minimum nuclear deterrent" would contain Pakistan absolutely. Kargil indicated to the outside world that there is a high risk of nuclear conflict in the subcontinent. The experience may have strengthened Pakistani advocates of the view that the nuclear deterrent is an instrument only of last resort. Kargil clarified an Indian view that nuclear deterrence does not preclude conventional conflict.

V. Bibliography

Note: To make this bibliography more readily useful, each item is followed by one annotation on the type and nationality of the source, although in many cases this will be evident: (1) Official sources are labeled GOI (Government of India) for India, GOP (Government of Pakistan) for Pakistan. (2) The nationality of foreign authors may be relevant, and is denoted by:

I for Indian
IA for American of Indian extraction
P for Pakistani
PA for American of Pakistani extraction

Nationals of other foreign countries may also be indicated, for example, UK for British (and UKI or UKP for Britishers of Indian or Pakistani extraction), and so forth.

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Appendix A

Fissile Material Stocks and Nuclear Weapon Equivalents (NWEs) in India and Pakistan

Unclassified sources provide no reliable information on how many nuclear weapons India and Pakistan have actually manufactured or deployed. Some unclassified sources do provide sufficient information, however, on the fissile material production facilities of both countries to estimate the approximate amounts of weapons-grade material that either could have accumulated. These estimated stockpile quantities in turn may be translated into "nuclear weapons equivalents" (NWEs). Since separated fissile material can be fabricated into nuclear weapons by weapon states in a relatively short time, the NWE estimates for India and Pakistan at a given point in time are the best approximation of their relative nuclear weapons capacities, or possible weapon inventories, at that time.

NWEs represent notionally the number of nuclear weapons that either government actually may have manufactured if it used all the readily available weapons-grade materials for this purpose. Certain assumptions regarding realistic nuclear facility operating conditions (efficiency or capacity factors) may be used to reduce the estimated output of NWEs below the theoretical maximum. Estimates of fissile materials accumulated by India and Pakistan, and of the NWEs they represent, may be further reduced from estimated totals in some cases where it is believed that certain quantities of separated weapons-grade materials have been used in other ways, e.g., in nuclear explosive testing or in other research activities.

The best-researched public source of engineering calculations of India's and Pakistan's inventories of fissile material through 1995 may be found in David Albright, Frans Berkhout and William Walker, *Plutonium and Highly Enriched Uranium 1996: World Inventories, Capabilities and Policies*, New York: Oxford University Press for Stockholm International Peace Research Institute, 1997, pp. 269-73 (India) and pp. 274-78 (Pakistan). A detailed compilation of Indian and Pakistani military and civilian nuclear facilities and infrastructure through mid-1998 is provided in Rodney W. Jones and Mark G. McDonough (et. al.), *Tracking Nuclear Proliferation: A Guide in Maps and Charts, 1998*, Washington, DC: Carnegie Endowment for International Peace (Brookings Institution Press), 1998, Section 6, pp. 111-130 (India), pp. 131-146 (Pakistan). The latter source identifies facilities, startup dates, and their reported or nominal capacities -- basic building block information in assessing aggregate fissile material inventories. Compiling information on facility operating histories was outside the scope of this work, however, so it does not assess aggregate fissile material inventories.

In his website publications, David Albright has provided fresh assessments on Indian and Pakistani fissile material inventories for 1998 and 1999.[62] Albright's latest assessments are reproduced later in this appendix to speak for themselves. But Albright's cryptic 1998-99 reporting of calculations employing Crystal Ball computer software and Monte Carlo statistical techniques, along with downgraded capacity assumptions attributed to unnamed sources, is less satisfactory than the more straightforward physical engineering numbers used in his earlier work. His 1998-99 analysis leads to peculiar results when weighed in historical context, and appears to be part of a recent trend of

[62] David Albright, "India and Pakistan's Fissile Material and Nuclear Weapons Inventory, end of 1998," Washington, DC: ISIS, October 27, 1999, and Albright, "India's and Pakistan's Fissile Material and Nuclear Weapons Inventory, end of 1999," ISIS, October 11, 2000 (available at: http://www.isis-online.org/publications/southasia/stocks1000.html).

