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Ballistic Missile Proliferation in Southern Asia: Options for Stabilization

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Ballistic Missile Proliferation in Southern Asia: Options for Stabilization

Abstract

This study assesses the destabilizing and stabilizing effects of ballistic missile development, induction, and deployment in Southern Asia. India's relations with China and Pakistan are characterized by poor communication and mutual distrust. Within this context, the delivery systems for nuclear and conventional weapons strongly influence each country's threat perceptions and military strategy. The study reviews the respective national missile programs and the concept of deterrence within the context of national nuclear and missile strategies. The recent concept of limited war is also reviewed. The study goes on to develop practical concepts that could decrease the instability resulting from the introduction of ballistic missiles. The analysis process uses three regional scenarios to identify stabilizing and destabilizing factors and assess potential options for improvement. The study presents options that could be initiated within the current regional political environment and presents additional options that could be applicable if political conditions improve. The stabilization options include political, operational, and communication initiatives. These initiatives are both unilateral and cooperative (bilateral between India-Pakistan or India-China)

Acronyms

ATACMS	Army Tactical Missile System
BSRBM	Battlefield Short Range Ballistic Missile
CASC	China Aerospace Corporation
CEP	Circular Error Probable
DCC	Development Control Committee
DRDL	Defence Research and Development Laboratory (India)
DRDO	Defence Research and Development Organisation (India)
ICBM	Intercontinental Ballistic Missile
IGMDP	Integrated Guided Missile Development Programme (India)
IRBM	Intermediate Range Ballistic Missile
ISRO	Indian Space Research Organisation
JWG	Joint Working Group
KRL	A.Q. Khan Research Laboratory (Pakistan)
LOC	Line of Control (India-Pakistan)
MTCR	Missile Technology Control Regime
MRBM	Medium Range Ballistic Missile
NDC	National Defense Complex (Pakistan)
PAEC	Pakistan Atomic Energy Commission
PLA	Peoples Liberation Army
RCI	Research Centre Imarat
SFC	Strategic Forces Command
SLV	Space Launched Vehicle
SRBM	Short Range Ballistic Missile
SUPARCO	Space and Upper Atmospheric Research Commission (Pakistan)
TEL	Transporter Erector Launcher
WMD	Weapons of Mass Destruction

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Executive Summary

The presence of nuclear weapons and ballistic missiles is now a fact of life in Southern Asia. According to some defense analysts, the Indian and Pakistani nuclear tests of 1998 were going to increase stability. Overt and deployed nuclear capabilities and delivery systems would be the "great equalizer" and encourage India and Pakistan to disengage from their low-intensity warfare in Kashmir. Since the tests, however, bilateral relations have been characterized by instability and crises.

The growth of Indian, Chinese, and Pakistani ballistic missile forces has both stabilizing and destabilizing effects. Regional stability is derived from strategic stability, crisis stability, and arms race stability. Strategic stability (in the nuclear context) is a situation where neither side has incentives to use its nuclear weapons first. Crisis stability is when neither side fears a pre-emptive strike. Arms race stability is when neither side fears its potential adversary is developing weapons that might undermine strategic or crisis stability.

Nuclear-armed missiles can provide a survivable deterrent force and conventionally-armed missiles can balance military inferiority. However, uncertainty about the status of an opponent’s missiles, short warning time and the consequences of a sudden attack may cause a country to strike pre-emptively in the early stages of a crisis.

This study assesses the effects of ballistic missile development and deployment within the historical and strategic context of India, China, and Pakistan. Regional scenarios are used to identify factors affecting stability. Based on this analysis, the study defines a number of political and operational options – both unilateral and cooperative – to increase overall stability. The options include actions such as selected transparency to reduce threat perceptions. Some unilateral options presented do not require much political will because they are in the country’s best interests. The options can be initiated individually or as an integrated set. Unilateral steps, combined with incremental

engagement on security topics, could create the environment for reciprocal and cooperative actions. The stabilization options presented in the study are:

Options applicable to missile and nuclear strategy

- Renew adherence with existing security agreements (*India-Pakistan-China*)
- Maintain and/or declare a no-first-use policy (*India-Pakistan-China*)
- Enter into a de-targeting agreement (*India-China*)
- Declare missiles with less than 300 km range as non-nuclear (*India-Pakistan*)
- Eliminate a functional class of missiles (*India-Pakistan*)
- Ban future deployment of sea-launched ballistic missiles (*India-Pakistan*)

Options applicable to missile operations and uncertainty

- Separate ("de-mate") warheads and missiles (*India-Pakistan-China*)
- Declare number of missiles (by type) and launchers (*India-Pakistan-China*)
- Continue and enhance pre-notification of missile tests (*India-Pakistan*)
- Conduct test launches from coastal sites over the ocean (*India-Pakistan*)
- Create missile non-deployment zones (*India-Pakistan*)
- Base MRBMs and IRBMs in fixed hardened structures (*India-Pakistan-China*)

Options applicable to perception and preemption

- Incorporate access control into missile storage facilities (*India-Pakistan*)
- Integrate use-control mechanisms on launch system (*India-Pakistan*)
- Implement a missile "Personnel Reliability Program" (*India-Pakistan-China*)
- Re-deploy most capable counter-force aircraft to rear bases (*India-Pakistan*)
- Install barriers at storage sites to create stabilizing delays (*India-Pakistan-China*)

To date, none of the countries has applied its expertise in defense matters to improving stability. This study asserts that governments should be prepared, if opportunities for reconciliation arise, by establishing working groups within their defense and foreign policy establishments to systematically develop stabilization options and assess how to implement them. The study of the options presented in this study and their refinement would support the process. Cooperation in implementing or evaluating an experiment which tests a stabilization option would be particularly helpful. Additionally, third parties could play a beneficial role by conducting demonstrations and training.

Ballistic Missile Proliferation in Southern Asia: Options for Stabilization

1.0 Southern Asia, Ballistic Missiles, and the Risk of War

1.1 Introduction

Southern Asia (a term including South Asia and western China) has a quarter of the world's population and a long history of domestic insurgencies and political-military conflict. The region's three powers (India, China, Pakistan) currently possess large standing militaries, nuclear weapons, strike aircraft, and ballistic missiles. India and Pakistan going overtly nuclear in 1998, in particular, has changed the strategic landscape in the region.

Weapon delivery systems strongly affect the threat perceptions and resultant strategies of India, Pakistan, and China. Ballistic missiles present a combination of operational capabilities (range, survivability, lack of an effective defense) and features (flexibility, cost) unmatched by aircraft. As nuclear delivery systems, they can provide a survivable deterrent force. As conventional delivery systems, the relatively low cost of missiles can enable a militarily weak state to counter its numerical inferiority in other areas. As a result, ballistic missiles have become an important part of the world's military arsenals. 34 countries possess some type of ballistic missile. Appendix A describes the operational characteristics of ballistic missiles and their implications.

Ballistic missiles play an increasing role in the political and security dynamics of Southern Asia. India and Pakistan frequently match missile tests on a tit-for-tat basis. The presence of significant numbers of ballistic missiles concurrent with a crisis creates a security dilemma where the protagonists might opt for preemptive military action.[1] Missiles are a factor in domestic politics as well. India and Pakistan use deeply symbolic and historical names for their missiles. The display of missiles in Indian, Pakistani, and Chinese parades indicates that they are perceived as significant national accomplishments and not merely another weapon (Figure 1).

[1] Michael D. Swaine with Loren H. Runyon, "Ballistic Missiles and Missile Defense in Asia," *NBR Analysis*, June 2002, 13:3, p.72. (www.ceip.org)

Figure 1: Indian, Chinese and Pakistani ballistic missiles on parade

The growth of ballistic missile forces in Southern Asia has resulted from an action-reaction cycle in which one side reacts to an act (or perception of an act) by another. India's concern about the ability of Chinese missiles to strike its territory is at the core of its threat analysis. Pakistan feels threatened by the development and capability of Indian missiles. China's transfer of ballistic missile technology to Pakistan, in response to India's development activities, alarms India. Hence, the threat perceptions of the three countries are linked to their respective ballistic missile programs.

1.2 Missiles and Regional Stability

Regional stability is derived from strategic stability, crisis stability, and arms race stability. Strategic stability (in the nuclear context) is a situation where neither side has incentives to use its nuclear weapons first. An alternative definition requires each side to have a secure second-strike capability. Crisis stability is when neither side fears a pre-emptive strike. Arms race stability is when neither side fears that its potential adversary is developing weapons that might undermine strategic stability or crisis stability.[2]

[2] These definitions have been developed by the Center for Nonproliferation Studies (Monterey, CA) and Sumit Ganguly, "India's Pathway to Pokhran II," *International Security*, Vol. 23, No.4 (Spring 1999).

Experts have debated whether the introduction of ballistic missiles in Southern Asia contributes to or detracts from overall stability. Some argue that ballistic missiles promote stability and cite the Cold War to illustrate how they helped to ensure military restraint by maintaining nuclear deterrence.[3] However, these analysts note there are major differences between the Cold War and the current tensions in Southern Asia. Unlike the US-Soviet experience, India and Pakistan have a high level of animosity and have fought four wars since independence. A second difference is that Southern Asia's arsenals of missiles and nuclear weapons are much smaller. The US and Soviet arsenals had the capability to damage each other's society beyond recovery. China, India, and Pakistan may not necessarily rely on a deterrent strategy of "mutually assured destruction." In fact, the concept of "limited war" has been discussed in all three countries.

The current security problem in Southern Asia stems from asymmetry. Threat perceptions need to be managed and reduced. Strategic stability with respect to ballistic missiles and nuclear weapons is best achieved within an arms control framework aimed at achieving a mutually agreed set of objectives. It seems likely that, in the absence of arms control agreements, the growth of ballistic missile forces in the region will continue.

1.3 Goals of the Study

The first goal of this study focuses on assessing the destabilizing and stabilizing strategic effects of the development and deployment of ballistic missiles in Southern Asia, in nuclear and conventional contexts.[4] For the purposes of this study, "deployed" refers to a system that is combat-ready, no longer in developmental testing, exists or is being manufactured in significant numbers, is assigned to and exercised by its military operators, and is essentially ready to use with a few hours for preparation.[5]

The second goal is to develop operational concepts, within the strategic/policy context of Southern Asia, that help stabilize the overall effects of ballistic missile development, induction, and deployment. These options include political, procedural, and

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[3] Steve Fetter (University of Maryland), Lawrence Schiennman (Monterey Institute) and Joseph Cirincione (Carnegie Foundation) presented this view during interviews.

[4] Chemical and biological weapon warheads are excluded because India, Pakistan, and China are parties to the Chemical and Biological Weapons Conventions.

[5] The term "inducted" is used by South Asian officials and writers who differentiate the word from "deployment." This study interprets "induction" to mean physical possession of a missile system but one that does not meet the previously defined operational criteria for "deployment."

communication options (both declaratory and through technically-based cooperative monitoring). The study did not restrict itself to a particular set of political conditions and seeks to include options for changing political conditions. The analysis developed three regional scenarios to identify stabilizing and destabilizing factors and assess options. Options for stabilization will be presented that address different sources of instability.

2.0 Security Issues between India, Pakistan, and China

The most important sources of tension for the three countries stem from unresolved borders.

2.1 India-Pakistan

The current border problem originated in the British colonial period and the partition of the former colony. The process to enable the semi-independent princely states of British India to join the new states of India and Pakistan was politically difficult and resulted in dual claims to Jammu and Kashmir. Today India and Pakistan share an international (and mutually recognized border) running for some 2,500 km plus a line of control (LOC) in disputed Kashmir and Jammu of 740 km. India and Pakistan believe that the other is in illegal occupation of its sovereign territory. Significant conflicts related to Kashmir occurred in 1947, 1965, 1971, and 1999 with innumerable skirmishes in between. A 10-month long crisis with full military mobilization resulted from the December 13, 2001 terrorist attack on the Indian parliament. Low intensity conflict continues in Kashmir with the ever-present risk of a new crisis rising.

