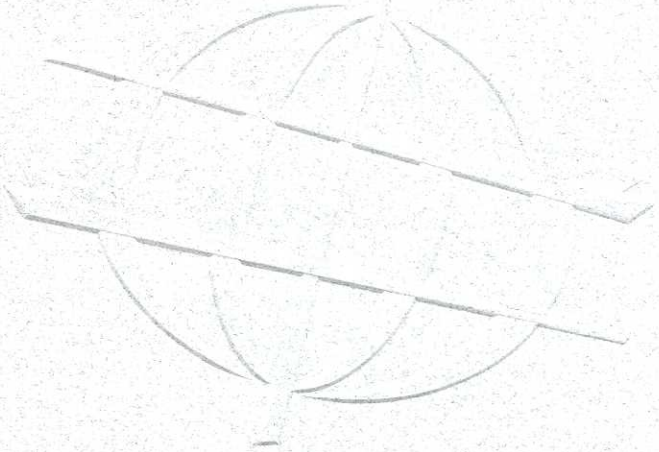
CMC
OCCASIONAL PAPERS



Reducing Risk in South Asia: Managing India - Pakistan Tensions

Shirin Tahir-Kheli
Director, South Asia Program
Johns Hopkins University School of Advanced International Studies
Washington, DC, USA

Kent L. Biringer
South Asia Program Manager
Cooperative Monitoring Center
Sandia National Laboratories
Albuquerque, NM, USA

COOPERATIVE MONITORING CENTER

Issued by Sandia National Laboratories, operated for the United States Department of Energy by Sandia Corporation.

Available to DOE and DOE contractors from
Office of Scientific and Technical Information
PO Box 62
Oak Ridge, TN 37831

Prices available from (615) 576-8401, FTS 626-8401

Available to the public from
National Technical Information Service
US Department of Commerce
5285 Port Royal Rd.
Springfield, VA 22161

NTIS price codes
Printed Copy: A03
Microfiche Copy: A01

SAND98-0505/20

March 2001

Reducing Risk in South Asia: Managing India - Pakistan Tensions

Shirin Tahir-Kheli
Director, South Asia Program
The Johns Hopkins University School of Advanced International Studies
Washington, DC, USA

Kent L. Biringer
South Asia Program Manager
Cooperative Monitoring Center
Sandia National Laboratories
Albuquerque, NM, USA

Cooperative Monitoring Center Occasional Paper

Sandia is a multiprogram laboratory operated

by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.

The Cooperative Monitoring Center (CMC) at Sandia National Laboratories assists political and technical experts from around the world to acquire the technology-based tools they need to assess, design, analyze, and implement nonproliferation, arms control, and other cooperative security measures. As part of its mission, the CMC sponsors research on cooperative security and the role of technology. Reports of that work are provided through the Occasional Papers series. Research is conducted by Sandia staff, international technical experts, and visiting scholars. (The CMC's Visiting Scholars Program is administered by the Institute for Public Policy at the University of New Mexico.) For additional information on the CMC's programs, visit the CMC home page on the World Wide Web at <http://www.cmc.sandia.gov> or write to:

Cooperative Monitoring Center

Sandia National Laboratories

Mail Stop 1373

Albuquerque, NM 87185-1373

For specific information on this report contact:

Kent Biringer at the above address.

This report was prepared by Sandia National Laboratories

Albuquerque, NM 87185 and Livermore, CA 94550

Reducing Risk in South Asia:

Managing India - Pakistan Tensions

Abstract

The two most likely scenarios for future war in the subcontinent are a breakdown along the common border in Kashmir and failure of nuclear policy. Each one of these issues offers options for the management of border relations and nuclear risk reduction. The authors propose an alternative approach through which India and Pakistan can begin to cooperate in managing their common border to prevent a breakdown that could lead to war. Should there be a breakdown through border problems, the resulting war could go to the nuclear level. We discuss ways in which the risk of a nuclear war can be diminished and conclude with steps that India and Pakistan might take for a more secure and stable South Asia. In making the case for greater cooperation between India and Pakistan, we take existing agreements between the two countries as a starting point. We do so keeping in mind that throughout their history they have moved forward with confidence building measures despite extended periods of poor relations.

Our approach uses jointly operated monitoring technology as a catalyst for engaging the political leadership in support of agreements. Monitoring does not depend on complete trust but can be used to verify compliance with agreements. It can help structure a dialogue by asking what information is needed to ensure security, stability, and compliance. Cooperative monitoring utilizes technologies available to both parties with plans to share data collected. It also postulates peaceful mechanisms for dispute resolution. Sharing information involves some degree of openness and the potential to reveal vulnerabilities. This, however, is traded for the benefits that accrue from knowledge that agreements to limit threats are being honored. Technology is a tool to be used as an instrument of political will. Despite the incompatibility of the ideas of cooperation and openness with the present politics of South Asia, the highly charged

atmosphere between India and Pakistan demands serious consideration of the role of monitoring in enhancing the prospects for peace and stability.

The first part of this paper (dealing with border security) summarizes work previously explored in Occasional Paper SANDOC98/0505-17, *Preventing Another India-Pakistan War: Enhancing Stability Along the Border*. This paper expands on that work to include risk associated with nuclear safety, security, and stability.

Acronyms

CBM	confidence building measure
GPS	Global Positioning System
LAC	Line of Actual Control
LOC	Line of Control
SACEP	South Asia Cooperative Environmental Program
TEL	transporter erector launcher
UAV	unmanned aerial vehicle
USGS	U.S. Geological Survey

Contents

Figures

Reducing Risk in South Asia:
Managing India - Pakistan Tensions

1. Border Relations

Tensions along the India-Pakistan border represent the greatest potential for armed conflict and risk of all-out war. Thus, management of border relations is important. While Kashmir poses the greatest threat to peace, incidents anywhere along the border could erupt into war. A variety of boundary regions divide India from Pakistan; these regions differ physically and politically. In the far north is the Siachen Glacier; then comes the Line of Control (LOC) dividing the Indian and Pakistani parts of Kashmir; the “working boundary,” i.e., the boundary between Pakistan and the old state of Jammu and Kashmir; the recognized international border; the Sir Creek region; and the maritime boundary. Figure 1 depicts these regions.

