



SPECIAL REPORT

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ABOUT THE REPORT

This report examines US concerns regarding India-Pakistan security competition and assesses whether new and emerging technology could mitigate the risks of inadvertent escalation or the unauthorized use or theft of nuclear materials on the subcontinent. It is supported by the Asia Center at the United States Institute of Peace. The analysis and opinion expressed are those of the author and do not reflect the official policy or position of the intelligence community, Department of Defense, Department of State, or the US Government.

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Satellite Imagery, Remote Sensing, and Diminishing the Risk of Nuclear War in South Asia

Summary

- Structural political and security factors generate persistent security competition on the South Asian subcontinent.
- This competition in turn creates a small but difficult-to-close window for nuclear catastrophe.
- However unlikely, deployment of tactical nuclear weapons can open the door to inadvertent escalation or unauthorized use or theft. Any of these outcomes would be a catastrophe for the region and the world.
- The risk of catastrophe, though low, is more likely to grow than shrink in the short term. Indian political discourse about using conventional forces to punish Pakistan if necessary has sharpened. Growing disparities between India and Pakistan will exacerbate the degree to which Pakistan perceives a threat from India.
- The US role in South Asia as an honest broker may be jeopardized by its estrangement from Pakistan and growing relationship with India.
- Traditional confidence-building measures have not generated enough goodwill to ease security competition between the two countries.
- Technological advances in commercially available imagery are a potential avenue for reducing nuclear risk. A handful of proposals in the late 1990s and early 2000s suggested a cooperative aerial monitoring agreement.
- These proposals argued that such an arrangement would build confidence, lower the chances of inadvertent escalation, and decrease Pakistani incentives to deploy weapons in ways that endangered regional security.

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- Similarly, a limited transparency regime, enabled by remotely sensed commercial imagery and administered by a trusted third party, could diminish some of the pressures that increase nuclear risks on the subcontinent. While technically feasible, such a regime would require a robust period of preliminary study to prepare, test, and bring online.
- Fundamental change in the structural elements of India-Pakistan security competition is unlikely anytime soon. But, given the stakes, it is worth pursuing an effort that diminishes the chances for nuclear catastrophe.

Introduction

In August 2017, US President Donald Trump used a public speech to describe components of his newly approved South Asia strategy. The speech largely focused on US aims and goals in Afghanistan and a threat to halt security assistance to Pakistan, but also alluded to the nuclear-related considerations underpinning a broader approach for the region. He described India and Pakistan as “two nuclear-armed states whose tense relations threaten to spiral into conflict” and warned that “we must prevent nuclear weapons and materials from coming into the hands of terrorists and being used against us, or anywhere in the world for that matter.”¹

The president’s language reflected a set of long-standing US concerns about nuclear weapons in South Asia. Increasingly since the late 1980s crisis over a series of exercises on either side of the India-Pakistan border, US policymakers have worried that persistent conflict dynamics between the two countries could lead to nuclear escalation. Many of the prospective scenarios envision escalation of armed conflict between the two countries from either the conventional or the sub-conventional level to the use of nuclear weapons. A separate but closely related worry is that the development of nuclear weapons technologies and doctrines increases the risk for the unauthorized use or theft of nuclear materials by encouraging the deployment of nuclear weapons in ways that weaken controls over them. Most analyses suggest that these are low-probability outcomes. However, because the consequences of a nuclear detonation on the subcontinent would be catastrophic, even the small chance of such an outcome is worth trying to minimize.

The United States has pressured both sides to reduce these risks by encouraging different forms of rapprochement. The two countries have intermittently agreed to a series of security, economic, and social confidence-building measures—last year, for instance, extending the five-year Reducing the Risk of Accidents Relating to Nuclear Weapons agreement. However, the beneficial effect of these measures has been temporary, superficial, or contingent on fleeting geopolitical circumstance. Proposals for further advancing dialogue have included steps as ambitious as a comprehensive dialogue to resolve all contentious bilateral issues, and as modest as focusing on smaller economic issues as a gateway to further discussions. A spate of US-based policy and academic assessments—particularly in the late 1990s and 2000s—highlighted ways in which India and Pakistan could advance confidence building through formal information sharing and transparency arrangements.