2.2 India-China

After the Communist revolution, the new People's Republic of China described the McMahon line between India and Tibet drawn by the British as "unlawful." Tensions along the India-China border culminated in the 1962 war which resulted in China taking physical control of some 38,000 square km of Indian territory along both the eastern and western sections of the border. China has claimed an additional 90,000 square km of Indian territory including the entire northeastern state of Arunachal Pradesh. The India-China border appears to be stable although talks by the Joint Working Group (JWG) to

formalize the border have continued since 1988 without significant progress. Indian and Chinese maps of the line of actual control were finally exchanged in November 2000. India and China concluded agreements in 1993 and 1996 to stabilize military relations.

In 1963, Pakistan ceded 5,180 square km of territory under its control in the Northern Territories area of Kashmir to China – an act that India does not recognize since it considers the territory to be its own. Thus the India-China border dispute is also linked to the India-Pakistan dispute over the state of Jammu and Kashmir.

There are other underlying pressures for strategic competition between India and China. These stem from Chinese efforts to establish and expand political and security relations with countries in the South Asia-Indian Ocean region and Indian efforts to block such links.[6] Although both countries see themselves as acting defensively, there is a tendency by each to attribute hostile motives to the actions of the other. This inspires defensively motivated counter-actions that are, in turn, seen as threatening by the other power, which then devises its own defensively inspired counter-actions in response. The ballistic missile race is a case in point.

India and China see the efforts of the other as threatening because they contribute to conditions adverse to its own national security. China identifies two sources of insecurity originating in South Asia: the stability of Chinese integration of Tibet and the security of China's sea lanes of trade (particularly oil) across the Indian Ocean. China's actions to balance these concerns include its alliance with Pakistan and diplomatic and military initiatives with Nepal, Myanmar, Bangladesh and Bhutan. Indian strategists have traditionally viewed this region as an informal Indian security zone.[7] Indian strategic analysts over a wide political spectrum perceive Chinese activity in the South Asian-Indian Ocean region to be potentially threatening. The improved Chinese-Indian relations described above have modified but not fundamentally altered the dominance of this outlook.

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[6] John Garver, "The Security Dilemma in Sino-Indian Relations," *India Review*, Vol. 1, Number 4, October 2002, pp. 1-38.
[7] George Tanham, "Indian Strategic Culture," *Washington Quarterly* (Winter 1992), pp. 129-42.

3.0 Ballistic Missile Development in Southern Asia

Given India's, Pakistan's, and China's stated goals of creating survivable nuclear forces, they will attempt to diversify their nuclear stockpiles between aircraft and missile delivered weapons. None of the countries have large nuclear stockpiles so it is virtually certain there will be more ballistic missiles in their inventories than nuclear weapons. Consequently there will be conventional as well as nuclear roles for missiles – perhaps even of the same missile type.

3.1 China's Ballistic Missile Program and Doctrine

China's missile program is the oldest in Asia (begun in the late 1950s) and the most advanced. Chinese leaders have articulated that a limited but long-range missile capability is a key component of national strength and prestige. The Air Force is relatively weak and China's nuclear weapons delivery systems are mainly land-based missiles, plus a few submarine launched systems of intermediate range. Most ballistic missiles are short- to medium-range systems. Appendix B describes China's missiles.

China has a large, well-established infrastructure for the development and production of ballistic missiles. The China Academy of Launch Vehicle Technology (1st Academy) of the China Aerospace Corporation (CASC) and its subordinate development, production and test facilities are responsible for ballistic missile production. China has conducted a modernization program for more than a decade, and it is estimated that by 2015 Chinese ballistic missile forces will increase several fold.[8,9] China has been accused of exploiting space technology supplied to assist with launching American civilian satellites, to improve the accuracy of its long-range missiles.[10] One characteristic of Chinese weapon programs is that it takes a long time (sometimes decades) for a new missile, submarine, or bomber to enter service.

Swaine reviewed the role of ballistic missiles in military doctrines of Asian countries and concluded that China does not view ballistic missiles as solely for nuclear

[8] U.S. Office of the Secretary of Defense, "Proliferation: Threat and Response," January 2001.
[9] U.S. National Foreign Intelligence Board, "Foreign Missile Developments and the Ballistic Missile Threat Through 2015," Unclassified summary of a National Intelligence Estimate (2002).
[10] Barbara Starr, "Chinese Modernisation Efforts Breach U.S. Law," *Jane's Defense Weekly*, December 11 1996, p.11. Bryan Bender, "U.S. Export Policy on Satellite Work Under Scrutiny," *Jane's Defense Weekly*, June 24, 1998, p.4.

weapons delivery but as highly versatile delivery systems for both nuclear and conventional warheads.[11] The Cox Commission review concurred with this assessment and said that conventional ballistic missile forces are viewed as potential weapons for use during regional conflicts.[12] China is significantly improving its theater missile capabilities and is increasing its short range missile force deployed opposite Taiwan.[13]

Potential targets for Chinese ballistic missiles include local conflicts along the country's periphery – Taiwan, Vietnam, India, Russia, Central Asia, and the greater Pacific region (Japan, U.S. military bases in Asia and the western Pacific). China possesses a small ICBM force directed at the U.S. (although the two agreed not to target each other in 1998) and European Russia. A member of China's Institute of Systems Engineering indicated at an international conference of nuclear scientists in November 1996 that China no longer formulates strategic military plans with India in mind.[14]

3.2 Pakistan's Ballistic Missile Program and Doctrine

Pakistan created the Space and Upper Atmosphere Research Commission (SUPARCO) in 1961 to oversee research in space science. During the 1960s, SUPARCO established a test range at Sonmiani Bay and conducted experiments with foreign (primarily French) rockets. By 1970 it had developed the capability to fabricate small solid-fuel rocket motors. In the mid-1980s, Pakistan began a military ballistic missile program in response to SCUD missile attacks on Afghan guerilla camps in Pakistan by the Government of Afghanistan and the initiation of the Integrated Guided Missile Development Programme (IGMDP) by India in 1983.

Beginning with little aerospace or defense infrastructure, the Pakistani ballistic missile program has made surprisingly rapid progress. Half a dozen types of missiles have been tested in the *Hatf* (meaning "deadly") series. Some missiles appear to be overlapping in their missions. A description of Pakistani missiles is complicated by the practice of using multiple names and/or re-designating new and existing missiles with names formerly applied to other systems. Appendix B describes Pakistan's missiles.

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[11] Swaine and Runyon, op. cit., p. 45.
[12] U.S. House of Representatives REPORT 105-851, op. cit., Chapter 4.
[13] National Intelligence Council, Bob Walpole, *Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015*, September 1999.
[14] Eric Arnett, "What Threat", *Bulletin of the Atomic Scientists*, Vol. 53, No.2, 1997.

The Rumsfeld Commission stated in 1998:[15]

"Pakistan's ballistic missile infrastructure is now more advanced than that of North Korea. It will support development of a missile of 2,500-km range, which we believe Pakistan will seek in order to put all of India within range of its missiles. Through foreign acquisition, and beginning without an extensive domestic science and technology base, Pakistan has acquired these missile capabilities quite rapidly. China and North Korea are Pakistan's major sources of ballistic missiles, production facilities and technology."

Pakistan has two parallel and competing special weapons programs for nuclear weapons and missiles: the A.Q. Khan Research Laboratories (KRL) and the National Defense Complex (NDC) of the Pakistan Atomic Energy Commission (PAEC). It is not clear whether this very expensive strategy of competition is intended to minimize technological risk by developing a variety of prototypes (a possible hedge against the loss of support by either China or North Korea), or a bureaucratic response to different political constituencies. KRL, formerly called the Engineering Research Laboratories, was founded in July 1976 and focuses on two strategic missions: 1) enriching uranium for nuclear weapons and 2) liquid-fueled ballistic missiles. The National Defense Complex (NDC) was created in 1993 under the Pakistan Atomic Energy Commission (PAEC) with the objective of developing an infrastructure for indigenous development, production, and integration of solid-fuel missiles, launchers, explosive materials and propellants.

Pakistan has officially denied the transfer of missile technology and expertise from China and North Korea. China and Pakistan began a partnership in various defense programs in the late 1960's. The relationship grew out of their mutual needs in countering Soviet and Indian influence and threats and but continued through the post-Cold War period. Reports of Chinese technical assistance continued through 2000.[16] During the summer of 2001 the U.S. again imposed Category II sanctions on Pakistani and Chinese organizations for the sale of dual-use Chinese technology to Pakistan. These sanctions were rescinded as part of the normalization of relations with Pakistan after the

[15] Report of the Commission to Assess the Ballistic Missile Threat to the United States, July 15, 1998.
[16] Swaine, op. cit. Andrew Koch, "Pakistan's tests: warning for India," *Jane's Defense Weekly*, Vol. 37, no. 23, June 5 2002, p.2.

September 11, 2001 terrorist attacks.[17] The Chinese government announced new rules in August 2002 to govern the export of missile technology.[18]

The motivation for North Korean support appears to be mercantile. North Korea has exported the SCUD series of missiles to a number of countries (although not to Pakistan) since the mid-1980s. A Pakistani delegation visited North Korean research and production facilities in 1992 and may have been present at the May 1993 Nodong test launch in North Korea.[19] On April 24, 1996 the U.S. imposed sanctions against KRL and North Korean Changgwang Sinyong trading Corporation.[20]

Given the relative weaknesses of Pakistan's air force compared to India's, missiles are considered delivery systems for both nuclear and conventional warheads.[21] Pakistan will likely rely on ballistic missiles as its primary delivery system for the foreseeable future. Pakistan has stated that the battlefield short range Hatf 1 and 2 missiles have only conventional missions.[22] These missiles serve as a conventional means to strike targets behind advancing formations or to disrupt troop concentrations.

Like China and India, Pakistan's missiles are mobile. There is some ambiguity about whether Pakistani missiles are normally maintained at more than low alert status. There were allegations of missiles being moved during the 1999 and 2002 crises. It would be very difficult to determine whether such activity was for defensive dispersal or offensive deployment. Some experts argue that the risk of a crippling first strike by India will result in Pakistan maintaining its ballistic missile force at a high state of readiness. A low-alert standby status would depend on Pakistani planners believing that 1) strategic warning of Indian ground force mobilization would be achieved at least days before a major conventional offense could be launched, 2) India would not launch a preemptive first-strike without warning, and 3) India could not preempt Pakistani nuclear assets by using conventional air-delivered weapons or special operations forces in a surprise attack.

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[17] Joseph Cirincione, *Deadly Arsenals*, Carnegie Endowment for International Peace, 2002.
[18] Elisabeth Rosenthal, "China Issues Rules on Export of Missile Technology," *New York Times*, August 26, 2002, p.3.
[19] Joseph Bermudez, "A History of Ballistic Missile Development in the DPRK," Occasional Paper No. 2, Center for Nonproliferation Studies of the Monterey Institute for International Studies, November 1999.
[20] "Imposition of Missile Proliferation Sanctions Against Entities in Iran and North Korea," *The Federal Register*, Department of State, June 12, 1996.
[21] Gregory Koblentz, 'Viewpoint: Theater Missile Defense and South Asia: A Volatile Mix", *Non-Proliferation Review*, Spring-Summer 1997, p.58 and also see Swaine and Runyon, op. cit., p. 51.
[22] *Jane's Defense Weekly*, Vol. 37, no. 23 (June 5, 2002), p.2.

3.3 India's Ballistic Missile Program and Doctrine

India's missile program is second only to China's in the developing world. The Indian space program began in early 1960s with cooperation from the United States, France, and the Soviet Union. The Indian Space Research Organization (ISRO) was founded in 1969. By 1972, it had developed and tested the Rohini-560 two-stage, solid propulsion sounding rocket. India tested its Space Launch Vehicle 3 (SLV) in 1979 and launched a satellite with it in 1980. In 1987 the larger Augmented Space Launch Vehicle was flight- tested and used to place small satellites in orbit. The much larger Polar Space Launch Vehicle was first tested in 1994 and is currently used to launch Indian remote sensing, weather, and communications satellites.