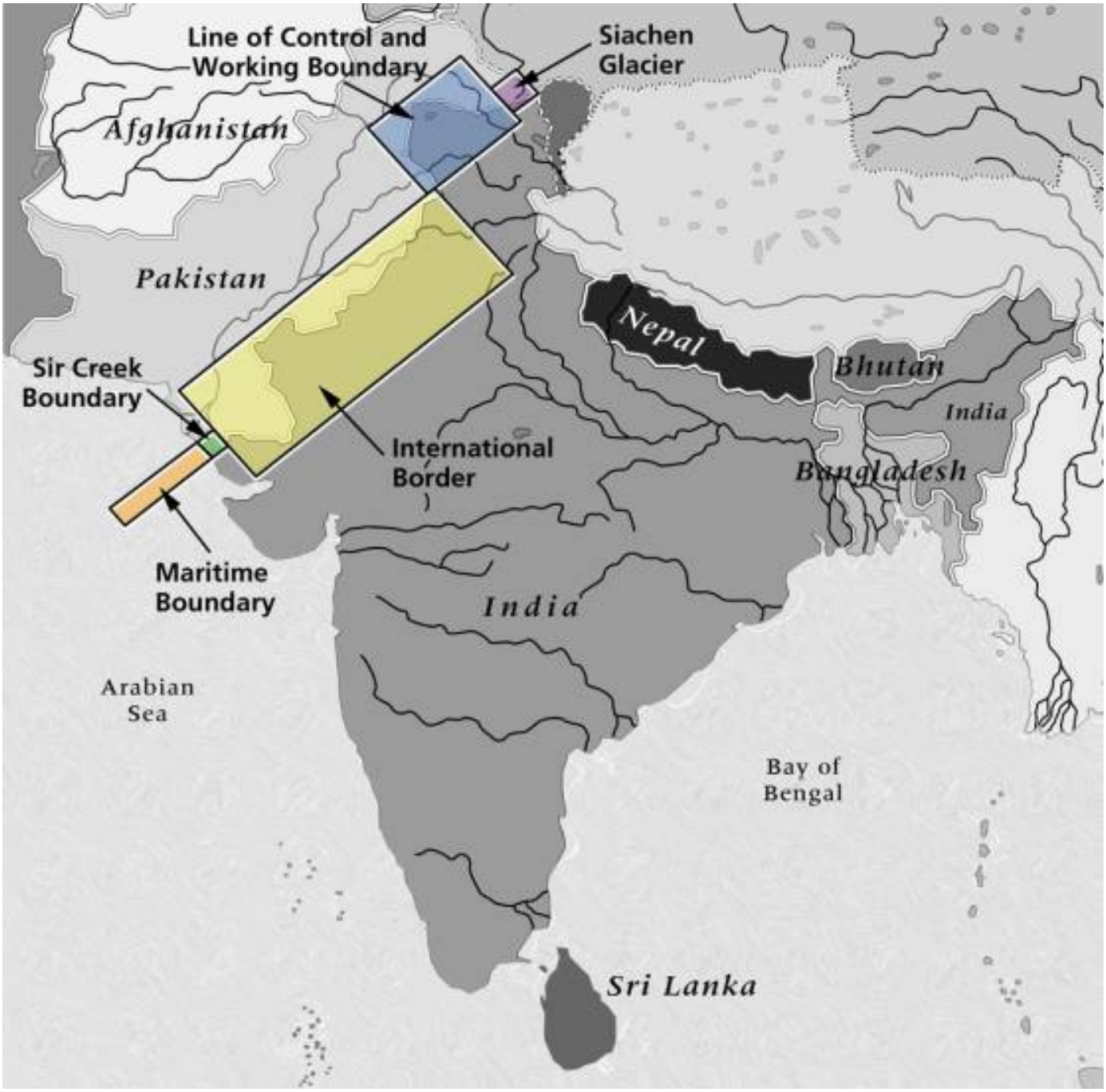


Figure 1 . Boundary regions along the India-Pakistan border

India and Pakistan have had conflict along essentially all types of their common border. For example, they have fought in parts of Kashmir in 1948, 1965, 1971, and 1999. Their international border saw major fighting in the 1965 and 1971 wars. Wider conflict nearly erupted as a result of fighting in the Sir Creek area in April 1965, where despite arbitration, problems persist. While there has been no open conflict over the maritime boundary, there are daily problems with the crossing of the boundary by fishermen whose arrest, when they are found in the territorial waters of the other side, feeds mutual suspicion and mistrust. Each of these border sections is dealt with below along with a notional regime for cooperative monitoring.

1.1. Siachen

The northern extreme boundary between India and Pakistan lies along the Saltoro mountain range in an area named for its most prominent feature, the Siachen Glacier. Since 1984, the two nations have battled over a 2,500-square-km

triangle of contested territory. The dispute arose over differing interpretations of a provision of the 1949 cease-fire, as well as the subse-quent 1972 Simla agreement, which left a portion of the cease-fire line undefined. The boundary was delineated only to map coordinate NJ9842 and vaguely referenced the direction from there as “thence north to the glaciers”—leaving a distance of about 65 kilometers undemarcated and disputed, but untouched. Differences arose when in 1984 Indian troops occupied the watershed line along the Saltoro range northwesterly from NJ9842. Conflict erupted and has remained for over 15 years with Pakistani troops holding positions across from Indian troops. Pakistan claims a northeasterly line to the Karakoram pass from NJ9842 towards the Chinese border (Figure 2).

The Siachen Glacier region is among the highest in the world with mountains of over 7500 meters and troop deployments at altitudes up to 6,700 meters. Warfare in this region is extremely costly, with the cost of fighting conservatively estimated at $200 million annually for India and at least half that amount for Pakistan with its easier lines of communication and access.

A political settlement of the Siachen issue was nearly achieved in 1988 when the defense secretaries and military leaders made a proposal to pull back troops and set aside territorial questions. A future agreement would include increasingly comprehensive provisions for de-escalation, disengagement, and demilitarization.[1] In addition to national means for verification, compliance determination would be enhanced through efforts at bilateral cooperation in moni-toring. The large area, difficult terrain, and harsh climate present unique monitoring challenges in the region. For example, monitoring efforts would need to detect and identify the presence or the absence of troops and military equipment deployed in and around the Siachen area.

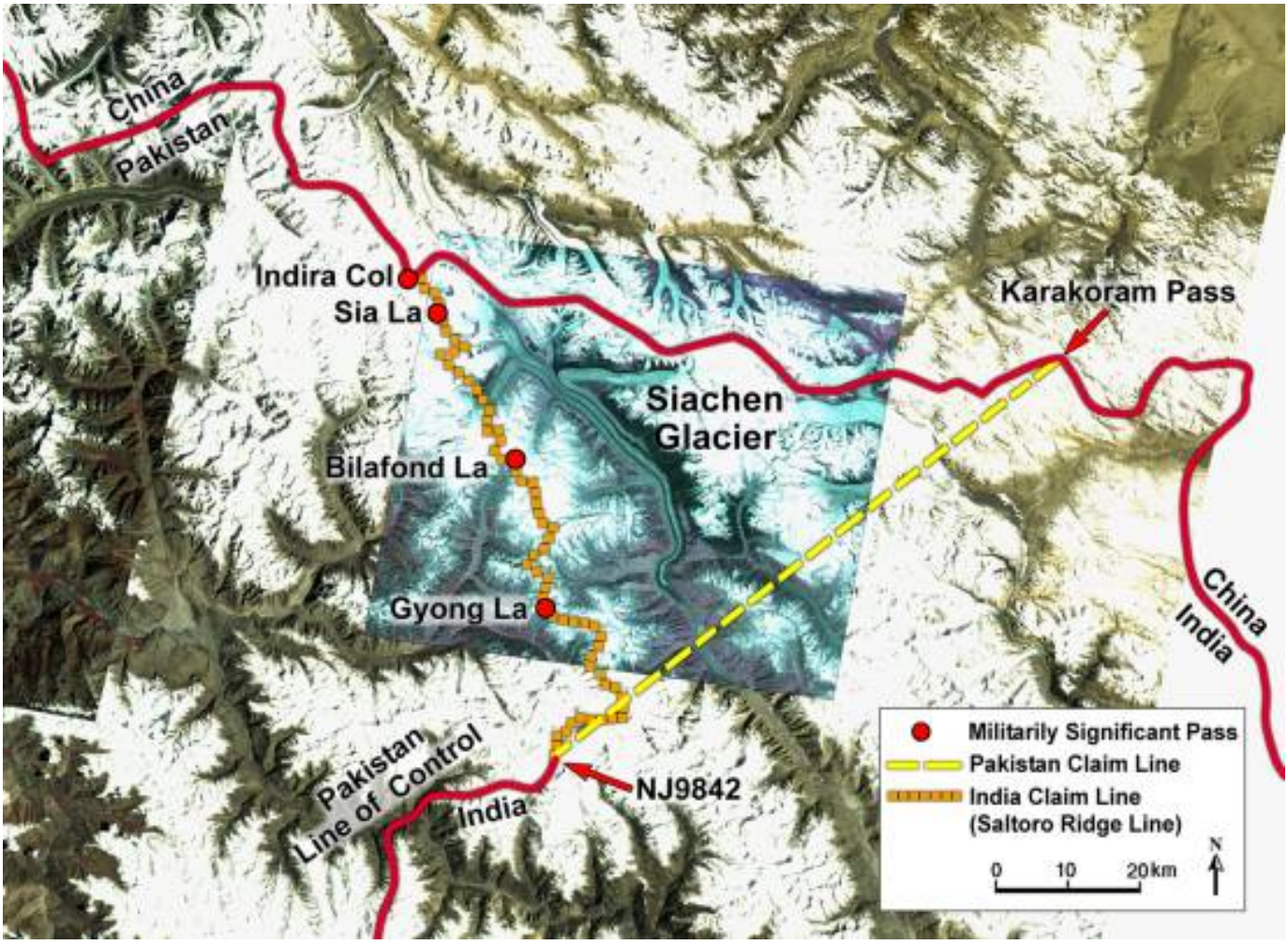


Figure 2 . Siachen Glacier region composite satellite image with claim lines and areas of dispute