revising estimates of India's accumulated plutonium inventory to much lower levels, based on recent Indian writing that may be officially-inspired.[63] Hence, while this assessment essentially accepts the basic approach and conclusions of Albright's 1997 book as well as the substance of his 1998-99 findings on the NWE relevance of the spent fuel arising from India's civilian power reactors, it independently recalculates the output of India's "dedicated" (nuclear weapon) production facilities and provides its own "best guess" both of Indian production and of the probable output of Pakistan's "dedicated" uranium enrichment program (see below, "For uranium"). Albright's estimates derived from India's large unsafeguarded civilian power reactor stockpile are less sensitive to different capacity assumptions than are those for the smaller, dedicated reactor stockpile.

The basis for the "best guess" assessments and the high and low projections of NWE inventories from nuclear facilities in India and Pakistan presented in this analysis are further explained below:

<u>For plutonium</u>:

1. India's dedicated plutonium-producing facilities have been the CIRUS 40 megawatt thermal (40 MWt) and Dhruva (100 MWt) heavy-water research reactors. CIRUS has been operating since 1964, and Dhruva began full operation in January 1988. The rule of thumb for estimating the plutonium output of natural uranium-fueled reactors of this type is that one megawatt-day of operation (or thermal energy release) produces one gram of Pu-239.[64] The maximum production capacity of CIRUS, then, would be 40 grams of plutonium per day, or 14.6 kilograms per year. That of Dhruva would be 100 grams per day, or 36.5 kg per year. Similarly, the maximum production capacity of Pakistan's Khushab heavy water research reactor (50 MWt), which reportedly was started up for the first time in April 1998, would be 50 grams of plutonium per day, or 18.25 kg per year. For this analysis, it is assumed that meaningful Khushab production begins in 1999.

2. Operating capacity of plutonium production facilities seldom if ever approaches 100 per cent over long periods of time, and achieving 80 per cent of maximum capacity over time would be unusual. Reactors may be run during start up trials at low power and, as in Dhruva's case, this trial period may last 2 or 3 years. Even after they have been brought into full operation, reactor operations often face periods of downtime for repair or servicing and, depending on design, refueling. Some fraction of plutonium in spent fuel is not recovered due to imperfections in the operations of chemical reprocessing plants. Limits on reprocessing plant capacities can also be a bottleneck for plutonium separation. They have been so at earlier times in India's nuclear history, and may be so in Pakistan today. It is assumed for purposes of this analysis, however, that reprocessing capacity in both countries today is sufficient to handle the output of the existing dedicated reactors and was sufficient in India over time to catch up with any previous backlog.

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[63] For a recent American analysis reflecting this discounting trend, see Gregory S. Jones, *From Testing to Deploying Nuclear Forces: The Hard Choices Facing India and Pakistan*, Santa Monica: RAND, Document IP-192, 2000. An even more recent RAND analysis that documents the Indian sources that have driven the discounting trend, and that essentially accepts their thrust, is Ashley Tellis, *India's Emerging Nuclear Posture: Between Recessed Deterrent and Ready Arsenal*, Santa Monica: RAND, 2001, pp. 481-98. Analyses of India's plutonium capacity in the 1970s and 1980s tended to ask the question how much nuclear weapons potential could India theoretically have. Recent analyses tend to focus on how much nuclear material India probably does have. Albright's 1997 analysis addressed both questions, but attempted to provide a best guess on the latter question. This analysis does much the same, but excludes unsubstantiated discounting. India's lack of dedicated nuclear program transparency should lead objective analysts to cautious judgments, absent empirical information to the contrary.