Interest in many of these ideas has dimmed, perhaps because the initial steps have not yielded the virtuous circle of confidence building envisioned. However, the technological development, sophistication, accessibility, and responsiveness of remote-sensing technology has accelerated, opening a door to increased transparency between the two countries—at the very least reducing nuclear risk.

Security Dynamics in South Asia

The security rivalry between India and Pakistan has existed since the 1947 partition of British India. Wars in 1947, 1965, and 1971 underscored it, including the bisection of East Pakistan (now Bangladesh) from Pakistan by India in 1971. Several serious bilateral crises over the past thirty years, including the Kargil conflict of 1999, also underscore the dynamic. Competing political visions, contested identities, and territorial and military asymmetries underpin and drive security competition. India's growth as a major Asian power and its security competition with China help sustain a dynamic in which Pakistan both supports groups that compete against India at the sub-conventional level and seeks to deter major Indian territorial aggression. As a result, the relationships between Pakistan's military and intelligence services and the militant and terrorist groups that operate across the border into India—particularly Lashkar-e-Tayyiba—have proven greatly resistant to efforts by other states to induce or compel changes in these relationships. Moreover, although Lashkar-e-Tayyiba's armed wing numbers roughly in the thousands, the group's charitable organizations are deeply embedded in Pakistani society, especially in Punjab and Pakistani-administered Kashmir. As a result, even unexpectedly ambitious efforts to disarm, demobilize, and reintegrate elements of the group would take years, if not decades.²

The heart of the rivalry is the disputed Jammu and Kashmir region. The dividing line between the areas administered by Pakistan and those by India—called the Line of Control (LOC)—runs about 460 miles (740 kilometers). Although the two countries agreed to a related cease-fire agreement in 2003, violations have increased steadily, driven by multiple factors, including defense construction, exchanges of fire and maneuvers by smaller military units on either side of the border, and terrorist infiltration from Pakistan into the Indian side of Kashmir. Cross-border incursions from Pakistan inflame and heighten security dynamics; a major terrorist attack inside India, even if inaccurately attributed to a Pakistan-based network, could result in a major Indian reprisal that could escalate. Cross-border artillery shelling and buildups foster a perpetual sense of instability and hostility, even if both sides deliberately engineer some cease-fire violations for political effect. These exchanges both reflect and exacerbate the conflict between the two countries such that “even if terrorist infiltration were to end, conflict in the region—including ceasefire violations— might well continue.”³

Other territorial disputes—including the disputed waters of Sir Creek and the barren Siachen Glacier—also rankle the two countries, as do periodic disputes over water rights. Perennial political tensions inside the state of Jammu and Kashmir help inflame political relations. Tumultuous domestic politics on both sides, including “rising religious majoritarianism and nationalism” further increase the possibility of crisis.⁴

Window for Escalation

The persistent rivalry has shaped and helped define each state's development of nuclear weapons. Sub-conventional and low-level conventional competition persists under a nuclear overhang with a low but nonzero chance of escalation. Any discussion of the asymmetric strategies, capabilities, and doctrines that sustain the threat of nuclear war requires a brief history, starting in the 1980s.

The 1986–87 Brasstacks crisis, in which a large-scale Indian exercise nearly provoked a Pakistani military response, helped convince decision makers in both countries that “nuclearization was both desirable and inevitable.” The so-called Compound Crisis of 1990 also saw leaders on both sides publicly, albeit indirectly, allude to the potential nuclear dimension of

At the outset of the twenty-first century, India's stated nuclear doctrine emphasized a no-first-use posture, but a policy of massive retaliation if nuclear weapons were used against its forces.

a potential conflict—though the issue did not dictate the course of the crisis.⁵ The incursion of Pakistani forces into Kargil in 1999 and the Indian responses to a cross-border attack from Pakistan-based militants in 2001 and 2002 (also described as the Twin Peaks crisis) exacerbated a dynamic in which Pakistan sought to confront India under the nuclear umbrella. India responded by rhetorically posturing for confrontation and initiating reforms to confront and punish Pakistan without triggering escalation—which underscored to Pakistani decision makers that Pakistani deterrence had been and would continue to be decisive.⁶

Doctrinal development intertwined with each country's development of capabilities and expectations about the other's likely behavior in a crisis. At the outset of the twenty-first century, India's stated nuclear doctrine emphasized a no-first-use posture and a minimal deterrent, but a policy of massive retaliation if nuclear weapons were used against its forces or its territory.⁷ In reaction to the Twin Peaks crisis, the Indian army launched an operational concept that came to be called Cold Start (though the degree to which this doctrine has been adopted remains unclear). India's army developed the plan

to launch a retaliatory conventional strike against Pakistan that would inflict significant harm on the Pakistan Army before the international community could intercede, and at the same time, pursue narrow enough aims to deny Islamabad a justification to escalate the clash to the nuclear level.... Such an approach would leverage India's modest superiority in conventional forces to respond to Pakistan's continued provocation.