India's ballistic missile program is in large part a response to China's capabilities and is administratively separate from the civilian space program. It does, however, share a common technical origin with the civilian space program. The Rumsfeld Commission concluded that India used its commercial space launch program to develop the skills and infrastructure needed to support a ballistic missile program.[23] India initiated its Integrated Guided Missile Development Program (IGMDP) in 1983 with the aim of achieving self-sufficiency in military missile production and development. The IGMDP comprises five core systems: the Agni ("Fire") series of MRBMs, Prithvi ("Earth") series of SRBMs, the Trishul ("Trident") short range SAM, the Akash ("Sky") medium range SAM, and the Nag ("Cobra") anti-tank guided missile. Appendix B contains descriptions of India's ballistic missiles.

The IGMDP, and other defense projects, is managed by the Defence Research and Development Organisation (DRDO) whose long-time Head and Secretary, Dr. A.P.J. Abdul Kalam, is the current President of India. It functions as the nodal agency for the execution of major development programs of relevance to the MOD through integration of research, development, testing and production facilities with the national scientific institutions, public sector companies and other agencies. Indian defense development, like China's, tends to proceed at a slow pace. The Defence Research and Development

[23] Daniel Gouré, Michael Krepon and David Tanks; Appendix III: Unclassified Working Papers, The Commission to Assess the Ballistic Missile Threat to the United States, 104th Congress, July 15, 1998.

Laboratory (DRDL), also formerly directed by A.P.J. Abdul Kalam, is responsible for implementing India's missile development program. It is located in the Defence Research Complex at Kanchanbagh near Hyderabad. The Research Centre Imarat (RCI) was established in 1988 near DRDL and is dedicated to work in advanced missile technologies. Bharat Dynamics Limited of Hyderabad, a commercial defense contractor to the MOD, integrates missile components and conducts assembly.

In the 1990s, the United States applied pressure on India to slow its missile development programs. This was motivated by concerns about an India-China-Pakistan arms race and the potential for India to be a proliferator of missile technology. As a result, India shelved its Agni medium range missile program. In 1997, under the Gujral government, India restarted the Agni program after articulating its threat perceptions and an increase in the level of horizontal proliferation between China and Pakistan. The Chinese modernization program has stimulated the development of the Agni-III intermediate range missile.[24] To date, India has displayed no inclination to export its missiles or associated technology.

India appears to view medium and intermediate range missiles as being almost exclusively for nuclear weapons delivery. All systems are mobile and rely on covertness to survive a first strike and retaliate. Like China, Indian missiles would not routinely be on a high level of alert (e.g., dispersed in the field with nuclear warheads mounted).

India seems to view short range missiles as primarily for conventional warhead delivery with a secondary role for nuclear weapons. The Army views the Prithvi 1 missiles as a conventional means to hit targets behind an advancing enemy formation or to disrupt and disperse troop concentrations (held in reserve or being shifted between fronts). A potential nuclear role for the Prithvi was defined after its conventional mission and was advocated by the civilian research establishment.[25] The Indian Air Force views the Prithvi 2 missiles as conventional weapons to attack airfields and air defense sites.[26]

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[24] Arvind Kumar, "Missile Defense and Strategic Modernization in Southern Asia," in Michael Krepon and Chris Gagne, eds., *The Impact of US Ballistic Missile Defenses on Southern Asia*, The Henry L. Stimson Center, Report no.46, July 2002. Internet: www.stimson.org

[25] Raj Chengappa, *Missiles of Peace*, Simon and Schuster. 2000.

[26] J.P. Joshi, "Employment of Prithvi Missiles," *Journal of the United Services Institution of India*, October/December 1996.

4.0 Nuclear Deterrence and the Role of Ballistic Missiles

4.1 Deterrence Theory in Southern Asia

There is a clear linkage between nuclear deterrence and ballistic missile capability.[28] George Fernandes, the Indian Defense Minister, made the following statement on April 23, 1999:[29]

"The acquisition of a missile system capable of delivering conventional or nuclear warhead bridges a key gap in the nuclear deterrent profile of the country. The double distinction of being nuclear-capable and a possessor of the means of delivery means that India can hold its head high without fear of being bullied in a hostile security environment. China with its vast nuclear arsenal, Pakistan with its nuclear weapons and delivery system capability, America perching in Diego Garcia and 8 other Asian countries possessing missiles is quite a grim security scenario."

In the formative stages of the US-Soviet nuclear competition, deterrence theorists identified a *stability-instability* paradox associated with the acquisition of offsetting nuclear weapon capabilities. The essence of this paradox was that nuclear weapons were supposed to stabilize relations between adversaries, and to foreclose a major war between them. At the same time, offsetting nuclear capabilities might well increase instability by encouraging provocations and conflict at lower levels – precisely because nuclear weapons would presumably provide protection against escalation.[30]

The India-Pakistan dynamic is different and in some ways more volatile than the historic United States-Soviet Union rivalry. Sagan notes that India and Pakistan have more in common than the Americans and the Soviets, who were on opposite sides of the globe and viewed each others as mysterious, often unpredictable adversaries. In contrast to the subcontinent, the U.S. and Soviet rivalry was ideological without disputed territory

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[28] During interviews in Washington, DC, Col. Jack Gill, Leonard Spector, Lawrence Schiennman, Steve Fetter, Joseph Cirincione, Michael O' Hanlon, Robert Hathaway adhered to this view. The common argument was that nuclear deterrence is insufficiently effective in the absence of a ballistic missile capability to deliver nuclear weapons. Ballistic missiles bring the concept of 'force multiplier' into the domain of the possessor. However, the command and control systems also are an important element and C^4I^2 increases the nuclear deterrent value of ballistic missiles.

[29] Press Information Bureau, Government of India, Internet: www.nic.in/india-image/pib/f230499.html.

[30] Michael Krepon and Chris Gagne, eds., *The Stability-Instability Paradox: Nuclear Weapons and Brinksmanship in South Asia,* Report no. 38, June 2001, The Henry L Stimson Center, Washington, D.C.. Internet: www.stimson.org/

and a history of armed conflict.[31] Many observers of South Asia have accepted Kenneth Waltz's position (summarized in Sagan's paper[32]) and have argued for the nuclear weapons forces of India and Pakistan to adopt a more cautious, less bellicose approach toward each other. In their view, the possibility of large-scale, deliberate conventional conflict between the two states has lessened considerably, and nuclear deterrence ultimately compelled restraint, de-escalation, and disengagement on both sides.[33] Other scholars in India, Pakistan and the U.S. have argued that nuclear and missile arsenal proliferation will increase the likelihood of crises, accidents, and nuclear war.[34]

India's nuclear policy since the mid-1960s has been driven by China with the Pakistani threat as secondary.[35] Pakistan's entry into the nuclear club has not brought a period of détente and stability between India and Pakistan. Although there was a brief period of détente represented by the Lahore summit of February 1999, the "spirit of Lahore" was crushed by the Kargil conflict of May-June 1999 and disputes have grown more intense and more frequent and more dangerous since then. The Kargil crisis seems to indicate that Pakistan is loosing the fear of retaliation central to the concept of deterrence because it now has nuclear weapons. Pakistan has never declared a no-first-use policy, and there is a growing concern in India about the threshold at which Pakistan might use nuclear weapons in a limited war. During the 2002 crisis, India felt itself sufficiently handicapped to prevent any policy decisions with regard to 'hot pursuits' in Pakistan-controlled Kashmir despite a number of provocative Pakistani actions.[36] Hence, Kenneth Waltz's argument does not appear to be applicable within the context of India and Pakistan. It is likely that both countries will continue to test each other's limits, with the resultant risk that the nuclear threshold may be crossed.

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[31] Scott Sagan, "The Perils of Proliferation in South Asia," *Asian Survey*, Vol. XLI, No. 6, November-December 2001.
[32] Scott Sagan, "More Will be Worse," in *The Spread of Nuclear Weapons*, (New York), 1995, pp. 47-91.
[33] Maleeha Lodhi, "Security Challenges in South Asia," *Nonproliferation Review*, Vol. 8, Summer 2001, p.119.
[34] Kanti Bajpai, "The Fallacy of an Indian Deterrent," in *India's Nuclear Deterrent: Pokhran II and Beyond*, ed. Amitabh Mattoo (New Delhi), 1999, pp. 150-88. Samina Ahmed, "Security Dilemmas of Nuclear-armed Pakistan," *Third World Quarterly*, Vol. 21, no. 5, September 2000, pp. 781-93. Scott Sagan, "More Will be Worse," The Spread of Nuclear Weapons, (New York), 1995, pp. 47-91.
[35] Jasjit Singh, editor, Nuclear India, IDSA: New Delhi p.6.
[36] Arvind Kumar, "Nuclear Deterrence: Waning Motif," *Deccan Herald*, August 22, 2002.

4.2 National Nuclear Doctrines

Neither China nor India nor Pakistan has officially declared the size or character of its nuclear stockpile. China conducted its first nuclear test in 1964. India conducted its first nuclear test in 1974 and ended its self-imposed ban on testing on May 11 and 13, 1998. Pakistan conducted its first nuclear tests on May 28 and 30, 1998. There is a gap between the number and declared yields officially declared and independent estimates.[37]

There are two general categories of doctrines: countervalue and counterforce. The countervalue strategy targets the population and industry of the opponent, while the counterforce strategy targets the opponent's strategic military forces and military-industrial infrastructure. A goal of counterforce targeting is to provide an adversary with an incentive to not strike cities. Early deterrence theorists like Robert McNamara thought that countervalue was a more true form of deterrence as long as a secure second-strike capability could be maintained.

China

China's nuclear doctrine was unstated for about 30 years after its first nuclear test in 1964.[38] In the mid-1990s, several public statements and speeches by officials described Chinese strategic thinking as completely defensive.[39] China's strategy was first described in the 1998 White Paper of National Defense. The position described in the 2002 National Defense Paper is unchanged:

"China solemnly declared that at no time and under no circumstances would it be the first to use such weapons. Later, China undertook unconditionally not to use or threaten to use nuclear weapons against non-nuclear-weapon states or nuclear-weapon-

[37] Terry Wallace, "The May 1998 India and Pakistan Nuclear Tests," *Seismic Research Letters*, Vol. 69, September 1998, pp. 386-393.
[38] Alastair Iain Johnston, "China's New 'Old Thinking': The Concept of Limited Deterrence," *International Security*, Vol. 20, No. 3 (Winter 1995-96), pp. 5-42.
[39] Address by Lt. General Li Jijun, "Traditional Military Thinking and the Defensive Strategy of China," US Army War College, July 15, 1997; Letort Paper, No. 1, 29 August 1997, p. 7.

free zones. China has always exercised utmost restraint on the development of nuclear weapons, and its nuclear arsenal is kept at the lowest level necessary for self-defense."

Given the absence of an explicit statement, China's doctrine can be inferred by various self-imposed constraints on its use of nuclear weapons:

- Since 1964, China has adopted a universal no-first-use pledge (including Taiwan).
- China provides non-nuclear weapon states with unconditional negative security assurances.
- China urges the United States and Russia to make deep cuts in their nuclear forces and advocates the complete destruction of nuclear weapons.
- China has pledged not to target its nuclear weapons against the US or Russia.
- China participates in several nuclear weapon free zone treaties; these commitments prohibit China from deploying, using or threatening to use nuclear weapons in these regions.
- China opposes the development and deployment of space-based weapons and missile defenses.
- China supports a treaty banning the production of fissile material.
- China has agreed to a moratorium on nuclear testing and has signed - but not ratified the Comprehensive Nuclear Test Ban Treaty.

The Chinese strategy is probably one of delayed second strike where retaliation occurs after withstanding a nuclear strike, rather than attempting either a launch-under-attack or a launch-on-warning type strategy. Chinese retaliation for strategic or tactical attacks would probably strike countervalue rather than counterforce targets given its small nuclear stockpile and the accuracy and response times of its missile force.