[64] See Federation of American Scientists, "Plutonium Production," at the following website and URL: http://www.fas.org/nuke/intro/nuke/plutonium.htm

3. The graphs of NWEs from plutonium from dedicated facilities in Charts 1 and 2 show separately plotted average capacity factors of 100, 60, and 40 per cent of the theoretical maximum capacity of the dedicated plutonium production reactors. The figures based on 100 per cent of maximum capacity are operationally unrealistic. The "best guess" here of NWEs from dedicated plutonium facilities assumes achievement of an average capacity of 60 per cent, a reasonably conservative figure that official Indian sources claimed they met or exceeded (up to 70 per cent) in the years before 1998, according to Albright.[65] The 40 per cent extrapolation seems implausibly low, but is presented for comparison. The same capacity factors are plotted for Pakistan's plutonium production after the Khushab reactor came on line, and the 60 per cent capacity plot is also taken as the best guess of actual output.

4. The figures for spent fuel and plutonium produced by India's civilian power reactors are based on Albright's calculations. The estimates in Chart 2, however, include only the plutonium production capacity of India's *unsafeguarded* power reactors, not those under IAEA safeguards.[66] The NWE estimates derived from unsafeguarded civil plutonium display separately those that would be attributable to separated (reprocessed) plutonium stocks and that contained in spent fuel (still awaiting reprocessing). Theoretically, India could also derive weapons from the plutonium resident in the spent fuel from its safeguarded reactors, by violating or abrogating safeguards agreements. Limits on India's civil reprocessing capacity imply that this could take some time. Both of Pakistan's electric power reactors operate under IAEA safeguards. These are the Canadian-supplied Karachi heavy water reactor (KANUPP, 137 MWe) installed in the early 1970s, and the Chinese-supplied, light water reactor at Chasma (Chasma-1, 310 MWe), which was started up in November 1999.

5. Following Albright, the critical mass quantity for one NWE of weapons-grade plutonium (from *dedicated*, reactors like CIRUS, Dhruva and Khushab) is assumed to be, on average, about 4.5 kg. for traditional fission weapons of 10 to 20 kiloton yield. With respect to weapons-usable plutonium derived from civilian power reactors, a larger critical mass of 8 kg. per NWE is assumed.

6. This presentation does not include the potential production capacity of weapons-grade plutonium from India's non-transparent, fast-breeder reactor program or other dedicated reactors that could have been built covertly, or that could be built in the near future.

<u>For enriched uranium</u>:

1. Pakistan secretly established a dedicated gas-centrifuge uranium-enrichment facility at Kahuta (Khan Research Laboratories, or KRL) in the late 1970s, expanding the pilot-scale operation to 1,000 centrifuges by the mid-1980s. In the trial stages, it is believed that operational difficulties persisted and only low-enriched uranium (LEU) was produced. Public sources indicate, however, that KRL was producing highly-enriched uranium (HEU) in significant quantities by 1986. They further indicate that Pakistan's enrichment capacity at KRL and that added by other Pakistani centrifuge facilities (e.g., Golra and Gadwal are other sites mentioned) was expanded to 3,000 centrifuges by

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[65] See Albright, "India and Pakistan's Fissile Material and Nuclear Weapons Inventory, end of 1998," *Ibid.*
[66] While research reactors are usually rated by their thermal energy output, electric power reactor ratings are normally given as electrical power output units, e.g., 1,000 MWe. The general rule of thumb is that the thermal output of a power reactor is three times the electrical capacity. Thus a 1,000 MWe power reactor normally would have a thermal capacity of 3,000 MWt. *Ibid*.

1991, and that the HEU production capacity of these 3,000 centrifuges would be between 45 and 100 kg. annually.[67]

Beginning in the 1970s, India also established gas centrifuge enrichment facilities, and reportedly pursued research on laser-isotopic separation (LIS) of uranium from the early 1980s.[68] Little is known publicly about the capacity of these facilities but reports that one of India's reasons for uranium enrichment was acquiring HEU for submarine nuclear propulsion reactors implies that the intent was to accumulate large quantities of HEU.[69] Although unclassified sources do not provide sufficient information to make it possible to count NWEs from India's HEU program activities in the tables and graphs presented here, the existence of these programs should not be overlooked.