Initial determinations of troop deployments or disengagement as part of a settlement would be possible through declarations and notifications supplemented with periodic inspections of deployment locations. As confidence

developed, the addition of ground-based monitoring technologies could provide a continuous assessment of relevant activities. Deployment of radars mounted near critical peaks or passes would also detect ground or aerial activities in the region.[2] Video monitoring could supplement other sensors by characterizing activities. Examples of operating web-based camera systems exist in other similarly harsh environments such as the Antarctic.[3]

Ground sensors with limited range would not provide broad coverage of the remote Siachen region. In addition, the extreme climate and the harsh terrain make the employment of ground-based sensors problematic without explicit experimentation. However, joint aerial monitoring missions could be used to demonstrate compliance with disengagement or troop pullout agreements that could remove a constant irritant and threat. This concept would use sensors mounted on aircraft to periodically assess troop locations, equipment inventories, and the status of operational or abandoned facilities. A variety of optical sensors and video cameras, infrared line scanners, and radars are candidate monitoring sensors. Given the high elevations at Siachen, only aircraft capable of operating at high altitudes could be employed for observation. Unmanned aerial vehicles (UAV) could be employed to lessen concerns about piloted overflights. Precedents for such cooperative remote sensing exist in the multilateral Open Skies treaty (signed but never entered into force, awaiting ratification by the Russian Duma), or the bilateral Open Skies agreement between Hungary and Romania.

An initial step in implementing monitoring provisions in Siachen could focus on conducting cooperative experiments to demonstrate the potential of sensor technologies to operate in the harsh environment and detect activities along strategic paths of movement and at fixed locations such as posts or pickets. Experiments with trial flights of aerial monitoring systems could establish confidence in the technology for this application. Working together to define and operate these systems could build confidence between the parties.

As countries move toward demilitarization of Siachen, concern may remain over the lack of national presence in the area. This concern can be addressed by replacing the current military presence with a scientific one. The concept for a Siachen Science Center suggests that the region become the focus for unique high-altitude scientific research, similar to the scientific research emphasis established by the Antarctic Treaty.[4] Cooperative efforts to conduct astronomy, glaciology, atmospheric science, human physiology, and many other fields of study could provide a joint India-Pakistan human presence in the area for cooperative scientific rather than for military purposes.

1.2. Line of Control

The LOC extends south of Siachen through the former princely state of Kashmir. This line was established in 1949 as a cease-fire line at the conclusion of the first India-Pakistan war of 1948. The cease-fire line was formalized with the signing of the Karachi Agreement in July 1949. Following the third India-Pakistan war in 1971, the cease-fire line (with some modification) became the LOC. The Simla Agreement of July 1972 specified the LOC resulting from the December 1971 cease-fire and called for the line to be respected by both sides without prejudice to the position of either side. The line is characterized by different terrain from the valleys and the rivers in the southern regions to the high mountains in the north. The length of the LOC is 740 kilometers.[5]

While the LOC has been the subject of numerous agreements between India and Pakistan, efforts to cooperatively monitor the line do not exist, even as there are nearly daily charges of firing by one against the other. Because of the presence of civilians close to the LOC on both sides and the escalation possibilities that exist with breaches of the LOC, even as each denies any violation, some method for checking the veracity of the claims is in the interest of both India and Pakistan. Further, an agreement to implement cooperative monitoring could contribute to building confidence and reducing tensions along the LOC. Because this region (specifically the Kargil sector) represents one of the recent flashpoints in India-Pakistan relations, there is an urgency to implement some confidence building measures (CBMs) along the LOC. Detecting and characterizing illegal cross-border movements are vital to regional stability. These crossings may be politically, militarily, or economically motivated. However, in each such instance, they threaten the fragile relationships of the region.

Border tensions could be reduced through military-to-military interactions in the form of enhanced communication,

exchange visits to deployment locations, a reduced threat posture, and efforts aimed at the implementation of the Lahore Declaration.[6] Initial steps could include periodic joint meetings of military officials along the LOC. These could later be expanded into inspections of selected military deployments along the LOC to demonstrate compliance with cease-fire or other agreements. Similar provisions exist in the 1993 and the 1996 CBM agreements between India and China on Peace and Tranquility and on Military CBMs along their Line of Actual Control (LAC).

Once dialogue has been established and an effective inspection regime put in place, ground-based sensors could be deployed to supplement efforts by ground forces to monitor unauthorized movements or actions along portions of the LOC. Specific use of sensors would vary along the LOC, based on terrain, perceived threat, cost, and required extent of sensor coverage. The LOC is a very porous boundary because of the variable terrain and wooded conditions in some portions. Instrumented fences could not be deployed in the high mountains but could provide some measure of cooperative monitoring in the southern sector of the LOC, which has relatively level terrain. Given the total absence of collaborative experience between the border security forces of India and Pakistan, even this limited effort could be extremely useful. Ground-based sensors, including seismic, magnetic, acoustic, and infrared, could provide detection and some characterization of movements along known roads, paths, or other routes of passage. Sensor activation could alert both sides of possible violations of the LOC and a joint monitoring center could collect all sensor inputs and disseminate information.

These categories of technology have had useful applications elsewhere. For example, in the 1970s, Israel, Egypt, and the United States used sensor systems to monitor terms of the Sinai accords. These systems helped maintain a cease-fire agreement and enabled the eventual withdrawal of Israeli forces from the Sinai. Two mountain passes, considered critical for launching a military attack across the Sinai, were instrumented with sensors and watch stations. This system ensured a separation of forces and allowed the peace process to unfold.[7]

Aerial and remote sensing using jointly manned aircraft with a stipulated suite of cameras and sensors could be periodically deployed along the agreed portions of the LOC. Such a procedure could ensure that a military buildup, unannounced exercise, or other potentially threatening military action along the LOC does not go undetected. Again, the very process of defining and implementing such a cooperative monitoring regime is in itself part of the confidence building process.

1.3. Working Boundary

While India considers the portion beyond the LOC to be part of the international border, Pakistan subscribes to the segment as the “working boundary” between Pakistani Punjab and Indian Kashmir because of the dispute over Kashmir.[8]

Cooperative monitoring along the working boundary is similar to that along the LOC. However, the less rugged terrain offers itself to deployment of ground-based monitoring systems. India has been unilaterally fencing much of this boundary, an action to which Pakistan has objected. Building confidence along this portion of the border could begin with regular discussions among the military commanders.[9] Portions of the existing fence could become sites for joint experiments on instrumented border monitoring.

As shown in Figure 3, the use of satellite and aerial imagery can be a tool to facilitate cooperation and resolution of territorial disputes. For example, such imagery helped define areas of separation and boundaries as part of the Dayton Accords, which dealt with the Bosnia and Herzegovina conflict. Such tools could be useful for South Asian negotiators in defining inspec-tions, overflights, or ground-based instrumentation deployments in Siachen, along the LOC, or along the working boundary.