Two organizations are charged with command and control of nuclear weapons: the State and the Party Central Military Commissions. The State Central Military Commission is China's decision-making body in military affairs and commands the armed forces. The Party Central Military Commission, elected by the Central Committee and chaired by the President, has authoritative policy-making authority and operational control over the military through the General Political Department of the People's Liberation Army. The Second Artillery Corps maintains operational control over China's nuclear and conventional missile forces. It is under the operational control of the general

staff, but is directly controlled by the Central Military Commission, and has been an independent arm of the Chinese armed forces since 1974.

Chinese strategists may be considering shifting their doctrine from *minimum* to *limited* deterrence. China would need to possess a more sophisticated force structure capable of *controlling* nuclear escalation during a conflict by targeting military forces and infrastructure in addition to cities. The US Congress's Cox Commission report of 1999 concluded that, **"**These enhancements (improvements to missiles, previous testing of an enhanced radiation weapon) to the PRC's nuclear forces, together with its expanding economic capabilities, present the PRC with additional options for changes in its strategic doctrine."[40] In July 2000, Jiang Zemin outlined the "Five Musts" on nuclear weapons during the Central Military Commission conference on strategic military equipment:[41]

- China must own strategic nuclear weapons of a definite quality and quantity in order to ensure national security.
- China must guarantee the safety of strategic nuclear bases and prevent against the loss of combat effectiveness from attacks and destruction by hostile countries.
- China must ensure that its strategic nuclear weapons are at a high degree of war preparedness.
- When an aggressor launches a nuclear attack against China, China must be able to launch nuclear counterattack and nuclear re-attack against the aggressor.
- China must pay attention to the global situation of strategic balance and stability and, when there are changes in the situation, adjust its strategic nuclear weapon development strategy in a timely manner.

India

India declared a policy of no-first-use of nuclear weapons in August 1998. Prime Minister Vajpayee emphasized India's self-restraint but did not state the official policy of a "minimum, but credible, nuclear deterrent" until December 1998.[42] Early official

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[40] HOUSE REPORT 105-851, *Report Of The Select Committee On U.S. National Security And Military/Commercial Concerns With The People's Republic Of China*, January 1999.
[41] "HK Paper Reports PRC CMC Meeting on Nuclear Weapons Strategy," *Hong Kong Tai Yang Pao*, in Chinese 17 July 2000, in FBIS-CPP20000717000021.
[42] Raja Mohan, "India Committed to Minimum N-Deterrence," *The Hindu*, December 7, 1998.

statements did not assert a specific nuclear threat to India. In August 1999 the Indian Government issued the *Draft Report on Indian Nuclear Doctrine* that reiterates the policy of credible minimum deterrence against any state or entity.[43] The report was not official policy but included several descriptive statements:

- "India's nuclear forces and their command and control shall be organized for very high survivability against surprise attacks and for rapid punitive response." This statement appears to forgo a strategy of delayed second strike.
- "India's peacetime posture aims at convincing any potential aggressor that any threat of use of nuclear weapons against India shall invoke measures to counter the threat." This statement implies that actions by conventional as well as nuclear forces might be initiated against the threat.
- It calls for India's nuclear forces to be based on a "triad of aircraft, land-based mobile missiles, and sea-based assets." This statement implies that Indian nuclear stockpile will be larger than a few dozen weapons. The report does not distinguish between tactical and strategic nuclear weapons.
- "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." India's no-first-use may be more flexible (or subjective) than its initial unconditional statements.

India updated the draft nuclear doctrine in January 2003 adding several features:[44]

- A posture of "No First Use" nuclear weapons will only be used in retaliation against a nuclear attack on Indian territory or on Indian forces anywhere;
- Nuclear retaliation to a first strike will be massive and designed to inflict unacceptable damage.
- Nuclear retaliatory attacks can only be authorized by the civilian political leadership through the Nuclear Command Authority.
- Non-use of nuclear weapons against non-nuclear weapon states;

[43] http://www.indianembassy.org/policy/CTBT/nuclear_doctrine_aug_17_1999.html
[44] Press Release, Press Information Bureau, Ministry of External Affairs, *The Cabinet Committee on Security Reviews Operationalization of India's Nuclear Doctrine*, January 4, 2003.

- However, in the event of a major attack against India, or Indian forces anywhere, by biological or chemical weapons, India will retain the option of retaliating with nuclear weapons;
- A continuance of strict controls on export of nuclear and missile related materials and technologies, participation in the Fissile Material Cutoff Treaty negotiations, and continued observance of the moratorium on nuclear tests.
- Continued commitment to the goal of a nuclear weapon free world, through global, verifiable and non-discriminatory nuclear disarmament.

India created the Strategic Forces Command (SFC) organization in January 2003 to provide command and control of nuclear forces. The Strategic Rocket Command was created within the army to manage surface-to-surface missiles. In January 2003, India created a Nuclear Command Authority composed of a Political and Executive Councils.[45]

Operational factors suggest that India may adopt a strategy that holds military targets and critical economic infrastructure, in and around key cities, at risk – a mixed counterforce-countervalue policy. In Rodney Jones's opinion, Indian targeting of Pakistan probably will be counterforce and/or against military infrastructure.[46] Ashley Tellis argues that India is more likely to adopt a countervalue (or even counter-population) strategy against both China and Pakistan.[47]

Pakistan

In contrast to India, Pakistan's nuclear strategy and operational planning are almost entirely under the control of the military. Like India, officials made general statements in 1998-99 describing Pakistan's strategy as "minimum nuclear deterrence" but, unlike India, did not make a no-first-use pledge. Pakistan cites India as its sole nuclear threat. As the weaker side in the highly asymmetrical nuclear and conventional military balance, Pakistani planners may reach the conclusion that only a first-strike option will provide maximum nuclear deterrent credibility. Pakistani planners would

[45] K. Alan Kronstadt, India-U.S. Relations, Issue Brief for Congress (IB93097), Congressional Research Service, The Library of Congress, January 29, 2003.
[46] Rodney Jones, "Is Stable Nuclear Deterrence Feasible?" *The Friday Times*, February 22, 2002.
[47] Ashley Tellis, India's Emerging Nuclear Posture: Between Recessed Deterrent and Ready Arsenal, Rand Corp., Santa Monica, CA, 2001, p.357.

need to operationally define "red lines" that, if crossed, would set nuclear strike preparations in motion. These redlines need not be publicly stated.[48]

In January 2002, General Kidwai, head of the Strategic Plans Division (SPD), conducted an interview with Italian researchers from the Landau Network – Centro Volta.[49] Kidwai said that Pakistan's nuclear weapons are stored in a disassembled state but can be assembled "very quickly." He added that Pakistan had no interest in developing battlefield nuclear weapons for artillery. Moving to deterrence Kidwai said, "In case deterrence fails, they (nuclear weapons) will be used if:

- India attacks Pakistan and conquers a large part of its territory;
- India destroys a large part of either Pakistan's land or air forces;
- India proceeds to the economic strangling of Pakistan; or
- India pushes Pakistan into political destabilization or creates a large-scale internal subversion."

Questioned about the stability of this strategy, Kidwai stated that India and Pakistan would conduct "rational decision making" and stay away from the nuclear threshold. He added that Pakistan does not currently plan to develop and publicize a nuclear doctrine like the draft one released by India in 1999.

Pakistan's defense authorities began organizing a formal nuclear planning system and inter-service chain of command in early 1999. [50,51] Prime Minister Sharif announced the establishment of National Command Authority (NCA) for nuclear weapons in a May 20, 1999 speech. Gen. Musharraf (then the Chief of Army Staff) announced on February 2, 2000 that the National Security Council had formed the NCA. The NCA has two committees that provide a management and coordination mechanism among the services. The Employment Control Committee (ECC) sets nuclear employment policy and would convene in a crisis to decide responses. The ECC is chaired by the political head of government (constitutionally the Prime Minister) and includes the security cabinet ministers, chairman of the Joint Chiefs of Staff, the military chiefs, the head of the

[48] Husain Haqqani, "Withdraw the Indian Threat of War," *International Herald Tribune*, 11 June 2002.
[49] Maurizio Martellini, Paolo Cotta-Ramusino, "Nuclear Safety, Nuclear Stability and Nuclear Strategy in Pakistan," January 2002 (www.landaunetwork.org).
[50] Rodney Jones, "Minimum Nuclear Deterrence Posture in South Asia: An Overview," p. 32.
[51] Cordesman, p. 6.

NCA's Strategic Plans Division,[52] and technical advisors. The Development Control Committee (DCC) is responsible for the development and production of nuclear weapons, delivery systems, and related equipment. The DCC is chaired by the political head of government with the other members being military and technical. This structure gives ultimate responsibility for decisions on nuclear weapon use to the head of government.

4.3 The Concept of Limited War in Southern Asia

The concept of limited war has been raised as an option in Southern Asia since the nuclear tests of 1998. In general, total war is aimed at the destruction of the enemy regime and possible conquest of the nation while limited war seeks only to resolve a conflict that does not endanger the survival of either belligerent. Characteristics of total war are violence directed against civilian populations as well as armies in the field and mobilization of an entire society (e.g., conscription, a war economy). The concept of limited war within the context of nuclear-armed states was argued in the 1950s from two different perspectives: the first was based on Cold War strategy and advocated limited war to enhance national security; and the second was based on humanitarian principles that focused on limiting the nature of war to protect the civilian population.

The Kargil conflict is the first example of limited war in a nuclear South Asia. India responded in a measured way (such as ordering its forces not to cross the LOC). In January 2000, Indian Defense Minister Fernandes and Army Chief of Staff Malik laid out an architecture for future limited war with Pakistan (and by implication China) during two seminars.[53] Drawing on the Chinese doctrine of local border wars, Fernandes emphasized that limited conventional wars would be the wars of the future and that the Indian military should be prepared to fight and win such wars. Fernandes said:

"Nuclear weapons did not make war obsolete; they simply imposed another dimension on the way warfare was conducted. … There was the perception (in Pakistan) that the overt nuclear status had ensured that covert war could continue and aggression across the LOC could be carried out while India would be deterred by the nuclear factor.

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[52] The Strategic Plans Division supports the ECC and has four Directorates: 1) Operations and Strategic Plans, 2) Strategic Weapons Development, 3) Control, communications, computer, and intelligence (C^4I), and 4) Arms Control and Disarmament.

[53] Institute of Defense Studies and Analysis Seminar, "The Challenges of Limited War: Parameters and Options," New Delhi, January 5, 2000.

… Obviously they have not absorbed the real meaning of nuclearization: that it can deter only the use of nuclear weapons, but not all and any war. Elementary reading of history would tell us that 30 years ago two nuclear-armed neighboring countries – China and the Soviet Union – had fought a bitter war across their borders. So the issue was not that war had been made obsolete by nuclear weapons, and that covert war by proxy was the only option, but that conventional war remained feasible, though with definite limitations, if escalation across the nuclear threshold was to be avoided."

Malik reinforced this perspective:[54]

"India must remain operationally prepared for the entire spectrum of war – from proxy war to an all out war. … Strategy adopted for Kargil, including the LOC constraints, may not be applicable in the next war. In all limited wars the only commonality would be the national aim and objectives."

In response to a question during an interview in February 2000 about how limited war would work against Pakistan, Fernandes said: "We have fought only limited wars with Pakistan and I am not trying to propound a new thesis. What I am trying to say is that limited wars, confined to a geographical area such as we witnessed in Kargil, are inevitable with a hostile neighbor."[55]

How India would respond to localized military actions or unconventional conflict – short of nuclear weapon use – is a closely held secret. Gen. V.R. Raghavan (ret) described a series of conceptual actions that might be implemented by India and Pakistan with the goal of maintaining nuclear discipline:[56]

- Declaring a moratorium on further nuclear tests;
- Pledging not to deploy nuclear weapons;
- Pledging not to transfer nuclear weapon technology to other countries;
- Supporting the negotiation of a fissile material control regime at the Conference on Disarmament; and
- Endorsing the goal of continuing a dialog to resolve bilateral issues.