2. Estimates of the production capacities for secretly operated gas centrifuge facilities have many uncertainties. The technology is difficult to master and the ultra-high speed centrifuge rotors are prone to break down, with the well known potential for catastrophic failure of centrifuges interconnected in production cascades. To reach the 90 per cent or greater levels of U-235 in weapons-grade uranium, enriching the less than 1 per cent initial fraction of the U-235 isotope in natural uranium requires many separative iterations of the gaseous uranium feedstock. Following Albright's engineering estimates, we assume that 1,000 centrifuges have the capacity to produce somewhere between 15 and 33 kgs. of U-235 annually, and 3,000 centrifuges three times that amount. We assume here that 1986 was the startup year in Pakistan for HEU production from 1,000 centrifuges, and that 2,000 additional centrifuges were installed in 1991.

3. Charts 1 and 2 project Pakistan's cumulative HEU based on the upper and lower limits in Albright's engineering estimates. The "best guess" in this analysis assumes, however, that Pakistan's net HEU production (and corresponding NWE accumulation) probably reached 1.3 times Albright's low capacity estimate. That "best guess" of actual production is plotted separately.

4. Following Albright again, the critical mass of 90 per cent enriched HEU for one NWE (for a traditional 10-20 kiloton fission weapon) is assumed on average to be 18 kilograms.

5. Albright's 1998-99 analyses assume that Pakistan may have observed a pledge made to the United States in 1991 not to produce HEU, but that this moratorium would have lapsed after Pakistan's nuclear explosive tests at the end of May 1998. During that period, Pakistan would have continued to produce LEU. A stockpile of LEU already enriched to a level of about 20 per cent could have been re-enriched by the centrifuge facilities to a 90 per cent level quite rapidly, producing an artificial spike in Pakistan's HEU production and a sudden jump in accumulated NWEs.[70] While it may be

[67] Federation of American Scientists, "Pakistan's Nuclear Weapons Program: Present Capabilities," August 6, 2001 (available at: http://www.fas.org/nuke/hew/Pakistan/PakArsenal.html). The FAS analysis of Pakistani fissile material produce relies on Albright, et. al, *Plutonium and Highly Enriched Uranium 1996*, *op. cit*. For Pakistan's enrichment and other nuclear facility locations, see Jones and McDonough, *Tracking Nuclear Proliferation*, *op. cit*., pp. 144-145.

[68] See Jones and McDonough, *Tracking Nuclear Proliferation*, *op. cit*., pp. 112, 126, 128-129.

[69] *Ibid*., p. 120, note 23.

[70] Some reporters erroneously interpreted this supposed spike in Pakistan's fissile material separation capacity as representing an actual nuclear weapons inventory that brought Pakistan abreast of or even ahead of India. A further source of their confusion apparently was Indian reports that claimed that India had only actually manufactured a handful of weapons, whereas Pakistan had converted most of its HEU into weapons. While in Pakistan's case this allegation is plausible, the allegation that India by 1999 had only fabricated a handful of weapons has never been substantiated and conflicts with earlier reports from other, more credible, Indian sources. What is more important for any nuclear military capability assessment of India and Pakistan at this juncture, now that both countries have tested nuclear weapons, is not the exact number of nuclear weapons that either may have manufactured -- which cannot be verified in present circumstances -- but how many either could fabricate and deploy on short notice, and that is best reflected in NWE production capacities over time.

historically interesting to determine whether Pakistan actually observed an HEU moratorium for several years and then re-enriched LEU to HEU rapidly in 1998-99, in retrospect it makes little practical difference to any basic comparison of India's and Pakistan's near term nuclear weapons potential. The graph used here on Pakistan's accumulating NWEs displays the supposed enrichment moratorium and spike, but notes that displaying a smoothed out (continuous) curve would have been just as meaningful -- since the net accumulation of NWE's by 1999 or 2000 would be essentially the same.