The concept envisioned the creation of eight integrated battle groups able to make relatively shallow territorial gains into Pakistan within seventy-two to ninety-six hours of a crisis, which it could then use to extract concessions from Islamabad.⁸ India's goal was to leverage conventional military advantage for military gains while staying under the nuclear threshold.

Pakistan's doctrine—developed in the same time frame but never formally spelled out—also highlighted the importance of “minimal credible deterrence.” Pakistani leaders sought to telegraph ambiguous redlines that might lead to a nuclear response.⁹ Remarks in 2002 by the then chief of Pakistan's Strategic Plans Division, Lieutenant General Khalid Kidwai, to two Italian physicists are a case in point:

Nuclear weapons are aimed solely at India. In case that deterrence fails, they will be used if: a. India attacks Pakistan and conquers a large part of its territory (space threshold); b. India destroys a large part either of its land or air forces (military threshold); c. India proceeds to the economic strangling of Pakistan (economic strangling); d. India pushes Pakistan into political destabilization or creates a large-scale internal subversion in Pakistan (domestic destabilization).¹⁰

Pakistan accelerated its development of battlefield nuclear weapons during this period, accelerating work on the nuclear-capable Nasr short-range ballistic missile. Feroz Khan, a former brigadier in the Pakistan Army and expert on the development of Pakistan's nuclear weapons program, conveys the official Pakistani thinking behind the development and employment of the Nasr:

As of 2001 and 2002 the country had restored the strategic balance in the region; it was disturbed by India's military doctrine of limited war under the nuclear overhang and nuanced through the Cold State Doctrine. Nasr, therefore, re-restores 'the strategic balance by closing in the gap at the operational and tactical level.' ... Nasr pours cold water to Cold Start.... It should convince India to think long before deciding to attack.¹¹

However, the Nasr—as well as other Pakistani battlefield weapons, such as a submarine-launched nuclear cruise missile—has the potential to create destabilizing battlefield effects. If ever deployed during a crisis, a nuclear-armed Nasr would create dilemmas for key decision makers on either side of the border, prompting Pakistan to choose between a potentially ineffective centralized control and a dangerous pre-delegated launch authority, forcing high-stakes efforts by Indian authorities to distinguish conventional from nuclear systems and raising the risks of inadvertent escalation, leaving open the chance for a yield-producing event on the battlefield. As Feroz Khan notes, “[Although] Pakistan assumes TNWs [tactical nuclear weapons] will enhance deterrence, their deployment during a crisis would nonetheless be provocative, adding incentive for India to strike immediately to eliminate the weapon system rather than running the risks of facing its effects.”¹²

Is it too dramatic to argue that this dynamic raises the risks of nuclear conflict? Since the initial Indian soundings about Cold Start, brinkmanship and skirmishes have punctuated a nuclear standoff that is only superficially static. Cross-border incursions and shelling attacks, as well as a handful of major terrorist attacks inside India, have resulted in carefully calibrated Indian responses. Nuclear optimists believe that the potential involvement of nuclear weapons will increase caution and deliberation on either side.¹³ Separately, Moeed Yusuf of the US Institute of Peace maintains that both countries have learned to rely on—and when advantageous, elicit—third-party intervention as a useful pathway out of security- and nuclear-related crises.¹⁴

However, this equilibrium cannot be guaranteed in the coming years. Cold Start’s meaning in the context of Indian doctrine and its real-world command-and-control and mobilization capabilities remain unclear. In 2017, India’s army chief used the phrase to refer to India’s ability to launch conventional attacks into Pakistan, walking back his comments days later by saying that he sought “to communicate to the rank and file and field commanders the kind of preparations they have to carry out for future combat.”¹⁵ Pakistani decision makers are more likely to focus on dramatic statements than on subsequent equivocations, and Pakistani fears over Indian capabilities are pushing nuclear deployments and doctrines in directions that raise nuclear risks.