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[54] "Limited War Can Erupt Anytime: Malik," *Times of India*, January 6, 2000.
[55] "Pakistan Unpredictable," *Asia Wee*k, February 11, 2000, Vol. 26, No. 5.
[56] V. R. Raghavan, "Limited War and Nuclear Escalation in South Asia," *The Nonproliferation Review*, Fall-Winter 2001, pp. 82-98.

Raghavan argues that the effectiveness of nuclear weapons is related to the extent to which the two countries deter each other. Nuclear deterrence between two countries will operate best when both fully understand each other's capability and decision-making processes. There is, on both these issues, more opacity than transparency between India and Pakistan. Doubts and mistrust combined with disinformation may encourage both countries to seek a deterrence advantage. The stability of deterrence between India and Pakistan runs the risk of being affected adversely by the uncertainty about who has an advantage. Nuclear deterrence between India and Pakistan is therefore of an uncertain quality. It is neither based on deterrence stability, nor on a desire to seek it.

With this context for limited war, the role of ballistic missiles is destabilizing. Instability results from the perception of ballistic missiles having a dual conventional/nuclear capability. Both India, Pakistan and, too a lesser extent, China propagate this perception in ambiguous official statements. This ambiguity stimulates speculation in the press and academic communities about the nature of limited (and by extension general) war, which in turn affects public attitudes and policy. Ambiguity has the effect of lowering the nuclear threshold because preparation, movement, or use of conventionally armed ballistic missiles stimulates a response based on the potential or expectation for nuclear weapon use.

5.0 Scenarios for Ballistic Missile Deployment in Southern Asia

The preceding sections have presented the historical, strategic, and operational factors associated with the deployment of ballistic missiles and nuclear weapons in Southern Asia. This section contains a set of scenarios used to assess stabilizing/destabilizing effects of ballistic missile deployment. The scenarios address both Indo-Pak and Indo-Sino situations. The goal was to identify the stabilizing and destabilizing factors in each scenario as well as common themes between the scenarios. These factors are used as the basis for the development of operational concepts to improve stability presented in Section 6.

5.1 Scenario 1: India-Pakistan Crisis in Kashmir

This scenario addresses the situation of a military crisis and build-up in Kashmir. Low-intensity conflict, involving both regular and irregular forces, has been ongoing in Kashmir since 1989. The 2002 crisis was initiated and sustained by terrorist attacks in Kashmir and at the Indian Parliament. India and Pakistan engaged in a classic action-reaction escalation response to the other's military preparations. In the scenario, infiltration continues across the LOC and India threatens to destroy Kashmiri terrorist bases. The conflict would occur within the context of limited war, as described in the previous section, with military activity limited to Kashmir.

Artillery rockets (with ranges up to 40 km) are deployed with ground forces but ballistic missiles are not normally garrisoned in or near Kashmir. In the chain of escalation, the question is whether SRBMs would be moved to positions in or near Jammu and Kashmir where they are capable of striking targets with conventional warheads. MRBMs do not have a role because they have primarily nuclear missions and are too few and expensive to use in conventional missions in Kashmir. Relatively small numbers of missiles (e.g., 50) are available for deployment. These missiles are capable of striking military force concentrations or large facilities outside of Jammu and Kashmir. Distances to potential targets are so short that each side might not wait to confirm an attack warning or assess the nature of a strike (i.e., from aircraft, rocket, or ballistic missile) before reacting. The fog of war makes these judgments difficult.

Ballistic missile units in both India and Pakistan are controlled at the general headquarters level rather than at the corps commander level. The decision to arm missiles with nuclear warheads is made by the national command authority. There is the potential for an escalation jump by the weaker party, Pakistan, in an attempt to shock the stronger party, India, if preemption could destroy most of Pakistan's retaliatory capability. This could stop the conflict or expand it outside of Kashmir. Given the relatively small number of ballistic missiles on both sides, they would likely be held as a reserve and used for emergencies or if air strikes were ineffective. The movement and concentration of ballistic missile units has the side effect of creating an attractive target for preemption.

5.1.1. Destabilizing factors:

- Asymmetry regarding national statements of no first use of nuclear weapons

- Ambiguous official statements about the role of ballistic missiles
- Potential for dual conventional and nuclear missions for missiles
- Uncertainty of the status and location of missiles (e.g., unpacked or assembled, prepared for flight, dispersed from their base, moved to their launch locations, armed with warhead).
- If one side detects the other's missiles moving, even for defensive purposes, it may be perceived as preparation for an attack
- The potential for an accidental or unauthorized missile launch to ignite or escalate a conflict
- Short time of flight to prospective targets
- Short time to react combined with incomplete information may encourage preemption of key military assets by the other side ("use it or loose it")
- Strikes by artillery rockets may be mistaken for ballistic missiles.

5.1.2. Stabilizing factors:

- The relatively low numbers of ballistic missiles with medium accuracy present negates the utility of conventional attacks on point targets
- Mobile missiles are difficult to track and constitute a survivable deterrent force
- Delay is created by the process of preparing and moving missiles to launch points relatively near the LOC
- Delay is created by the necessity of mating separately stored warheads to missiles
- Neither country has a history of targeting population centers during conflicts.

5.2 Scenario 2: India-Pakistan Missile Race and Military Exercises

In the future, India and Pakistan plan to build larger ballistic missile forces with a greater variety of missile types. Larger missile forces increase each country's military options. In particular, they increase the likelihood of a conventional role for missiles. There are two reasons for this: the number of missiles will likely exceed the number of nuclear warheads available and multiple conventionally armed missiles can be launched at targets increasing the probability of destruction. New missiles with longer ranges increase targeting options and do not require missile units to deploy near the border. Improvements in accuracy enable the consideration of a counterforce role when armed

with nuclear weapons and conventional strikes on point targets. All Indian and Pakistani missiles are mobile which increases the difficulty in assessing the status of these forces.

In this scenario, bilateral relations are stable although low intensity conflict continues in Kashmir. Both India and Pakistan periodically conduct large military exercises along the international border. Mobilizations also occur for purposes of political signaling. Missile test flights may be conducted by either side concurrently with the exercise. A concern of both countries is that an exercise is a precursor to an attack across the border. Such an attack would constitute full-scale war rather than a limited conflict. In this situation, ballistic missiles would be used in the opening phases of the conflict in nuclear and/or conventional roles to attack key military facilities and troop concentrations. Relatively large numbers of missiles (e.g., 200) are available for deployment. The status of ballistic missile units thus becomes very important. Ambiguity regarding their status and intentions can lead to an action-reaction cycle where one side increases the alert level of its forces in response to perceived actions by the other. There are several concerns associated with ballistic missiles:

- Whether ballistic missile units are participating in the exercise
- Whether ballistic missile units have left their garrisons
- Whether there is an increase in activity at missile garrisons within range of the other country; and
- Whether nuclear weapons been removed from storage.

5.2.1. Destabilizing Factors:

- Asymmetric policy regarding the first use of nuclear weapons and uncertainty by Pakistan about India’s commitment to its non first-use pledge
- Missile tests conducted during these periods of mobilization are provocative and might be mistaken for an offensive launch.
- Uncertainty about location and status of ballistic missile units
- Ambiguity about whether nuclear warheads exist for a missile type
- Uncertainty about whether a nuclear capable missile is carrying a nuclear warhead
- Ambiguity about the other side’s missile command and control
- An accidental or unauthorized launch could ignite a conflict

- Short flight times to target
- Detection of any missile-related activity may be interpreted as hostile.
- The long standoff range of MRBMs make detection and assessment by intelligence organizations difficult
- Short time to react combined with incomplete information may encourage preemption of key military assets by the other side.

5.2.2. Stabilizing Factors:

- Neither country has a history of targeting urban populations during conflict
- Ballistic missiles compensate for Pakistan's concern about its weaker forces and lack of strategic depth
- Delay is created by necessity of mating separately stored warheads to missiles
- Mobile missiles are difficult to detect and track enhancing their deterrent effect
- Neither side has a missile defense system which enhances deterrence
- Missile tests are not normally flown in the direction of the border.

5.3 Scenario 3: India-China Missile Race

As described in section 2.2, India and China have the potential to become strategic competitors in the Indian Ocean region. In addition, there is the stable but still unresolved border dispute. There is currently a significant asymmetry between China and India in that China can target virtually all of India while India has no comparable response. The reported Chinese missile bases at Kunming, Yunnan province and Xining, Qinghai province may include India as a targeting option (see map in Figure 2).[57] Neither country has a significant strategic bomber force. Under this scenario, India's long-term threat assessment concludes that it needs to have a retaliatory capability to deter Chinese coercion or attack during potential future crises. Furthermore, it concludes that a new IRBM is needed to reach targets in the Chinese heartland. Consequently India deploys the Agni-II MRBM in northeast India against potential targets in southern China and actively develops the Agni-III IRBM. India's goal is to create a credible deterrent to China but not seek numerical parity in missiles or nuclear warheads.

[57] Nuclear Threat Initiative, http://www.nti.org/db/china/sac.htm

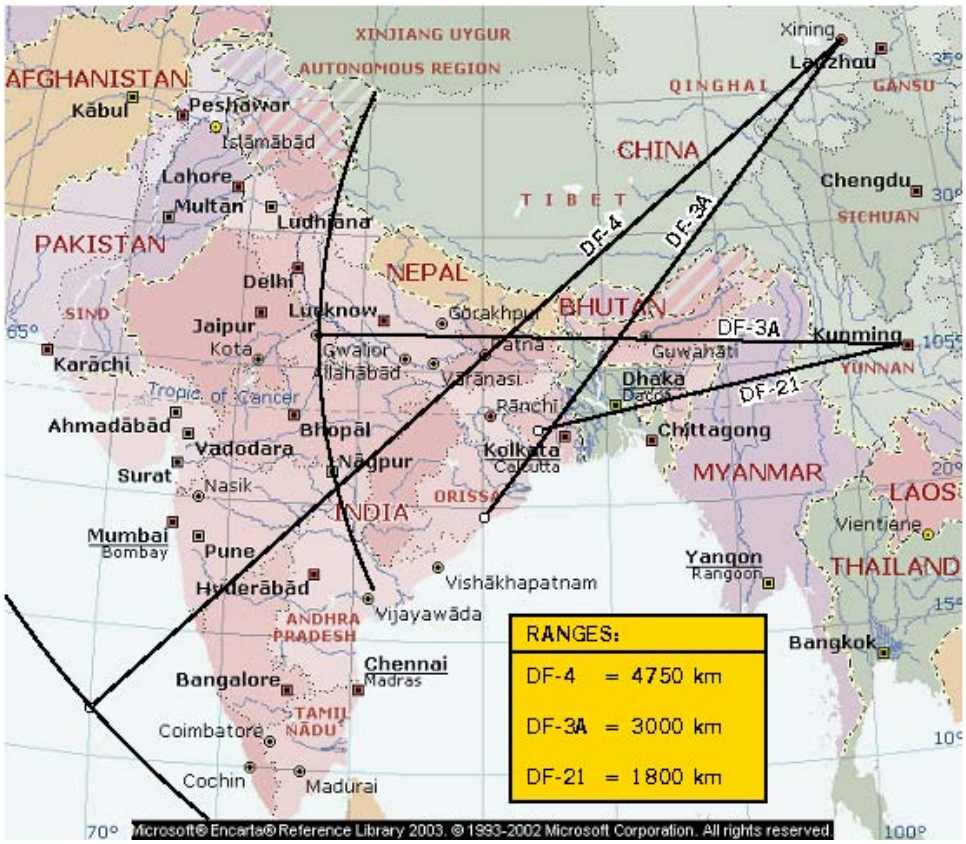

Figure 2: Missile targeting coverage of India from Chinese bases

5.3.1. Destabilizing factors:

- Pakistan may view expanded Agni-II deployment and Agni-III development as being a threat
- Neither country has good intelligence coverage of the other's missile forces and reports of missile activity may be interpreted as hostile
- China might respond by increasing the number of IRBMs or ICBMs directed at India or deploy SRBMs or MRBMs in Tibet in response creating an arms race
- China might aid Pakistani missile development and deployment.