Appendix B

Draft Report of National Security Advisory Board on Indian Nuclear Doctrine

New Delhi, August 17, 1999

Editorial Note: italics are not in the original but were added for emphasis.

1. Preamble

1.1. The use of nuclear weapons in particular as well as other weapons of mass destruction constitutes the gravest threat to humanity and to peace and stability in the international system. Unlike the other two categories of weapons of mass destruction, biological and chemical weapons which have been outlawed by international treaties, nuclear weapons remain instruments for national and collective security, the possession of which on a selective basis has been sought to be legitimised through permanent extension of the Nuclear Non-proliferation Treaty (NPT) in May 1995. Nuclear weapon states have asserted that they will continue to rely on nuclear weapons with some of them adopting policies to use them even in a non-nuclear context. These developments amount to virtual abandonment of nuclear disarmament. This is a serious setback to the struggle of the international community to abolish weapons of mass destruction.

1.2. India's primary objective is to achieve economic, political, social, scientific and technological development within a peaceful and democratic framework. This requires an environment of durable peace and insurance against potential risks to peace and stability. It will be India's endeavour to proceed towards this overall objective in cooperation with the global democratic trends and to play a constructive role in advancing the international system toward a just, peaceful and equitable order.

1.3. Autonomy of decision making in the developmental process and in strategic matters is an inalienable democratic right of the Indian people. India will strenuously guard this right in a world where nuclear weapons for a select few are sought to be legitimised for an indefinite future, and where there is growing complexity and frequency in the use of force for political purposes.

1.4. India's security is an integral component of its development process. India continuously aims at promoting an ever-expanding area of peace and stability around it so that developmental priorities can be pursued without disruption.

1.5. However, the very existence of offensive doctrine pertaining to the first use of nuclear weapons and the insistence of some nuclear weapons states on the legitimacy of their use even against non-nuclear weapon countries constitute a threat to peace, stability and sovereignty of states.

1.6. This document outlines the broad principles for the development, deployment and employment of India's nuclear forces. Details of policy and strategy concerning force structures, deployment and employment of nuclear forces will flow from this framework and will be laid down separately and kept under constant review.

2. Objectives

2.1. In the absence of global nuclear disarmament India's strategic interests require effective, credible nuclear deterrence and adequate retaliatory capability should deterrence fail. This is consistent with the UN Charter, which sanctions the right of self-defence.

2.2. The requirements of deterrence should be carefully weighed in the design of Indian nuclear forces and in the strategy to provide for a level of capability consistent with maximum credibility, survivability, effectiveness, safety and security.

2.3. India shall pursue a doctrine of *credible minimum nuclear deterrence*. In this policy of "retaliation only", *the survivability of our arsenal is critical*. *This is a dynamic concept* related to the strategic environment, technological imperatives and the needs of national security. The actual size components, deployment and employment of nuclear forces will be decided in the light of these factors. India's peacetime posture aims at convincing any potential aggressor that :
(a) *any threat of use of nuclear weapons against India shall invoke measures to counter the threat*: and (b) any nuclear attack on India and its forces shall result in punitive retaliation with nuclear weapons to inflict damage unacceptable to the aggressor.

2.4. The fundamental purpose of Indian nuclear weapons is to deter the use and threat of use of nuclear weapons by any State or entity against India and its forces. India will not be the first to initiate a nuclear strike, but will respond with punitive retaliation should deterrence fail.

2.5. India will not resort to the use or threat of use of nuclear weapons against States which do not possess nuclear weapons, or are not aligned with nuclear weapon powers.

2.6. Deterrence requires that India maintain:

(a) Sufficient, survivable and operationally prepared nuclear forces,
(b) a robust command and control system,
(c) effective intelligence and early warning capabilities, and
(d) comprehensive planning and training for operations in line with the strategy, and
(e) the will to employ nuclear forces and weapons

2.7. Highly effective conventional military capabilities shall be maintained to raise the threshold of outbreak both of conventional military conflict as well as that of threat or use of nuclear weapons.