South Asia scholar Christopher Clary suggests that the most likely scenario for

unintended escalation, a process that could terminate at full-scale war, and perhaps the use of nuclear weapons [would begin] with a major terrorist attack in India that can be traced back to Pakistan.... It is fairly easy to imagine how it might escalate vertically (in terms of severity) or horizontally (in terms of geographic scope).¹⁶

Of nine escalation scenarios discussed at a Pakistani roundtable exercise in 2010, seven reportedly involved a major terrorist attack in India.¹⁷ Simulations in the past five years between retired Indian and Pakistani officers also underscore the propensity of each side to approach crises with bellicosity, misread signals, underestimate likely responses, and escalate conflict.¹⁸

In short, security competition between the two states is increasingly sustained not just by differing conventional capabilities but also by disparate nuclear doctrines that reflect built-in asymmetries and create pathways for escalation. Whether intentionally punitive or simply demonstrative, Indian reprisals against a terrorist attack could inadvertently cross Pakistani redlines left deliberately vague; Pakistani sensitivities to the risk of decapitation attacks or rapid strikes that threaten to bisect the country or target key urban areas could create a justification for a major escalation or extremely risky deployments. The perceived risk of nuclear weapons involvement on either side raises the stakes for any attack, shortens decision-making timelines, and potentially increases the possibility of catastrophic error.

Future Trends

The factors that drive India-Pakistan security competition and heighten its nuclear risks are likely to intensify over time. India's geopolitical position, economic heft, and perceived if not real conventional military superiority will almost certainly increase relative to Pakistan over the next decade. Even aside from its relationship with the United States, recent setbacks in multilateral fora such as the Financial Action Task Force signal Pakistan's increasing vulnerability to international isolation. Recent memory of Indian actions in the wake of the September 2016 attack by Pakistan-based militants in Uri, India—floating the abrogation of the Indus Water Treaty and leading a boycott of a Pakistan-hosted meeting of the South Asian Association for Regional Cooperation—probably heightens this sense of vulnerability. It may be, as some have suggested, that these concerns will ultimately compel Pakistan to do more against militant and terrorist networks operating in the region. But they may simply heighten Pakistan's willingness to double down on the kinds of asymmetric strategies, including support for militants, that heighten and provoke Indian military responses.

The issue of Pakistan is likely to remain politically contentious in India, increasing the incentives for a larger Indian response to a perceived provocation from Pakistan. Perhaps foreshadowing tropes to be used in the 2019 elections, Prime Minister Narendra Modi, during the 2017 special by-election in Gujarat, alleged that opposing local politicians were working with Pakistani officials to lay the groundwork for a defeat of his Bharatiya Janata Party.¹⁹ These may already be common themes in Indian politics, but continued cross-border incursions and terrorist attacks are likely to underline and amplify anti-Pakistan sentiment against a backdrop in which impatience is increasing within India over what is perceived as an inadequate response to terrorist attacks. For instance, the purportedly surgical strikes India used to respond to the Uri attack were stealth operations “well below the levels of even a low-scale conventional attack,” but they were unusual for India's public acknowledgment of a military operation across the LOC.²⁰ Nevertheless, the comments of one Delhi-based observer reflect a frustration in India that even this response is inadequate:

Announcing the attack publicly appeared to be a deterrence signal to Pakistan that New Delhi had overcome its long-held fear of escalation. The problem was that a single and limited attack was not going to be sufficient to signal that India had indeed overcome its old fear.... India's failure to respond with escalation to further provocations clearly demonstrated to Pakistan that the surgical strike did not represent a new Indian strategy but rather an aberration that it could safely ignore.²¹

Even as the pathways for conflict expand, India and Pakistan are pursuing nuclear weapons and nuclear weapons-related technologies that will compress crisis response times, heighten the incentives for more dangerous deployments, and compound escalation risks. As India seeks to counter Chinese nuclear weapons technologies, its pursuit of ballistic missile defense and multiple independently targetable reentry vehicle (MIRV) technologies—and Pakistan's own MIRV developments—could further destabilize the region by creating powerful incentives for a first-strike attack.²²