5.3.2. Stabilizing factors:

- Indian plans to deploy only small numbers of Agni missiles
- Survivability of Indian missiles is enhanced by mobility while most Chinese missiles capable of reaching India are fixed
- Both countries have a declared no first-use policy for nuclear weapons

- China does not view India as a primary threat and may not react to the Indian program
- The absence of a missile defense enhances the deterrent value of missile forces
- Technical and numerical limitations will probably result in both countries using a countervalue strategy with a high threshold for nuclear weapon use.

5.4 Important Factors in the Scenarios

A number of stability factors were found to play a common role in two or three of the scenarios. On balance there appears to be more destabilizing than stabilizing factors resulting from missile deployment. The most important factors are listed below. One factor, uncertainty about mobile missile location, can be either destabilizing or stabilizing depending on the context of the scenario. These stability factors provided the basis for the development of proposals presented in Section 6.0.

5.4.1 Primary Destabilizing Factors

- Official statements implying almost all missiles are “nuclear capable” creates ambiguity
- Missile tests conducted during periods of tension are provocative
- Ambiguity regarding whether a specific missile is nuclear armed
- Concern that the other side’s command, control and security of missiles and nuclear weapons may permit an accidental or unauthorized launch
- Concern about preemption causes missiles to be deployed defensively early in periods of tension
- Incomplete or inaccurate intelligence information may indicate that an attack is pending and support a decision for preemptive action.

5.4.2 Primary Stabilizing Factors

- Small numbers of MRBMs and IRBMs are to be deployed
- Delay results from the process of warhead mounting, missile preparation, and movement
- Missiles are located in garrisons during normal conditions.

6.0 Options for Enhancing Stability

6.1 A General Approach to Achieving Stability

This section presents a series of concepts for political and operational measures to improve overall stability associated with ballistic missiles in Southern Asia. These measures are intended to weaken the destabilizing factors and/or reinforce the stabilizing factors identified in the previous section. The measures could in implemented singularly or as an integrated system (often called a "regime"). The later approach is more effective but would likely be more difficult to negotiate.

India, Pakistan, and China recognize the dangers associated with ballistic missile development, induction, and deployment. What is needed are practical proposals and political will. The Lahore Declaration of 1999 included a commitment to "take immediate steps for reducing the risk of accidental or unauthorized use of nuclear weapons and discuss concepts and doctrines with a view to elaborating measures for confidence building in the nuclear and conventional fields, aimed at prevention of conflict."[58] To this effect, the Lahore Declaration issued a Memorandum of Understanding that included specific nuclear confidence-building measures, including prior notification of ballistic missile tests, a continuation of their unilateral moratorium on nuclear testing, and dialogue on nuclear and security issues.

Each country has raised the topic of missile control. For example, Pakistan Foreign Minister Abdul Sattar proposed several measures for missile control as part of a strategic restraint regime in South Asia during a speech to the UN Conference on Disarmament on March 28, 2002:[59]

- Non-deployment of nuclear-capable ballistic missiles
- Formalization of the understanding to provide adequate prior notification of flight tests of missiles
- A moratorium on the acquisition and deployment of anti-ballistic missile systems

[58] Ministry of External Affairs, Government of India website: www.meadev.nic.in/
[59] Conference on Disarmament, Final Record of the 900th Plenary Meeting, 28 March 2002, CD/PV.900.

- Confidence-building measures to reduce the risk of use of nuclear weapons by miscalculation or accident.

There are several generic strategies for reducing uncertainty, deceasing tensions, and increasing stability: declarations; notifications; transparency; constraints; and reduction of capability.

Transparency is a key tool reducing tensions and threat perceptions. The United Nations defines transparency as "The systematic provision of information about specific aspects of military activities under formal or informal international arrangements."[60] Such information can be provided by on-site inspection and technically based monitoring as well as by reports. Sometimes it may be in a country's own interest to act unilaterally to avoid misinterpretation of intent. In practice, there is a role for both transparency and opacity in measures to reduce the threat perception from missiles and increase stability.[61] Information to be shared might include everything from force levels to testing plans. However, choosing not to share certain information – retaining some opacity – can serve to enhance stability. For example, information such as system deployment locations, system vulnerabilities, and performance capabilities figure heavily in a country's deterrent strategy and unlikely to be shared. According to Biringer, transparency leads to greater stability when the following criteria are achieved:

- Increased symmetry of ballistic missile forces and/or capabilities;
- Increased warning time or reduced likelihood of preemption success;
- Reduced likelihood of misinterpretation of intent; and
- Minimized vulnerabilities for all sides.

6.2 Stabilization Options Applicable to Missile and Nuclear Strategy

Renew adherence with existing security agreements (*India-Pakistan-China*)

The recent period of crisis between India and Pakistan has caused some of these agreements to become dormant. Declaring that these agreements (e.g., non-targeting of

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[60] United Nations Experts Group, *Study on Ways and Means of Promoting Transparency in International Transfers of Conventional Arms*, Report to the Secretary General, UN Doct. A/46/301, September 9, 1991.
[61] Kent L. Biringer, "Missile Threat Reduction and Monitoring in South Asia", *The Stability-Instability Paradox: Nuclear Weapons and Brinkmanship in South Asia*, Michael Krepon and Chris Gagne, editors, (The Henry L. Stimson Center, Washington, D.C.), Report no. 38, June 2001, p. 60 (www.stimson.org).

nuclear facilities, advance notice of military movements and exercises) are still valid and that the country will perform the required acts necessary to implement them would be a step to rebuild relationships and increase confidence. This can be a unilateral action. Countries should consider either unilateral or multilateral ways to expand the scope of information exchanged (for example, the purpose of the movement or exercise, the type of weapons included, whether ballistic missiles are included in the military movement).

Maintain and/or declare no-first-use of nuclear weapons policy (*India-Pakistan-China*)

India and China have public no-first-use policies. Pakistan maintains a policy of ambiguity. India and China should maintain and unambiguously declare their non-first – use policies. Pakistan should declare a no-first-use policy. These acts could be unilateral or coordinated as a joint multilateral statement.

Enter into a de-targeting agreement (*India-China*)

India's nuclear and long-range missile programs were motivated in part by the its perceived threat from China. As described earlier, India's development programs have had the side-effect of stimulating Pakistan's nuclear and missile programs. India and China should enter into a de-targeting agreement as a confidence-building measure. A precedent for de-targeting was established in January 1994 when US President Clinton and Russian President Yeltsin agreed in the Moscow Declaration to redirect their strategic missiles to open ocean areas. Subsequently, the US and China entered into a de-targeting agreement. Although, de-targeting is largely symbolic, it publicly signals the intent to reduce tensions and work cooperatively to increase stability.

Declare missiles with less than 300 km range as non-nuclear (*India-Pakistan*)

Missiles with less than 300 km range are currently the most common type system in India and Pakistan. They are not efficient delivery systems for nuclear weapons. Their range is so short that they – and their nuclear cargo – would have to move close to the border in order to attack strategic targets. In addition, the forces are vulnerable to collateral damage from their own weapons. These missiles also have conventional missions in a crisis or conflict so their movement becomes particularly sensitive to the other side. If either or both countries declared these missiles to be non-nuclear, it would

be a significant step to decreasing threat perceptions and increasing stability. The missiles covered would be the Prithvi-1 and 2 for India and the Hatf-1, 2, and 3 for Pakistan. This declaration could be a unilateral or bilateral option. Pakistan has declared the Hatf-1 and 2 to be non-nuclear. India originally declared the Prithvi-1 and 2 to be conventional but later implied it also had a nuclear capability.

Eliminate a functional class of missiles (*India-Pakistan*)

As confidence increases as a result of the previous steps, India and Pakistan should work to establish an SRBM (150 – 800 km) elimination treaty. These missiles are the ones most likely to have a dual conventional/nuclear role (India: Prithvi-2, Agni-1; Pakistan: Hatf-2, 3, 4). The most effective way to resolve the problem of ambiguity in warhead type is to eliminate the systems entirely. Battlefield short range ballistic missiles (Prithvi-1 and Hatf-1) would be retained as would artillery rockets. MRBMs and IRBMs would not be affected enabling India to retain a strategic deterrent against China and Pakistan against India. Procedures to implement and verify the elimination of these missile systems could be based largely on the successful INF Treaty between the US and Soviet Union. Verification was largely based on on-site inspection.

Ban future deployment of sea-launched ballistic missiles (*India-Pakistan*)

Both India and Pakistan have programs to develop sea-launched ballistic missiles with India's being the most advanced. India's draft nuclear doctrine, released in 1999, calls for a triad of delivery systems. Deploying ballistic missiles at sea would a significant event and accelerate the arms race in the subcontinent. A bilateral agreement not to develop and deploy such missiles would decrease tensions and avoid an extremely expensive endeavor both countries. Cruise missiles would not be part of this agreement because their relatively short range restricts them to tactical applications. Furthermore, their small payload restricts them from carrying nuclear weapons – at least without further nuclear testing to develop small warheads. India and Pakistan's land-based MRBMs and IRBMs provide an effective deterrent force against each other as well as against China for India.

6.3 Stabilization Options Applicable to Uncertainty in Missile Operations

Separate ("de-mate") warheads and missiles (*India-Pakistan-China*)

This is a declared on-going practice for nuclear weapons that should be re-affirmed publicly. Monitoring to create limited transparency would be useful. There is a precedent for nuclear monitoring in INF Treaty. Although difficult to implement and requiring significant confidence and political will, a conceptual approach would be to remotely monitor stored missiles to provide assurance that warheads have not been mounted. It would be essential to conduct this monitoring *without* providing geographic location of storage and thus creating a destabilizing vulnerability.

Declare number of missiles (by type) and launchers (*India-Pakistan-China*)

This option would create a measure of transparency without revealing sensitive information. The countries could implement this by participating in the UN Transparency in Armaments Program. This option would probably require an informal multilateral agreement to jointly enter the transparency in armaments program; it might be done unilaterally to signal the intent to build confidence.

Continue and enhance pre-notification of missile tests (*India-Pakistan*)

India and Pakistan currently provide 48 to 72 hours notice of missile test launches. The Lahore Protocols called for such pre-notification but did not specify a length of time. The two countries have informally followed the guidelines of the Lahore Protocol even during the crisis of 2002. This practice should be continued and formalized. In addition, it should be enhanced by declaring the number of tests planned in next year. The advance notice of the test should be increased to 7 to 14 days. This would help to de-link the test from political signaling while retaining flexibility for technical development requirements.

Conduct test launches from coastal sites over ocean (*India-Pakistan*)

In coordination with a formal missile test prenotification agreement, both sides should conduct their missile test as far way from the other country as possible, over the ocean, and away from the border. India usually tests from sites on its east coast. Pakistan

usually tests relatively near the border and occasionally from its facility at Sonmiani Bay in Sind province. Pakistani flight test activities should be consolidated at Sonmiani Bay.

Create missile non-deployment zones (*India-Pakistan*)

This is more advanced form of cooperation that would require enhanced confidence. Restricting deployment of missiles from specific geographic locations moves them away from preferred launching points, so that likely targets are outside of their range. An alternative approach is to restrict mobile missiles to their garrisons. Without verification, an agreement to restrict geographic deployment is ineffective. However, monitoring could increase instability if it provides information that enables targeting of missile forces. Therefore monitoring must provide information that is geographically and temporally specific enough to provide assurance that the parties are complying with the agreement, yet not so specific that it creates vulnerabilities.

A new monitoring concept is to apply active tags to missiles or TELs that report to the other party if they enter a non-deployment zone. The tag would be based on geographic information system (GIS) software and GPS data. The shape and coordinates of the non-deployment zone are entered into the GIS software. The tag receives signals from GPS satellites, determines its position, and compares it to the boundaries of the zone using the GIS. If the tag is within the zone, it reports that fact using a cellular or satellite telephone modem. The report does not include the specific location of the tag and thus does not create vulnerability. The tag would include features to detect tampering. During operation, the tag would report its state-of-health periodically, including whether it had been removed or opened. Failure to report would constitute an incident. Interception of the tag's cellular or satellite telephone signal does not provide geographic information that is detailed enough for targeting purposes unless intercepted very close to the point of transmission.