1.4. International Border

Most of the boundary between India and Pakistan is an internationally recognized border.[10] The border lies between

the states of Punjab, Rajasthan, and Gujrat in India and the Pakistani states of Punjab and Sind. The terrain varies from coastal salt marshes, through deserts, to the agricultural plains of the Punjab. Limited legal border traffic along the border between India and Pakistan takes place through the *only* designated border crossing at Wagah in the Punjab.[11] The two governments are reluctant to open the border for greater official commerce and tourism. Mutual suspicion compounds the problems as each worries about the wrong type of commerce and the wrong type of tourist using the official channels. However, managing a cooperative effort at border crossings through technology for monitoring both goods and people could actually lead to greater confidence in the procedures. Current smuggling along the border deprives both governments of revenues, given that while the official trade remains around $250 million, unofficial trade (through smuggling or via third countries) stands at $1.5 to 2.0 billion annually.[12]

Hence, efforts to technically cooperate in monitoring and facilitating trade could pay enormous dividends. These efforts might include border development zones, modern customs and border crossing stations designed to streamline paperwork and vehicle inspections, along

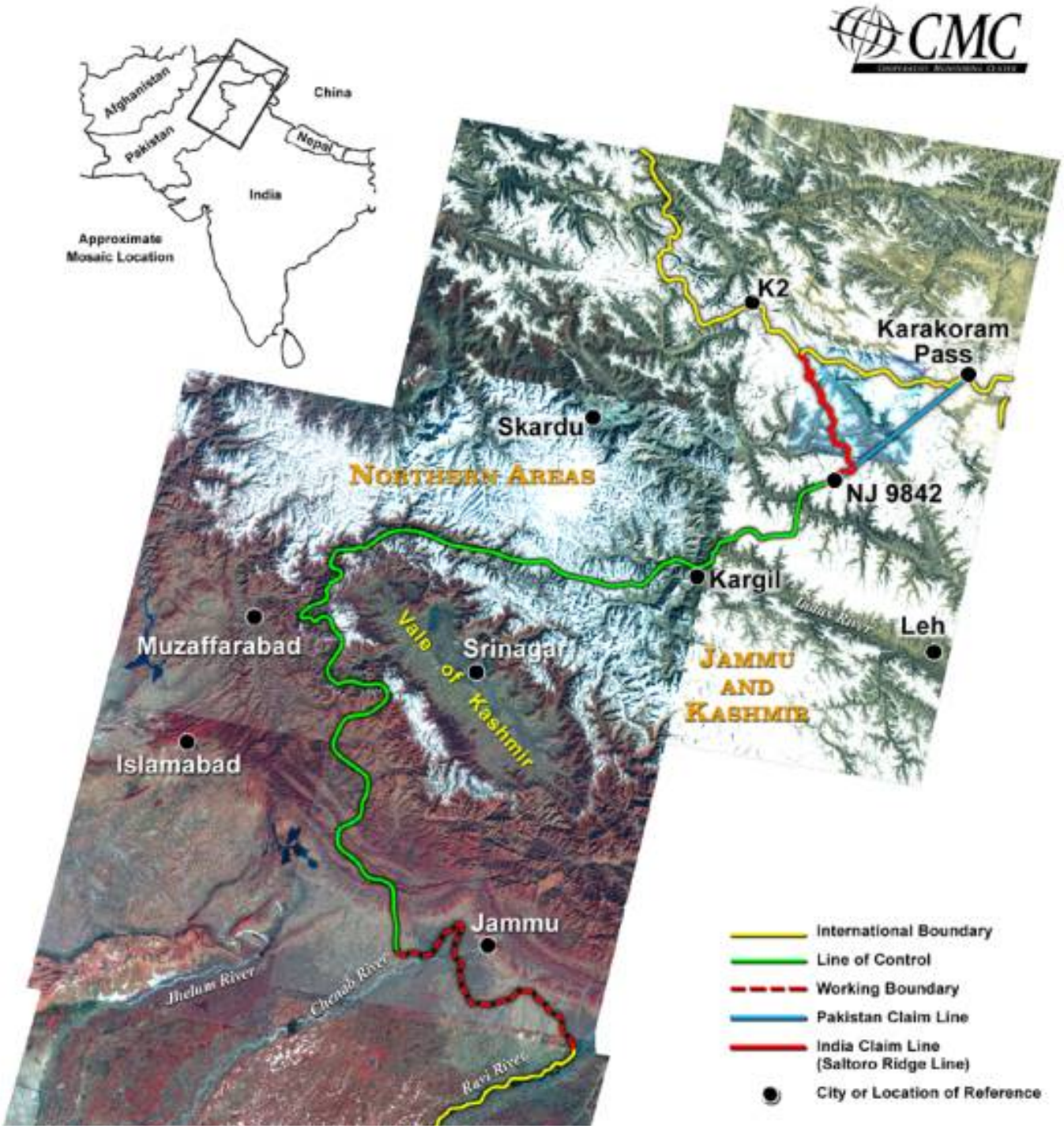


Figure 3 . Composite satellite image of Kashmir showing Siachen, the LOC, the working boundary, and the international border

with cooperative efforts to build an infrastructure of roads and communications to move goods and services between the trading partners. Since there is a minimum of existing cross-border infrastructure, moving in the above fashion provides the opportunity to work together to design border crossings and related infrastructure, i.e., roads, pipelines, power, communications, etc. Other examples of cooperative work using the latest technologies include the use of electronic shipping records, instrumented border crossings, real-time shipment tracking, and tags and seals for improved cargo security.

The international border has also been the scene of two India-Pakistan wars. This is also the region where large annual military exercises and troop deployments regularly send up alarm signals between the two capitals. To minimize these concerns, the *Agreement between India and Pakistan on the Advance Notice of Military Exercises, Maneuvers and Troop Movements* and the *Agreement for the Prevention of Air Space Violations and for Permitting Over-Flights and Landings by Military Aircraft* were concluded between the two sides in 1991.

While these agreements do exist, more work needs to be done to make them more effective. For example, increased confidence could result from the addition of monitoring provisions to the above agreements. Initial efforts could consist of invited observations of military exercises near the border. Such a transparency measure could reduce tensions and misinterpretations of military intent. Notification and monitoring of these activities could prevent the countries from coming to the brink of war, as was the case in the Brasstacks military exercises of 1986 and 1987. In addition to notification or monitoring of military exercises along the common border, agreements on further restrictions of movements or deployments may be possible. Such agreements could be expanded to include demilitarized or arms limitation zones along the border in order to further increase warning times and reduce the likelihood of conflict. The two sides could also work together to provide better border demarcation, particularly in the more remote and less populated desert regions.

The cooperative use of radar-equipped tethered balloons to monitor low-flying aircraft in selected portions of the border regions could actually enhance the existing agreement on the prevention of air space violation. This technology can also assess ground movements in the border regions. Tethering a balloon controls the altitude and positioning of the instruments. Joint staffing of the balloon deployment and data collection could establish a precedent for cooperative monitoring and data sharing. Technologies of this type are deployed along the United States/Mexican border and other international borders including that between Iraq and Kuwait. These systems do have some operational limitations, especially in severe weather condi-tions. A more extensive border-monitoring regime could include cooperative overflights along the established border to verify compliance with bilateral agreements to combat smuggling and drug trafficking.

Other regional precedents exist for border cooperation. India and China concluded two border agreements in 1993 and 1996. While many of the provisions (including notification, exercise limits, and aircraft restrictions) are similar to those already in place in India-Pakistan agreements, others offer additional prospects for confidence building. Chief among these may be exchanging maps, conducting flag-officer level meetings at designated border locations, assisting in sharing information on disease outbreaks, and providing disaster assistance.