Additionally, Pakistan is developing a seaborne nuclear force, driven in part by India's prospective development of ballistic missile defense. A 2017 analysis noted “reports that [Pakistan] is developing nuclear artillery shells and land mines as well. If war were to break out, Pakistan would have to use these weapons quickly.”²³ In that event, the deployment of short-range and sea-based systems would “put to severe test [Pakistani] claims that use authority will not be devolved to lower-level commanders,” raising concerns about unauthorized use during a crisis. Further, because the Nasr and sea-based systems would be mingled

with purely conventional platforms, the risks of inadvertent escalation and of theft or unauthorized use will increase.²⁴

The role of the United States in the region is also changing. President Trump's admonition in the summer of 2017 about the potential crisis facing US-Pakistan relations made it plausible that changes in US policies toward Pakistan could end with the two countries irreversibly estranged. At the same time, the United States is developing a closer strategic role with India. If the United States proves unable or unwilling to play the role of regional mediator at a moment of high tension (especially if contrary to the expectations of Pakistan or India), a crisis could play out in unexpected ways. For instance, the United States did not restrain India from the 2016 surgical strikes and pointedly did not criticize the operations, though it reportedly pressed India to avoid seeking to diplomatically isolate Pakistan.²⁵ As some argue, the changing US role could increase the role and prominence of other third parties and complicate efforts to mediate in crises even as the deployment of new weapons and technologies shorten the timelines of escalation.²⁶

Thus, security competition between Pakistan and India in the coming years is, if anything, likely to become more dangerous. Internal and bilateral dynamics will preserve or expand the most likely pathway to conflict, a terrorist attack executed from Pakistani soil leading to a major India reprisal; changes in the US role in South Asia will complicate efforts to mediate during a crisis; development and deployment of new nuclear weapons technologies could increase the incentives for a first strike and raise the risk of inadvertent escalation; and Pakistani development and deployment of nuclear weapons technologies intended to forestall an Indian advance or respond to a nuclear strike will raise the risk of theft or unauthorized use.

If the United States proves unable or unwilling to play the role of regional mediator at a moment of high tension, a crisis could play out in unexpected ways.

Traditional Confidence-Building Measures

Are there policy approaches that might blunt the sharpening risk of an escalating conflict between India and Pakistan? Periodically, the United States has looked hopefully to confidence-building measures (CBMs) between the two countries to ease conflict, only to be disappointed that the measures could not diminish the security competition. A CIA assessment noted thirty years ago that "India and Pakistan have little success developing confidence-building measures when defense and security interests are at stake—precisely the areas where the United States would like to see progress.... We believe there is little prospect that the two will achieve a breakthrough on their own."²⁷ These words capture not only the common belief that India and Pakistan ought to consider steps that would diminish bilateral tensions but also a pessimism that they can do so on their own. And yet conflict dynamics between the two countries appear ineradicable.

To be sure, moments of relative amity have resulted in productive agreements, even at the dawn of nuclear-tinged security competition. The Composite Dialogue, established in 1997 and reinvigorated in 2004, also created windows for confidence building, including the intermittent resumption of some personal and commercial travel. Most notably for this report, India and Pakistan agreed to a series of security-related—including some nuclear-related—measures in the 1999 Lahore Declaration, in which they stated that they were "fully committed to undertaking national measures to reducing the risks of accidental or unauthorized use of nuclear weapons [and establishing] the appropriate communication mechanism for this purpose."²⁸

Some agreements embodied in the Lahore Declaration have persisted. The two countries most recently exchanged nuclear facility lists in January 2018, continue to offer notifications of ballistic missile tests, and support communications between their respective opera-

tional commanders when incidents require.²⁹ Others, however, propose further diplomatic engagement that has either faltered or been held hostage to broader geopolitical trends in the bilateral relationship.³⁰

More recent proposals have included a “strategic nuclear dialogue [that] would be a more structured and institutionalized form of dialogue.”³¹ Another suggests that “nuclear CBMs alone will not be successful until they are placed in a comprehensive framework with complementary CBMs that address conventional and sub-conventional threats between India and Pakistan.”³²