An alternative approach would be to declare agreed missile forces by type, number, and location. Each side has right to call a "census" of declared missile forces. There are two options to monitor the agreement.

Option 1: Mobile missile launchers might be monitored if imagery were collected cooperatively. The approach is based on restricting missiles to a geographic zone with the

option for the parties to call a "census" of declared missiles. The census would require the missile launchers to move to positions within the zone where they could be photographed. The launchers would have several hours to move into position. At the agreed time, a commercial satellite or an aircraft would image the entire zone. After imaging the launchers would disperse. There is a time lag from the when the image is taken to the when it is available for analysis. This results from the time required to download the data from a satellite to a ground station or for the aircraft to return to base and its film to be processed. This lag is used to prevent the missile launchers from being targeted as a result of the imaging. In practice, it means that the declared missiles can move no farther from the zone than the period available to return if a census is called. Care must be taken to distinguish between decoys and actual launchers in an image.

Option 2: Conduct census by on-site observation under defined rules for timing. The INF Treaty between the US and the USSR contains some potentially applicable rules and procedures for conducting challenge inspections.

Base MRBMs and IRBMs in fixed hardened structures (*India-Pakistan-China*)

Mobile missile launchers are survivable but create uncertainty and concern about their status and location. It would be possible to create survivable deterrent force without the uncertainty associated with mobile launchers by locating the missiles in fixed hardened sites. This is a unilateral action that also improves security, command, and control. The size and locations of the missile force could be monitored by imagery from commercial satellites or aircraft providing a measure of transparency.

6.4 Stabilization Options Applicable to Perception and Preemption

Incorporate access control into missile storage facilities (*India-Pakistan*)

This is a unilateral action that improves security at storage sites. If publicized in a general way, it would create confidence in the other side that missiles could not be accessed or used by unauthorized people. A number of access control technologies are available from the security and commercial nuclear industries. In addition to the missiles themselves, access control should be applied to transporter-launchers, warheads, and key ancillary equipment. Figure 3 shows a picture of an access control system that confirms the identity of individuals based on the geometry of their hands.

Figure 3: Access control device using hand geometry for identification

Integrate use-control mechanisms on launch system (*India-Pakistan*)

Improved use-control improves security as well as command and control. If publicized generally, it builds confidence in the other side that missiles would not be launched accidentally or by unauthorized individuals. Several options are possible. A 2-man rule for launch procedure steps should be implemented. A more advanced use-control option is to require that both the missile unit commander and deputy simultaneously use dual keys to enable the launching process. An alternative approach would be for the commander to use a physical or "hard" key while the General Headquarters transmits an encrypted numeric key (a "soft" key) to enable the launching process. An example of a soft key is a password to use an automatic teller machine.

Implement a "Personnel Reliability Program" for missile crews and missile control headquarters staff (*India-Pakistan-China*)

This is a unilateral measure that improves security and reliability. If publicized generally, it builds confidence in the other side that missiles would not be launched accidentally or by unauthorized individuals.

Re-deploy most capable counter-force aircraft to rear bases (*India-Pakistan*)

Concern of pre-emption may cause a country to defensively deploy mobile missile launchers early in a crisis. The other side may interpret this action as offensive and escalate in response. One approach would be to redeploy counter-force strike aircraft away from the border so the threat of preemption would not be so urgent. The most capable nuclear/conventional strike aircraft in the Pakistani and Indian Air Forces respectively are the F-16s and the Mirage 2000s. Each country has approximately equal numbers of these aircraft. These F-16s could be redeployed from Sargoda Air Force Base (AFB) to Quetta AFB and the Indian Mirage 2000s from Gwalior AFB to Calcutta or Orissa AFBs. (Figure 4)

Figure 4: Deployment of Strike Aircraft to Rearward Bases

Install barriers at storage sites or launchers to create stabilizing delays (India-Pakistan-China)

Installing barriers at storage sites or launchers would create stabilizing delays that reduce the need for short-notice or "hair-trigger" deployment. Such actions would need to be multilateral. A barrier installation could be as simple as placing very large and heavy concrete blocks in front of the doors of storage facilities. These blocks would need to be

moved by specialized equipment before the missiles could be withdrawn. Remote monitoring could be conducted to assure the barriers remain in place. An alternate and more technical approach is to incorporate time-delayed access control systems similar to timed locks used in bank vaults.

7.0 Conclusions

Ballistic missiles are now a fact of life in Southern Asia. Combined with nuclear weapons, missiles have changed the strategic landscape in the region. Nuclear armed missiles can provide a survivable and credible deterrent force. Used as conventional weapons, the relatively low cost and operational flexibility of ballistic missiles enable a military weak state to counter its numerical inferiority in other areas. According to some neo-realist defense analysts, the Indian and Pakistani nuclear tests of 1998 were going to produce a degree of stability. Overt and deployed nuclear capabilities and delivery systems would be the "great equalizer" between India and Pakistan and enhance the prospect for more peaceful relations. According to this argument, the risk of nuclear war would encourage both countries to disengage from their low-intensity warfare in Kashmir. The historical record suggests otherwise. In the five years since the tests, relations between India and Pakistan have been characterized by instability and crises.

The growth of ballistic missile forces in the region thus has both stabilizing and destabilizing effects. The uncertainty about the status of an opponent’s missiles, short warning time and the consequences of a sudden attack may cause a country to strike pre-emptively in the early stages of a crisis. This study assessed the effects of current and likely ballistic missile development and deployment within the historical and strategic context of Southern Asia. Through the use of realistic regional scenarios, a number of common factors effecting stability were identified. Perhaps the most dangerous factor is the practice of using the same missile system for both conventional and nuclear missions.

Based on this analysis, the study defines a number of options – both unilateral and cooperative – to increase overall stability. The options include actions such as selected transparency to reduce threat perceptions. The options can be initiated individually or as an integrated set or “regime.” The latter approach is the most effective. Some may

consider these options to be utopian in the current political environment. Political will and trust are always in short supply in Southern Asia, but opportunities do arise. There are unilateral options presented that improve overall stability and do not require much political will because they are in the country's best interests. Such unilateral steps, combined with incremental engagement on security topics, could create the environment for cooperative and reciprocal actions. Governments should therefore be prepared when opportunities for reconciliation arise. The study of these options, their refinement, and the development of additional ones would support this process.

Every journey begins with a first step. India, Pakistan, and China have not been historically receptive to monitoring and verification of security agreements, but the Chemical Weapons Convention set a significant precedent. Although all three countries are advanced in defense matters, this expertise has not been applied to improving stability. Third parties could play a beneficial role by conducting demonstrations and training. The three countries could send observers (individually or together) to see how other nations implement the practical aspects of monitoring and transparency. Cooperation in implementing or evaluating an experiment demonstrating a stabilization option would be particularly helpful. It would increase understanding of procedures and tools and could become a basis for building confidence between India, Pakistan and China. Finally, all three governments should establish working groups within their defense and foreign policy establishments to systematically develop options and assess how to implement them.

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Appendix A: Ballistic Missile Fundamentals

Missiles as Military Weapons

A ballistic missile is one whose payload reaches its target by means of an initial powered boost phase followed by free flight along a high arcing trajectory. Part of the flight may occur outside the atmosphere. Guidance occurs during the boost phase and, in more advanced systems, during the final phase of their trajectory. Ballistic missiles fly at supersonic speeds and carry their own fuel oxidizer unlike air-breathing cruise missiles.

Missile accuracy is normally described as "circular error probable" (CEP) – a statistical measure of the distance from the aim point within which 50% of the missiles fired will impact. The measure reflects the operational variability between individual missiles caused by variation in engine performance, calibration, or system control. Most of a missile's deviation from its intended trajectory occurs during the boost phase, and a smooth propulsion system is needed to achieve high accuracy. A CEP can only be estimated with confidence by firing a substantial number of missiles (at least 15) at predetermined aim points. *Overall system error* is a statistical combination of the CEP and the uncertainty associated with the location of the launch point and the target.

The political and psychological reaction to ballistic missile use can be out of proportion to their actual military effect. Missiles consequently have a potential role as terror weapons. During the 1944-45 German missile campaign against England, the highly inaccurate V-2 missile delivered less explosive ordinance than the V-1 "buzz bomb" (an early cruise missile) and manned bombers. Yet the V-2's ability to strike London with 1000 kg warheads and no warning forced Prime Minister Churchill to redirect allied bombers away from strategic targets in Germany to a largely ineffective campaign against launch sites. Iran and Iraq conducted the "War of the Cities" during 1987-88 by firing numerous SCUD missiles at each other's population centers. This campaign contributed significantly to public war weariness in Iran.

Nuclear versus Conventional Missions

The term "nuclear capable" is used somewhat loosely in the literature but appears to have originated with the definition of controlled items in the Missile Technology Control Regime (MTCR) of 1987 (500 kg payload and 300 km range). The goal of the

MTCR is to prevent the proliferation of delivery vehicles for nuclear weapons while permitting conventional systems for self-defense. "Nuclear capable" does not automatically mean "nuclear armed." A missile system, such as the now-retired US Lance, may have both conventional and nuclear warheads. A missile might be physically capable of carrying a nuclear warhead but none has been developed for it such as the US Army Tactical Missile System (ATACMS).

Conventionally armed ballistic missiles are used to engage targets beyond the range of artillery. Some analysts argue that ballistic missiles are either too expensive or not sufficiently accurate to use for conventional military operations.[62] Neither argument fully represents the scope of missile operations.

Cost-effectiveness:

Battlefield and short-range ballistic missiles, the types most likely to be used for conventional operations, are cheaper than aircraft. SCUD missiles are sold for about $1 million each while $30 million is the typical cost for a modern tactical aircraft. In addition, SRBMs require much less infrastructure and training. Strike aircraft need airfields, trainer aircraft, maintenance hangers, flight controllers, etc. plus regular (and expensive) training for all personnel involved. Countries as undeveloped as Afghanistan have operated SCUD missiles.

Operational effectiveness:

The second argument against a conventional role for missiles is that unless accuracy is high, the small effect radius of conventional explosives renders a high probability of target damage or destruction impossible. Warheads that use submunitions have a larger effect radius than unitary high explosive warheads.[63] For large area targets such as airfields and industrial facilities, it may well be cost-effective to launch multiple missiles[64] at one target in order to achieve an acceptable probability of success.

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[62] Steve Fetter, "Ballistic Missiles and Weapons of Mass Destruction," *International Security*, Vol. 16, no. 1, 1991, pp. 5-41.

[63] The American ATACMS uses submunitions to destroy maneuver units, air defense sites, command-control-communications sites, supply depots, and helicopter support bases.

[64] The SCUD-B has a CEP of about 1000 m while more modern SRBMs are in the range of 100 to 200 m.

Inaccurate missiles may also be used as terror weapons against population centers as during the Iran-Iraq war.

Finally, strike aircraft can be countered by air defense systems while missile defense is uncommon and of arguable effectiveness. Although the press has given much coverage to the ability of "smart bombs," most bombs outside of the US military are not smart. Laser-guided systems require a direct line of sight to the target and constant laser illumination so performance is degraded by defensive fire, cloudy weather, dust, and smoke. When unguided bombs are used, their accuracy is comparable to ballistic missiles.[65]

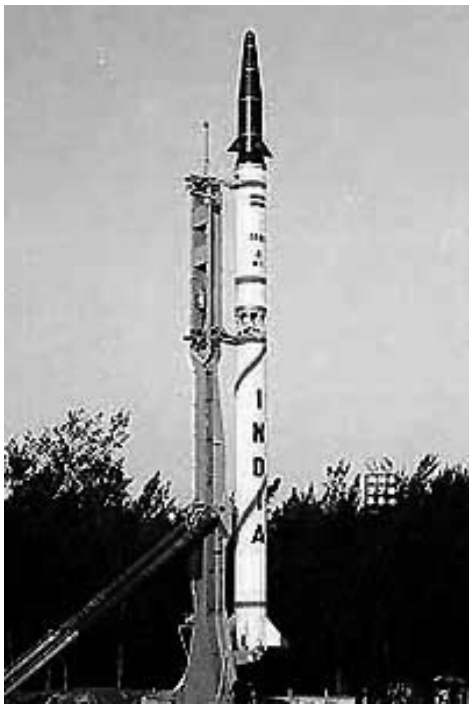
Basing Modes for Ballistic Missiles

There are several types of launchers and basing options. The simplest is the stationary above-ground launch platform. Their disadvantage is that their status can be easily observed and they are relatively vulnerable to attack. These launchers are typically used for test flights or civilian space launchers. A variation is a fixed but hardened structure, such as an underground silo or a tunnel. In the former case, the missile is launched vertically from the hole after the cover is removed and in the latter the missile is moved out of the shelter, raised, and fired. An attacker needs to have a weapon that is sufficiently accurate and powerful to break or block the launch facility. Stationary launchers provide a measure of transparency because their location and numbers are known.