1.5. Sir Creek

The Sir Creek issue involves defining the international boundary along Sir Creek, a 100 kilometer-long estuary in the saline wetlands of the Rann of Kutch between the states of Gujrat in India and Sind in Pakistan.[13] The origins of the dispute lie in maps drawn in 1914 and 1927 that depict differing boundaries along Sir Creek. The earlier map shows the boundary along the east bank of the creek. The later map delineates the boundary at midpoint. The official Indian government position interprets these maps as defining the boundary at midpoint of the creek with the boundary shifting as the creek meanders. Pakistani officials interpret the boundary as a geographically fixed boundary lying along the east bank of the creek. In addition to the historical dispute, accumulated sediment has created new land that did not exist at the time of the earlier maps, requiring an extension of the boundary to the new shoreline. How this line should be extended is also cause for dispute. The direction of the line does affect the determination of the respective Indian and Pakistani Exclusive Economic Zones along the continental shelf and beyond. The problem is magnified by the fact that these zones are potentially rich in oil and gas deposits.

Sir Creek is the subject of its own working group in the bilateral dialogue between India and Pakistan. Because of its finite length and disputed nature, the region offers itself for a specific type of monitoring possibilities.[14] As is the case in the Siachen, one possibility is the demilitarization of the Sir Creek area. Such an agreement could permit joint monitoring to ensure the absence of military or paramilitary troops or smugglers. A cooperative aerial monitoring arrangement could support such an agreement, build confidence and avoid the potential for conflict as occurred with the downing of the Pakistani naval aircraft in the region in August 1999. Jointly manned aircraft could provide coverage on both sides of the border, creating a single data bank to supplement that produced individually by each country.

Another cooperative venture in the Sir Creek region could be in the environmental area where joint scientific studies of pollution, water quality, water flows, and other measurements important to coastal and estuarine plant and animal life could be undertaken. Such cooperative work could shift the focus in a more positive direction while the political process continues to address the dispute over boundaries. Coastal cooperative environmental programs are successfully functioning in other regions. One example is the cooperative effort between Israel and Jordan in operating the Red Sea Marine Peace Park.[15]

1.6. Maritime Boundary

Not to be overlooked is the boundary between India and Pakistan that extends beyond land into the sea. Because of the disputes over the coastal boundary along Sir Creek, there is an accompanying dispute over the maritime boundary that extends 200 miles into the sea covering the economic zones and the national security boundary. The undemarcated and disputed nature of the maritime boundary has already resulted in problems, for example, the arrest and detention of fishermen from each side that wander into the other's territorial waters. There is also the possibility of naval incidents leading to increased tensions. Given the lack of trust, better management of the region in a cooperative fashion could reduce the likelihood of misunderstanding and help in confidence building. Furthermore, joint monitoring by the two countries could make this zone increasingly more attractive for capital investment in the exploration of natural resources.

Cooperative efforts, such as joint deployment of ocean buoys and the creation of joint teams for search and rescue or disaster response for the region, offer additional opportunities for technical collaboration. Joint communications to share information on emergencies and periodic exercises to test the efficacy of the joint program would strengthen the habit of collaboration. The development of a maritime risk reduction center could also be considered.[16] While these represent

only the beginning of potential areas for maritime cooperation, they are achievable and may be more acceptable since public opinion in India and in Pakistan has not hardened against collaboration in this area.

2. Nuclear Safety, Security, and Stability

India and Pakistan are nuclear powers with a history of conflict and a current state of zero official contact. A history of tension interspersed with war, lack of collaboration on issues of bilateral importance, and a simmering dispute over Kashmir have created a situation where each country expects the worst of the other. The South Asia environment is a crisis-prone region and the margin of safety is greatly reduced by the fact that missiles may have flight times of less than five minutes from launch to impact. Thus, reduction in the risk of another India-Pakistan war is essential. Rather than focusing on the strategic war-fighting capabilities and scenarios, we focus on the monitoring of nuclear safety, security, and stability.

This section discusses how the nuclear issue can be managed to create a more stable regime in South Asia.

The following offers a view of how “firebreaks” can be created in the India-Pakistan relationship to circumvent the escalatory ladder. Such an approach offers a potential zone of comfort which, in time, could lead to greater cooperation in bilateral measures aimed at reducing the risk of war, accidental or intentional. In setting up measures to provide nuclear stability for the subcontinent, one must remember that there have been no arms control agreements between India and Pakistan even to retire old weapons systems. Rather than restraint, international pressure or military necessity has ended conflicts, including the July 4, 1999, agreement brokered in Washington that led to the end of the Kargil episode.

There is a need to develop stabilizing measures to address a variety of nuclear-related issues. At one level, these include preventative measures to minimize conflict escalation and limit the threat posed by weapons of mass destruction. At the next level are measures intended to assist in crisis management at times when tensions are heightened and perhaps conventional conflict is in progress. Finally, mechanisms are needed to manage de-escalation and bring the regional parties back from the brink or the midst of nuclear conflict. While the primary protagonists in South Asia are India and Pakistan, it is important to recognize the pivotal role played by others, especially China, in the calculus of South Asia. This section discusses ideas for stabilizing the nuclear dimension of South Asian security. In particular, the roles of technology, data exchange, and monitoring will be explored. It remains to be seen whether this can be achieved in a bilateral, multilateral, or global context.

2.1. The Lahore Process

We take as a starting point, reflecting a measure of political will, the initiative for improved relations undertaken in Lahore, Pakistan, in February 1999. One provision from the text of the Lahore Declaration signed by the Prime Ministers of India and Pakistan on February 21, 1999 is that both governments:

“Shall 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.”[17]

A related Memorandum of Understanding signed at the same time by the Foreign Secretaries enumerated eight specific provisions, all but one of which have direct relevance to nuclear weapon and delivery system issues. These are enumerated below:

> “1. The two sides shall engage in bilateral consultations on security concepts, and nuclear doctrines, with a view to developing measures for confidence building in the nuclear and conventional fields, aimed at avoidance of conflict.

2. The two sides undertake to provide each other with advance notification in respect of ballistic missile flight tests, and shall conclude a bilateral agreement in this regard.

3. The two sides are fully committed to undertaking national measures to reduce the risks of accidental or unauthorized use of nuclear weapons under their respective control. The two sides further undertake to notify each other immediately in the event of any accidental, unauthorized or unexplained incident that could create the risk of a fallout with adverse consequences for both sides, or an outbreak of a nuclear war between the two countries, as well as to adopt measures aimed at diminishing the possibility of such actions, or such incidents being misinterpreted by the other. The two sides shall identify/establish the appropriate communication mechanism for this purpose.

4. The two sides shall continue to abide by their respective unilateral moratoria on conducting further nuclear test explosions unless either side, in exercise of its national sovereignty, decides that extraordinary events have jeopardized its supreme interests.

5. The two sides shall conclude an agreement on prevention of incidents at sea in order to ensure safety of navigation by naval vessels, and aircraft belonging to the two sides.[18]

6. The two sides shall periodically review the implementation of existing Confidence Building Measures (CBMs) and where necessary, set up appropriate consultative mechanisms to monitor and ensure effective implementation of these CBMs.

7. The two sides shall undertake a review of the existing communication links (e.g. between the respective Directors-General, Military Operations) with a view to upgrading and improving these links, and to provide for fail-safe and secure communications.

8. The two sides shall engage in bilateral consultations on security, disarmament and non-proliferation issues within the context of negotiations on these issues in multilateral fora."[19]

Finding ways to achieve these worthy goals requires framing the issues and then addressing options, including technical contributions, that can prevent nuclear crisis in the region. Below we offer ways to strengthen these elements of the Lahore process.