Some have argued for greater ambition in CBM efforts. Nuclear nonproliferation expert Toby Dalton argues that two of the most frequently cited CBMs—missile test notification and nuclear facility nonattack—have done little to lay the foundation of long-term stability and peace. Instead, he called for negotiations between India and Pakistan, including representatives from the security establishments of both countries, to continue to engage through existing channels and mechanisms “to keep the bureaucracies busy and focused” even as political actors seek an array of incremental progress and grand symbolic gestures that could create “fundamental changes in the relationship” between the two countries.³³

However, at least in the short term, it is unclear if political timelines and security trends leave room for these kinds of formal arrangements—which after all require some investment of political capital. A pervasive belief in India is that high-profile outreach will be followed by high-profile terrorist attacks originating in Pakistan. Moreover, given the past decade and a half since the 2004 agreement, skepticism is widespread that confidence-building measures can create the kinds of meaningful positive momentum their supporters perceive. Echoing the CIA’s assessment from 1987, Michael Krepon lamented in 2004 that

we [had] hoped that CBMs might be pursued in a cumulative and progressive fashion so as to facilitate a resolution of highly contentious issues. This hope foundered on the region’s hard geopolitical realities.... CBMs were viewed as temporizing rather than permanent measures. Sometimes they were adopted in the wake of a crisis to demonstrate responsible behavior to Washington and other foreign capitals. When the crisis was over, proper implementation by Pakistan or India could be turned on or off to reflect displeasure, to purposely annoy, or to seek leverage on more important matters.³⁴

Traditional confidence-building measures have been unable to reverse dangerous security dynamics in South Asia. But what about more specific proposals to mitigate mistrust regarding specific military deployments and activities along the border?

Proposals for Limited Transparency

Zachary Davis, an expert in South Asian security and nuclear proliferation, notes that “transparency, properly applied, is a method of managing regional tensions and arms competitions. South Asia, therefore offers an ideal laboratory for the development and application of transparency concepts.” Many transparency arrangements include the formal exchange of information about nuclear facilities or doctrines, but a few have sought to use the limited provision or exchange of imagery information to reduce the risk of military escalation. Although mostly focused on proposals to share nuclear-specific information, Davis suggested that “a variety of cooperatively employed sensors, detectors, on-site monitors and commercially available overhead imagery could ensure transparency for ... the Siachen Glacier” and advocated using such a regime to support a mutual pullback from the area.³⁵ Retired Indian and Pakistani army brigadiers in 2007 recommended a combination of on-

site inspections, remote monitoring, and remote sensing to support mutual disengagement at Siachen.³⁶ Even earlier, an India-based journalist and security analyst suggested in 1996 that “India might find acceptable” a cooperative aerial monitoring regime to support a full withdrawal of Indian and Pakistani troops from the area.³⁷

Likewise, retired officers from the Indian and Pakistani air forces have proposed a cooperative aerial monitoring agreement based on monitoring arrangements supporting the 1973 Sinai Agreement and the 1992 Open Skies Treaty. The proposal would help both countries avoid “misconstrued perceptions or accidents [that] could exacerbate the ongoing impasse over Jammu and Kashmir ... and add to tensions along the sensitive, fragile and overly militarized Line of Control ... that could precipitate an unintended, unwanted nuclear exchange.” It recommended carefully shaping the arrangement to employ common equipment and operating procedures to ensure that the arrangement resulted in transparency rather than intrusive intelligence gathering.³⁸ Along similar lines, Pakistan-based analyst and scholar Zafar Jaspal suggested in 2004, along with conventional arms control and limitations on forces along the India-Pakistan border, a “cooperative monitoring agreement for the line of control ... to facilitate both sides in detecting and checking illegal cross-border movements and inspections of selected military deployments along the LOC.”³⁹

Other suggestions for advancing transparency have gone further than the LOC. In cataloging potential risk reduction measures in 2004, South Asia analyst Chris Gagne suggested that India might

share some of its high-resolution satellite pictures with Pakistan. India has reconnaissance satellites that are capable of producing detailed images of Indian and Pakistani military movements and missile-related activities. If India were to share images of its own territory with Pakistan, this might help to reduce confusion and the potential for miscalculation in Islamabad. India would have little to lose since such images are available through commercial channels anyway. An agreement to share satellite images would be another gesture that might do little on its own but would help give thrust to a more substantial process of nuclear risk reduction.⁴⁰

Also writing in 2004, senior US South Asia diplomat Teresita Schaffer and John Hawes, the lead US negotiator for the Open Skies Treaty, noted that

a meaningful risk reduction program must also focus heavily on giving national military and political leaders sufficient information about the conventional force deployments of the other side to enable them to make informed choices in a crisis. To the degree this can be achieved, the observation program could dampen the possibility of escalation at the conventional level before the use of nuclear weapons might be considered.