Launchers may be made mobile using trucks or railcars. Mobility increases the effective range of a ballistic missile by enabling it to move closer to prospective targets and provides survivability as a result of the enemy's uncertainty about its location. Special trucks called transporter-erector-launchers (TEL) provide more mobility than trains that are restricted to tracks (Figure A-1). Mobility, however, increases the difficulty of command, control, safety, security, and maintenance. Mobile launchers are normally stored in bases during peacetime conditions. Shocks and vibrations endured while moving may damage missile components (e.g., create cracks in solid fuel motors) so

[65] The estimated CEP of US Air Force bombing during the Korean War was 300 m and 100 m during the Viet Nam War. In Viet Nam, anti-aircraft fire reduced accuracy from test range conditions by 50 to 70%.

continual transit and rough terrain will be avoided. Weather and other environmental exposures during extended periods of dispersal will degrade operational reliability of the missile and/or warhead. Finally, the act of dispersing mobile launchers may be perceived as very provocative if detected by prospective opponents.



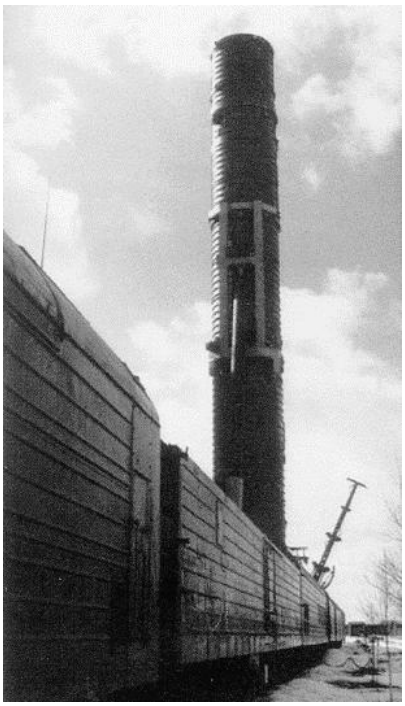


Figure A-1: Launcher types (clockwise): A fixed site for test launches, a Soviet SS-18 railcar launcher, and a Soviet MAZ-543 TEL for the SCUD-B missile

Appendix B: Regional Ballistic Missiles

The descriptions of Chinese, Pakistani, and Indian missiles in the following Tables 1 through 3 are based on publicly available government documents.[66] If multiple estimates of range are given, the low and high estimates are presented. Ranges are based on the nominal design payload and will vary with lighter or heavier warheads. Accuracy is often a function of range with the CEP of older systems in the span of thousands of meters and newer systems in the span of hundreds of meters.

This study uses the range classification categories defined by the Centre for Defence and International Studies (UK).[67] Range is based on the weight of the missile's normal warhead, thus the same missile with a lighter warhead would have a longer range.

- Battlefield Short Range Ballistic Missile (BSRBM) up to 150 km
- Short-Range Ballistic Missile (SRBM) 150 - 800 km
- Medium-Range Ballistic Missile (MRBM) 800 - 2400 km
- Intermediate-Range Ballistic Missile (IRBM) 2400 - 5500 km
- Intercontinental Ballistic Missile (ICBM) over 5500 km

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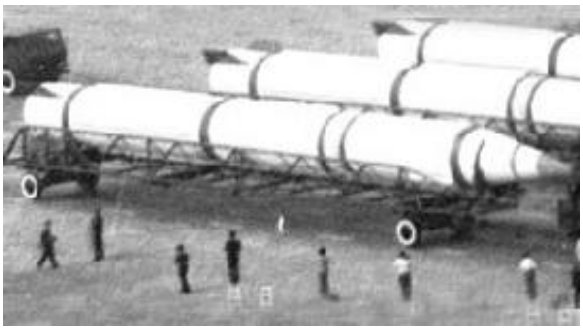
[66] US Government sources: (1) US Army Field Manual 100-12, *Army Theater Missile Defense Operations*, Headquarters, Department of the Army, March 31, 2000. (2) National Intelligence Council, Strategic and Nuclear Programs, *Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015*, September 1999. (3) US Army TRADOC Threat Support Directorate, *OPFOR Worldwide Equipment Guide*, Theater Missiles (chapter 13), November 7, 2000. (4) Report to Congress Pursuant to Section 1305 of the FY97 National Defense Authorization Act, *Selected Military Capabilities of the People's Republic of China*, 105th Congress, July 15, 1997. (5) Executive Summary of the Commission to Assess the Ballistic Missile Threat to the United States, 104th Congress, July 15, 1998. (6) Office of the Secretary of Defense, *Proliferation: Threat and Response*, November 1997.
India Government sources: (1) Ministry of Defense Annual Report for 1999-2000, *Defence Research and Development* (Chap. 8). (2) Press Information Bureau, *Induction of Missiles*, March 14, 2002. (3) Press Information Bureau (Dinkar Shukla), *Testing Agni-II*, April 23, 1999. (4) Ministry of Information and Broadcasting, Research, Reference and Training Division, *The Diary*, Vol. XLIV, 1-15 April 2000.
Pakistan Government sources: Ministry of Information and Broadcasting (multiple statements), (1) *Pakistan Test-Fires Hatf-II (Abdali) Missile*, May 28, 2002. (2) *Country Size Has Become Meaningless After Missile Tests, May 26, 2002*. (3) *President Congratulates Nation on Successful Test of Ghauri Missile*, May, 25, 2002.

[67] www.cdiss.org/bmrange.htm. The US Department of Defense uses somewhat different categories.

Table 1: Chinese Missiles

Name	Alias	Type	Estimated Maximum Range (km)	Remarks
DF-3 *DF-3A*	CSS-2	Liquid fuel IRBM	2800-3100	Oldest system with semi-mobile launchers based in tunnels. The DF-3s are being replaced by the DF-15 and DF-21 - possibly complete in 2002.
DF-4	CSS-3	Liquid fuel, two stage ICBM	5500	The DF-4 uses fixed launch sites.
DF-5 *DF-5A*	CSS-4	Solid fuel, two stage ICBM	13,000	Primary Chinese ICBM.
DF-21	CSS-5	Solid fuel, two stage MRBM	1800	First deployed in 1986, the DF-21 uses mobile launchers. The DF-21A has a radar-based terminal guidance system. The DF-21 is the basis for the JL-1 submarine launched ballistic missile.
DF-15	M-9 CSS-6	Solid fuel, two stage SRBM	600	The DF-15 has a separating warhead that improves accuracy and makes the warhead more difficult track.
DF-11	M-11 CSS-7	Solid fuel, single stage SRBM	300-350	Road-mobile replacement for liquid fueled SCUD.
M-7	CSS-8	Liquid fuel, single stage BSRBM	150	
DF-31	CSS-9	Solid fuel, three stage ICBM	8000	The DF-31 was first tested in 1995 to replace the DF-5. Most recently tested in 1999 and 2000 and may be in the initial phases of deployment. The SLBM JL-2 is based on the DF-31.
DF-41	CSS-10	Solid fuel, three stage ICBM	12,000	Under development to replace DF-5 is scheduled to be ready for service in 2010. It has not been flight tested.

DF-3



DF-4

DF-15

DF-11

DF-21

DF-31

Table 2: Indian Missiles

Name	Alias	Type	Estimated Maximum Range (km)	Remarks
Prithvi I	SS-150	Liquid fueled BSRBM	150	Army version, first tested in 1988. In service.
Prithvi II	SS-250	Liquid fueled SRBM	250	Air Force version tested in 2001. In service.
Prithvi III	SS-350, Dhanush	Liquid fueled SRBM	150-350	Navy version, in development. Tested 2000 (failure) and 2001 (success)
Agni		Liquid/solid fueled, two stage MRBM	1450 (1994 test)	Technology demonstrator first tested in 1989, inertial guidance, not active.
Agni I		Solid fueled, SRBM	800	System is road and rail mobile. First tested in 2002. Design based on the second stage of the Agni-II.
Agni II		Solid fueled, two stage MRBM	2000 - 2500	Rail mobile system with upgraded guidance system.
Agni III		Solid fueled, two stage IRBM	3500 - 4000	In early stages of development

Prithvi-1

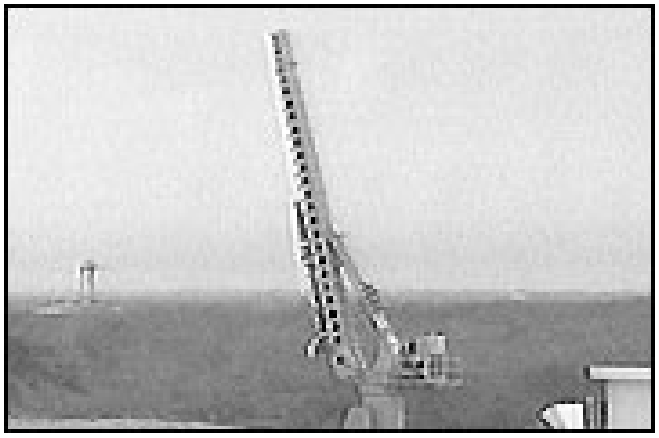
Dhanush (Prithvi-3)

Agni-I

Agni-II

Table 3: Pakistani Missiles

Name	Alias	Type	Estimated Maximum Range (km)	Remarks
HATF 1		Solid fueled BSRBM	80	May be out of service
HATF 1A		Solid fueled BSRBM	100	Indigenous design.
HATF 2	Abdali	Solid fueled SRBM	180	Tested in May 2002. Pakistan authorities have declared that HATF 2 would only carry conventional warheads.
HATF 3	Ghaznavi M-11 (China)	Solid fueled SRBM	290	Tested in May 2002
HAFT 4	Shaheen I M-9 (China)	Solid fueled SRBM	800	Based on Chinese M-9 missile. Tested for the first time in April 1999.
HATF 5	Ghauri I No-Dong I (DPRK)	Liquid fueled two-stage MRBM	1300	Based on DPRK No Dong missile. The Ghauri was tested in march 1998, April 1999 and May 2002.
	Ghauri II Hatf 6 No-Dong II (DPRK)	Liquid fueled, two stage MRBM	1500	The Ghauri-II has a lighter body and warhead resulting in longer range.
HATF 6	Shaheen II M-18 (China)	Solid fueled, two stage IRBM	2500	Based on Chinese M-18 missile. Not tested
HATF 7	Ghauri III	Liquid fueled IRBM	3500	In development, engine tested statically. May be based on DPRK Taepo Dong missile.



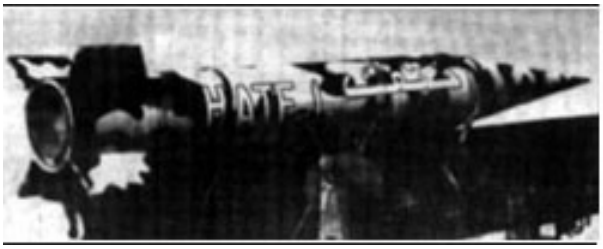
Hatf-2

Hatf-3

Hatf-4

Hatf-5

Hatf-6



Hatf-1

About the Authors

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