2.2. Categorizing Nuclear Concerns

The nuclear concerns identified in the Lahore documents and discussed in other regional security dialogues can be broadly characterized as:

I. Safety – ensuring the safety of nuclear weapons and materials

II. Security – ensuring physical protection of nuclear weapons and materials and appropriate accountability

III. Use Control – ensuring only authorized access to and use of nuclear weapons and materials

IV. Limits on Threat – limiting the magnitude and severity of the threat

V. Alert Status – assessing weapon deployment status and preventing use in anger or by miscalculation/misinterpretation

Problems in any of these areas would increase the level of tensions between the two countries, could lead to unintended consequences, and would challenge the systems of crisis management in the region. We will briefly describe each area of concern.

Nuclear weapon and material safety is necessary to ensure worker safety and public health, to avoid dispersal of radioactive materials, and to minimize the likelihood of accidental nuclear detonation. Safety is influenced by weapon design, handling procedures, and environmental factors. Examples of safety concerns include:

- Acts of nature – fire, lightning, winds, storms (building collapse, flooding, etc.)
- Handling issues – rough handling, dropping, transportation accidents, maintenance errors, attack
- Material issues – corrosion, delamination, degradation, material incompatibilities

Security concerns relate to the physical control and protection of nuclear weapons and materials. Security may be provided in the form of guards and other personnel, auditing and accounting procedures, as well as protected and access-controlled facilities. It also relates to transport vehicles that minimize likelihood of theft, damage, or sabotage to the secured items. Access control consists of technologies and procedures for controlling who has access to weapons or materials, by what means, for what purpose, where, and when. It may be a centralized issue if small quantities of materials or weapons are stored in a single location. It may be a more complicated management issue if access is granted at distributed locations.

Use control restricts the ability to activate, arm, or use a weapon system once access has been achieved. This control is a final barrier after gaining access, by authorized or unauthorized means. Use control is designed to permit weapon system operation in the way it was intended when properly and appropriately commanded and to prevent such use when proper procedures are not followed. This may involve locks, codes, timers, or other systems such as permissive action links requiring multiple personnel to activate, use, or disable a weapon system. Personnel reliability programs may also be an indirect element of a use control system or security system.

Developing measures to prevent escalation to a full-scale nuclear arms race also factors into the South Asian nuclear concern equation. In addition to the obvious economic strains placed on India and Pakistan, an arms race will lead to more distributed nuclear forces and greater challenges in providing the safety, security, and use control needs discussed above. Capabilities of the threat will also affect regional stability. The numbers of weapons and delivery systems, their range and yield, as well as their basing mode on land, sea, or air will impact insecurities of regional adversaries. Concerns include current inventories as well as production or procurement rates of additional systems.

The ability to assess the current operational and deployment status of nuclear weapons is perhaps the most critical factor in near-term crisis prevention. The ultimate concern about nuclear weapons is the possibility of their use in a time of conflict. In addition to deliberate use in anger is the possibility of use through miscalculation or misinterpretation. An example of miscalculation could be undertaking conventional military movements that are not intended to provoke a nuclear response, but do. Misinterpretation could be based on incorrect intelligence reports, mistaking a military exercise or missile test launch as an attack, or attributing detonation of a nuclear device through accident or other unintentional means as escalation to nuclear war.

Given this wide range of concerns with nuclear weapons systems or materials, it is necessary to determine what information is needed in order to assess or respond to a concern. Some of these issues must be addressed unilaterally while others lend themselves to international cooperation. Transparency can be used to build confidence, avoid misinterpretation, provide early dispute resolution, and help verify compliance with international agreements. A debate exists on the merits and consequences of providing this transparency. By cooperating in sharing information, it may also be possible to get more complete information than is available through unilateral monitoring or intelligence collections. On the other hand, transparency may reveal vulnerabilities, reduce the effectiveness of ambiguous

deterrence, or give false impressions in cases of deliberate deception. The tradeoffs of transparency and opacity in providing nuclear stability between India and Pakistan will remain a topic of debate for many years to come. While there are arguments both for and against transparency in the nuclear weapons issues of South Asia, we maintain that proper knowledge can be used to minimize uncertainty and better manage tensions and crises. As shown in the provisions of the Lahore documents, the national leaders recognize the value of information in managing the nuclear threats in the region. The balance of this paper will address near-term options for transparency related to the nuclear concerns outlined above.

2.3. Safety

Ensuring safety of nuclear weapons and materials in South Asia will primarily be a state responsibility because of the highly classified nature of most safety issues. These issues involve detailed design, material, and handling details. However, that does not mean than there is no role for transparency on safety issues. The declarations discussed earlier point to regional concerns over nuclear accidents.

An expanded mission for hot lines in South Asia could be to report nuclear accidents. In addition to a hot line between the Directors-General of Military Operations, a hot line between the heads of state might be established to address this critical issue.

Establishment of a regional joint radiation-monitoring network would also be useful in sharing information on nuclear safety. Such a network could include radiation sensors jointly deployed and monitored from a common data collection point. Operation of a network could occur under the auspices of regional entities, such as the South Asia Cooperative Environmental Program (SACEP), or through cooperative arrangements among national environmental authorities. The radiation sensors could be supplemented with meteorological instruments to simultaneously provide weather information on the spread of any detected radiation. Initially, such sensors could be deployed at noncontroversial locations and later be considered for deployment at more critical nuclear facilities such as reactors, enrichment or reprocessing facilities, test sites, or storage locations. Data could be shared over private or public networks such as the Internet. The exact measurements taken could be negotiated to provide adequate public safety information while minimizing sensitive or classified data collection. These data provide independent confirmation and assessment of notifications that would provide explanation of the source of radioactive release. Such a network could also be used to enhance international monitoring of nuclear events occurring elsewhere in the world.

2.4. Security

As in the case of safety, security is a sensitive and/or classified topic with respect to nuclear weapons. However, again some possibilities exist for limited transparency on security.

If agreement can be reached on eliminating or restricting deployment on any items associated with nuclear weapons, materials, or delivery systems, these excess items could be remotely monitored through camera and sensor systems to verify that they remain securely stored and inactive. Similar efforts are currently under way on an experimental basis between the United States and Russia. In these experiments, quantities of weapons-usable nuclear materials are jointly monitored in storage locations in the United States and Russia. The storage facilities have been equipped with a variety of sensors to detect motion, door opening, crane movement, and electronic seal breaks and use those signals to activate the recording of video images. The data can then be shared among experiment participants over telephone lines. Other development efforts are under way to share these same types of remotely collected sensor data over the Inter-net. In either case the possibility of quickly confirming the secure nature of sensitive items is possible.

While much of this discussion has focused on fixed-site monitoring, there may be times when monitoring of movement is a critical part of confidence building. Use of Global Positioning System (GPS) satellite receivers along with satellite-based communication systems permit tracking data and sensor information related to security or safety to be broadcast between nearly any two points on earth. This may help ensure that security of sensitive items is maintained while they are in transit.

Hot lines could again play a role between national leaders in sharing information on any failures of physical security that result in threat to or loss of weapons or material.

2.5. Use Control

Use control measures are part of a national system of command and control in the management of weapon systems. Notification or declarations about procedures for use control may give some assurance to the other side but are unlikely to be verifiable.

National decisions to include both technical and procedural mechanisms to restrict use of weapons and delivery systems will permit more time to attempt diplomatic solutions to conflict before initiating weapons use. They will also reduce the likelihood of accidental or unauthorized weapon system use.

However, of all the areas of potential nuclear confidence building, cooperation on use control is the least likely near-term topic for transparency.

2.6. Limits on Threat

One means for limiting the threat posed by nuclear weapons is to seek arms control measures that limit the size, capabilities, or basing of nuclear arsenals or delivery systems. If agreement can be reached on such measures, numerous monitoring tools are available for verifying compliance.