3. Nuclear Forces

3.1. India's nuclear forces will be effective, enduring, diverse, flexible, and responsive to the requirements in accordance with the concept of credible minimum deterrence. These forces will be based on a triad of aircraft, mobile land-based missiles and sea-based assets in keeping with the objectives outlined above. Survivability of the forces will be enhanced by a combination of multiple redundant systems, mobility, dispersion and deception.

3.2. *The doctrine envisages assured capability to shift from peacetime deployment to fully employable forces in the shortest possible time, and the ability to retaliate effectively even in a case of significant degradation by hostile strikes*.

4. Credibility and Survivability

The following principles are central to India's nuclear deterrent:

4.1. Credibility: Any adversary must know that India can and will retaliate with sufficient nuclear weapons to inflict destruction and punishment that the aggressor will find unacceptable if nuclear weapons are used against India and its forces.

4.2. Effectiveness: The efficacy of India's nuclear deterrent be maximised through synergy among all elements involving reliability, timeliness, accuracy and weight of the attack.

4.3 Survivability:

(i) India's nuclear forces and their command and control *shall be organised for very high survivability against surprise attacks and for rapid punitive response*. They shall be designed and deployed to ensure survival against a first strike and to endure repetitive attrition attempts with adequate retaliatory capabilities for a punishing strike which would be unacceptable to the aggressor.

(ii) Procedures for the continuity of nuclear command and control shall ensure a continuing capability to effectively employ nuclear weapons.

5. Command and Control

5.1. Nuclear weapons shall be tightly controlled and released for use at the highest political level. The authority to release nuclear weapons for use resides in the person of the Prime Minister of India, or the designated successor(s).

5.2. An effective and survivable command and control system with requisite flexibility and responsiveness shall be in place. An integrated operational plan, or a series of sequential plans, predicated on strategic objectives and a targetting policy shall form part of the system.

5.3. For effective employment the unity of command and control of nuclear forces including dual capable delivery systems shall be ensured.

5.4. The survivability of the nuclear arsenal and effective command, control, communications, computing, intelligence and information (C412) systems shall be assured.

5.5. The Indian defence forces shall be in a position to execute operations in an NBC environment with minimal degradation.

5.6. Space based and other assets shall be created to provide early warning, communications, damage/detonation assessment.

6. Security and Safety

6.1. Security: Extraordinary precautions shall be taken to ensure that nuclear weapons, their manufacture, transportation and storage are fully guarded against possible theft, loss, sabotage, damage or unauthorised access or use.

6.2. Safety is an absolute requirement and tamper proof procedures and systems shall be instituted to ensure that unauthorised or inadvertent activation/use of nuclear weapons does not take place and risks of accident are avoided.

6.3. Disaster control: India shall develop an appropriate disaster control system capable of handling the unique requirements of potential incidents involving nuclear weapons and materials.

7. Research and Development

7.1. India should step up efforts in research and development to keep up with technological advances in this field.

7.2. While India is committed to maintain the deployment of a deterrent which is both minimum and credible, it will not accept any restraints on building its R&D capability.

8. Disarmament and Arms Control

8.1. Global, verifiable and non-discriminatory nuclear disarmament is a national security objective. India shall continue its efforts to achieve the goal of a nuclear weapon-free world at an early date.

8.2. Since no-first use of nuclear weapons is India's basic commitment, every effort shall be made to persuade other States possessing nuclear weapons to join an international treaty banning first use.

8.3. Having provided unqualified negative security assurances, India shall work for internationally binding unconditional negative security assurances by nuclear weapon states to non-nuclear weapon states.

8.4. Nuclear arms control measures shall be sought as part of national security policy to reduce potential threats and to protect our own capability and its effectiveness.

8.5. In view of the very high destructive potential of nuclear weapons, appropriate nuclear risk reduction and confidence building measures shall be sought, negotiated and instituted.

Source: Embassy of India, Washington, DC, July 13, 2000
<http://www.indianembassy.org/policy/CTBT/nuclear_doctrine_aug_17_1999.html>