Currently both India and Pakistan are maintaining a moratorium on further nuclear testing. Sustaining such a moratorium will help limit the expansion of nuclear weapon capabilities in the region. The Lahore documents recognize the value of continuing to abide by these respective unilateral moratoria. One CBM in support of the moratorium could be the estab-lishment of a joint seismic monitoring effort. The effort could consist of a regional seismic working group, a regional data center for collecting and analyzing data, a series of calibration experiments to better characterize signal propagation, and monitoring experiments or deployments at selected sites in South Asia.[20]

If future political decisions aim to limit quantities of weapons systems such as missiles, then on-site inspections of production sites, storage facilities, or deployment locations could be conducted to confirm declarations. Missiles are of particular concern because of the short flight times of less than five minutes to reach targets in the other country. The use of passive or active electronic tags can provide unique identification of items counted as part of such agreements. This enables confirmation of declared inventories and subsequent absence of such tags could indicate an agreement violation.

Other inspections or monitoring regimes could be constructed to address a wide range of other future arms control agreements that could limit weapon capabilities (e.g., yield and range), deployment basing concepts (e.g., land, sea, or air), quantities, commerce, and testing.

2.7. Alert Status

Finding verifiable means for assessing deployment and alert status of nuclear forces could be critical in managing a nuclear crisis in South Asia. One way of minimizing or slowing the escalation to nuclear weapon use is to provide mechanisms to delay weapon deployment and minimize alert status.[21] Assessing these mechanisms will require transparency into some elements of weapons programs on the other side.

One such mechanism is disassembly of weapons or delivery systems, which adds to the time necessary to reconstitute the nuclear threat. At the same time it serves to minimize some of the concerns over nuclear safety, security, and use

control if only incomplete weapons systems are maintained. Inspections are a tool that can be used to verify this aspect of weapon dealertment. If an agreement were reached to maintain weapon systems in a disassembled state, then any fully assembled weapon or delivery system would be a violation of the agreement. By dispersing the components, it would be possible to provide some increased invulnerability while monitoring some critical components to ensure that they remain in a disassembled state. This monitoring could be by means of sensor-activated video systems that take pictures when events occur such as accessing the facility or removing material.

A second mechanism is the removal of key components from the weapon system. An example would be the removal of warheads from missiles. If warheads were stored apart from their delivery missiles or aircraft, this would build in an additional time delay. Monitoring launchers or delivery systems could be by means of inspection regime and/or technical remote monitoring to confirm this “de-mated” status.

Another de-alert mechanism is to remove delivery systems from deployment areas or launch sites. By not deploying or deploying out of range from the adversary, another time delay is built into the nuclear stability formula. This is more easily accomplished for shorter-range missiles that may require deployment near a border in order to reach targets in the adversary’s country. This kind of agreement could include declaration of weapon numbers and locations along with requirements for notifications of movement. Monitoring provisions could include inspection of launchers in garrisoned locations. The use of tags could be helpful in ensuring that items have been counted and items are not being moved without proper notification. Sensors and cameras could also monitor activity levels and movements at these distant storage or garrison locations. Periodic joint aerial monitoring could also be used to supplement information on the absence of missiles in restricted regions.

The use of barriers to provide added delay in moving or assembling weapon systems also could be used to help maintain a de-alert status. Physical barriers to movement, or mechanical barriers (for instance, to be removed before being able to mount a warhead on a missile) could serve as other points to monitor the de-alerted state of weapon systems.

Another element of nuclear stability is determining the readiness of launch systems. There may be a number of indicators associated with launcher alert status. These include:

- Flight parameters loaded, other software updates (if appropriate)
- Vehicle fueled (missile or aircraft)
- Crews readied
- Delivery vehicle in launch location (moved to launch point)
- Transporter system in ready position (e.g., transporter erector launcher (TEL) in raised launch position)
- Weapon armed

While most of these indicators of launch preparation are difficult to monitor, some, such as missile fueling and launcher movements, might be monitored through electronic sensors. As with many of these monitoring suggestions, significant intrusiveness and some vulnerability is introduced as part of the monitoring process. There needs to be a realization that the benefits derived from the enhanced transparency offset the risks.

As acknowledged in the Lahore documents, providing notification of potentially threatening missile launches is necessary. Agreeing to restrict certain aspects of missile testing could serve to reduce tensions. For example, launching missile tests on trajectories away from adversaries could reduce the risk of misperception and the possibility of launch on warning. Tension reduction could also be enhanced through monitoring at missile test sites and inclusion of observers at selected test launches. Including agreement provisions for not deploying launchers from fixed locations without advance notice could also contribute to stability and reduce misperceptions.

While not necessarily verifiable, an agreement to de-target missiles aimed at each other by removing target coordinates from missile guidance systems could reduce the consequences of accidental or unauthorized missile launch. These and other missile-related issues could be included in a formalized launch notification agreement suggested in Lahore. Such

an agreement might later be expanded into a nondeployment/de-alertment agreement that would formalize a weapon de-alert status in the region.

Because of the importance of sharing declarations and notifications as well as sensor and video information as part of a regime of nuclear monitoring, India and Pakistan could benefit from establishment of a nuclear risk reduction center to manage their nuclear affairs. Such a center could be a clearinghouse for nuclear information and serve as a central point for data collection and dissemination. Periodic meetings could be held among those operating the centers to improve communications systems, operating procedures, and data processing. Along with this management function is the need to establish a corresponding consultative commission to resolve nuclear-related concerns in any area. Such a commission can work to resolve disputes related to existing treaties, agreements, and CBMs as well as serve as a forum for defining future agreements. In 1973, the United States and Soviet Union concluded an agreement on Prevention of Nuclear War. In addition to outlining general conduct of both countries regarding the avoidance of nuclear war, the parties also agreed that they would commit to consult with each other in order to avoid the risk of nuclear confrontation.[22] In 1987 an agreement to establish a Nuclear Risk Reduction Center of the type described above was concluded. This center operates today, sharing nuclear-treaty-related declarations and data between the United States and Russia, as well as Ukraine, Kazakhstan, and Belarus.

2.8. Other Factors

Sharing information on any of the concerns highlighted in this paper will require an infrastructure of capabilities and procedures. These include methods for providing timely, reliable, secure, accurate, and authenticated communications. Having confidence in the accuracy and integrity of data will be an important element in sustainability of agreements. While initially any data sharing may build a first level of confidence, it will be important to expand monitoring to ensure increasing levels of completeness. It is important to know whether events take place outside of declared activities. The ability to conduct challenge inspections may also be a necessary part of future agreements.

Ensuring the integrity of collected information may also require technologies designed to detect tampering or altering of the monitoring system. Tags and seals can be applied to uniquely identify equipment and to detect opening or accessing of sensor systems. Switches may also be employed to alarm when sensor system integrity has been breached.

The choice of specific monitoring technologies and systems will be highly dependent on the levels of intrusiveness permitted. Other constraints will include cost, the need for redundancy, manpower requirements, technology availability, and timeliness of data. As agreements are formulated, these and other factors will influence the development of monitoring protocols. In the meantime, there is a role for experiments and collaborations on monitoring systems to demonstrate feasibility, both technically and politically, of different monitoring options. Developing confidence with the role that monitoring can play may permit the political and diplomatic process to move toward agreement.

Finally, after receiving information from sensors or inspections, there is the question of how to react or respond if violations or concerns are evident. The goal for monitoring and responding should be to build levels of escalation that avoid the need for escalation to nuclear exchange. Response mechanisms may include communication, face-to-face meetings, further information collection, or on-site inspections, before escalating to armed conflict, including the use of nuclear weapons. The process of monitoring itself is designed to build confidence and relationships through the meetings, agreements, and implementation required. Beginning a dialogue on cooperative nuclear threat reduction in South Asia remains a vital near-term need.

3. Conclusion

Questions relating to safety, security, and stability in South Asia require an important element of management of relations between India and Pakistan. We have presented two critical issues toward that end: border management and nuclear risk reduction. We have taken existing agreements such as the Lahore Memorandum of Understanding since these imply political will to move on certain issues. We recognize that under current conditions India is reluctant to

engage with Pakistan and some of the agreements remain unimplemented. Yet, that situation cannot continue indefinitely without severe degradation of the security picture in South Asia. Regional hawks have characterized the concern for nuclear crisis in the subcontinent as “alarmist and unrealistic.” We disagree. Given their capabilities, the lack of cooperation, absence of official contact, and the existing dispute over Kashmir, the risk of conflict between India and Pakistan remains real.

Some of the steps we have suggested for border and nuclear management can indeed be implemented on a unilateral basis by either country. However, such a step will not lead to a fundamental shift away from confrontation. Only cooperative work to deal with even the rudimentary issues dealing with a nuclearized South Asia based on bilateral agreements and procedures will offer a new hope for India-Pakistan relations in the 21st century.

About the Authors

Shirin Tahir-Kheli is the Director of the South Asia Program at The Johns Hopkins University, Foreign Policy Institute, School of Advanced International Studies, in Washington, DC. She was a Senior Fellow at the Foreign Policy Research Institute, Philadelphia, PA. She was formerly the United States’ Ambassador to the United Nations for Special Political Affairs (1990-1993) and served at the National Security Council (1984-1990). Tahir-Kheli was a member of the Presidential Commission on the Public Service under President George Bush. She served as a member of the Board of Trustees of the Aga Khan University in Pakistan (1996-1999) and is a member of the Advisory Board of Princeton University’s Institute for the Transregional Study of Contemporary Middle East, North Africa, and Central Asia. She received her Ph.D. and MA in International Relations at the University of Pennsylvania and a BA from Ohio Wesleyan University. Tahir-Kheli has taught numerous courses in comparative politics and international relations at The John Hopkins University, the U.S. Army War College, and Temple University. She is the author of numerous publications, including *India, Pakistan, and the United States: Breaking with the Past* (Council on Foreign Relations Press, 1997) and *The United States and Pakistan: The Evolution of an Influence Relationship* (New York: Praeger, 1982).

Kent Biringer is a Distinguished Member of the Technical Staff at Sandia National Laboratories in Albuquerque, New Mexico, and serves as Deputy Program Manager and as South Asia Project Manager at the Cooperative Monitoring Center (CMC). The CMC works with U.S. and foreign participants to explore ways that technology can facilitate regional confidence building in such areas as arms control, nonproliferation, and environmental security. Biringer has worked at Sandia for 24 years in solar and fossil energy research, systems analysis, arms control, nonproliferation, and cooperative monitoring. His educational background is in mechanical engineering with bachelor’s and master’s degrees from Rice University. Before coming to Sandia, he worked for Atlantic Richfield Oil Company.

Distribution

350	MS 1373	CMC Library, 5341
1	MS 9018	Central Tech Files, 8945-1
2	MS 0899	Technical Library, 9616
1	MS 0612	Review & Approval Desk, 9612 for DOE/OSTI

[1] "Siachen: A Solution Being Sought for the Third Time," *The Hindustan Times*, November 6, 1998. Also, see Samina Ahmed and Varun Sahni, *Freezing the Fighting: Military Disengagement on the Siachen Glacier*, SAND98-0505/1, Cooperative Monitoring Center Occasional Paper, Sandia National Laboratories, Albuquerque, NM, USA, March 1998. See also http://www.cmc.sandia.gov/00research-analysis/paperandreports/index.html.

[2] This idea has been proposed by Lawrence Livermore National Laboratory.

[3] See the Australia Antarctic web site at http://www.antdiv.gov.au/stations/live.html.

[4] Kent L. Biringer, *Siachen Science Center: A Concept for Cooperation at the Top of the World,* SAND98-0505/2, Cooperative Monitoring Center Occasional Paper, Sandia National Laboratories, Albuquerque, NM, USA, March 1998. Also available at: http://www.cmc.sandia.gov/00research-analysis/paperandreports/index.html

[5] *The Hindu*, July 28, 1999. Other values are given in other references, e.g., 790 km in the "About India" web site at www.aboutindia.com/neighbors/neighbor.htm

[6] For further details, see Shirin Tahir-Kheli, "The Role of Technology in India-Pakistan Agreements," BALUSA VII, Foreign Policy Research Institute, Philadelphia, June 3, 1999.

[7] Michael G. Vannoni, *Sensors in the Sinai: A Precedent for Regional Cooperative Monitoring,* SAND96-2574, Sandia National Laboratories, Albuquerque, NM, USA, reprinted, June 1998. Also available at the Sandia web site www.cmc.sandia.gov/issues.html.

[8] Refer to the Pakistan government web site at: www.pak.gov.pk/media/line_of_control.htm.

[9] For example, a four-day meeting between border commanders was held in Lahore to discuss the exchange of fire along the working boundary. See expressindia.com November 23, 1999.

[10] W*orld Fact Book 1999,* Central Intelligence Agency, www.odci.gov/cia/publications/factbook/in.htm. The total distance of 2912 kilometers includes disputed areas such as the Sir Creek, LOC in Kashmir, and Siachen.

[11] The second crossing at Khokrapar in the Sind remains closed.

[12] Maj. Gen. Mahmud Durrani, *India and Pakistan: The Cost of Conflict, The Benefits of Peace,* Johns Hopkins University Foreign Policy Institute, Sept. 2000, pp. 44-50.

[13] A.G. Noorani, "CBMs for the Siachen Glacier, Sir Creek, and Wullar Barrage," in *Crisis Prevention, Confidence Building and Reconciliation in South Asia,* Michael Krepon and Amit Sevak, editors, Henry L. Stimson Center, Washington, DC, 1995.

[14] Gaurav Rajen, *Cooperative Environmental Monitoring in the Coastal Regions of India and Pakistan,* SAND98-0505/11, Cooperative Monitoring Center Occasional Paper, Sandia National Laboratories, June 1999. Also available at the Sandia web site http://www.cmc.sandia.gov/00research-analysis/paperandreports/index.html.

[15] Aqaba Region Authority, "The Red Sea Marine Peace Park – Aqaba, A Summary," *Proceedings, Middle East Seas Regional Strategy Workshop for the International Coral Reef Initiative,* Aqaba, Jordan, September 21–25, 1997, published by the U.S. National Oceanic and Atmospheric Administration, Silver Springs, MD, 1997.

[16] Ayesha Siddiqa-Agha, *Maritime Cooperation Between India and Pakistan: Building Confidence at Sea,* SAND98-0505/18, Cooperative Monitoring Center, Occasional Paper, Sandia National Laboratories, October 2000. Also available at http://www.cmc.sandia.gov/00research-analysis/paperandreports/index.html.

[17] Text of the Lahore Declaration signed by the Prime Ministers of India and Pakistan on February 21, 1999.

[18] This is the only provision that lacks direct relevance to regional nuclear concerns.

[19] The text of the Memorandum of Understanding signed by the Indian Foreign Secretary, Mr. K. Raghunath, and the Pakistan Foreign Secretary, Mr. Shamshad Ahmad, in Lahore on February 21, 1999.

[20] This concept has been developed and proposed by Keith Nakanishi of Lawrence Livermore National Laboratory.

[21] For an assessment of missile de-alertment see paper by Michael W. Edenburn, et al., “De-Alerting Strategic Ballistic Missiles,” CMC Occasional Paper SAND98-0505/09, Sandia National Laboratories, Albuquerque, NM, USA, March 1999. Also available at http://www.cmc.sandia.gov/00research-analysis/paperandreports/index.html

[22] “Agreement Between the United States of America and the Union of Soviet Socialist Republics on the Prevention of Nuclear War,” *Arms Control and Disarmament Agreements*, United States Arms Control and Disarmament Agency, 1990, pp. 177–180.