Drawing on the experiences of the Egyptian-Israeli peace agreement of 1979 and the Open Skies model, Schaffer and Hawes sketch out a monitoring regime that would employ each country's aircraft to overfly its own territory along pre-arranged routes, with teams from both countries on board and cameras relaying the same data to both sides. The countries would jointly agree on the territory monitored, the scope and periodicity of the flights, and the sensors used.⁴¹

Taken together, these proposals reflect the intuitive concept that formal arrangements to share information—in the examples given, mostly imagery—could reduce the threat of conflict between India and Pakistan. The most modest proposal suggests using shared imagery to facilitate withdrawal from a specific geographic area—namely, the Siachen Glacier. Other proposals would use shared imagery to reduce tension and misunderstanding along

the LOC. The most ambitious would offer broader insight to both sides about a wider range of conventional force deployments and activities, intended to reduce the danger of miscalculation and misunderstanding. Trends since 2004—especially Pakistan’s concern about a Cold Start–like attack and India’s limited understanding of Pakistani redlines—have heightened the danger of inaccurate or incomplete information about either side’s conventional and strategic disposition toward the other, increasing the urgency of information sharing.

Yet, as described, neither country offers fertile ground for these kinds of formal arrangements, which after all would require a significant investment of political capital. Moreover, given the decade and a half since the agreement, there is little reason to conclude that more incremental confidence-building measures can create meaningful positive momentum to this end. As Hawes and Schaffer noted, just before the resumption of the Composite Dialogue, “Any program of cooperative aerial observation would require India and Pakistan to overcome major political challenges. The military establishments in both countries are accustomed to guarding information, not sharing it, and popular opinion has not been prepared for the change in philosophy inherent in a program of this sort.”⁴² If formal bilateral arrangements will be short-circuited by a lack of political will, are other kinds of arrangements possible?

“Any program of cooperative aerial observation would require India and Pakistan to overcome major political challenges. The military establishments in both countries are accustomed to guarding information, not sharing it.”

Third-Party Arrangements

The concept, then, of a bilateral transparency arrangement—limited to a proscribed area along the border—has had theoretical appeal for the better part of the past two decades. To recap, such an arrangement could advance in one or more of three broad directions:

- Enable a joint withdrawal from a specific contested geographic area by allowing each side confidence that the other has withdrawn forces to an agreed limit;
- Reduce misunderstanding along the LOC by offering a neutral source of information to serve as the basis for discussion about cease-fire violations such as cross-border incursions and weapons fires; or
- Diminish the risk of escalation between the two countries overall by diminishing misunderstanding of the other side’s conventional force posture and providing a basis for discussion of the same. (Although not explicitly articulated in previous proposals, this could diminish Pakistani concerns about a Cold Start–type of threat enough that it forgoes deploying systems to forestall an attack and developing smaller battlefield weapons systems that would increase the risk of unintended use or theft).

Regardless, security dynamics between the two countries, lack of political will, and years of negative experiences with confidence-building measures make such a bilateral transparency arrangement unlikely.

It is therefore worth asking about an alternative to traditional bilateral agreements that would nonetheless offer at least some of the same benefits. The use of aircraft, manned or unmanned, by any third party, over such a sensitive area, is difficult to imagine. However, one might ask whether it would be possible for a third party to leverage the availability, resolution, and timeliness of remotely sensed imagery to create the functional equivalent of cooperative aerial monitoring regimes without the formal arrangements that formal bilateral regimes would require.

Analysts have been mulling creative uses of satellite imagery to mitigate or diminish regional disputes since at least the late 1970s, when it became clear that the data gathered by remote-imaging satellites could be used to monitor and verify arms control agreements, and that remote-sensing technology was proliferating well beyond what had previously been the provenance of states. In 1979, France proposed to the United Nations an international satellite monitoring agency that would be “able to obtain information essential for set-

ting disputes between nations.” These proposals all suffered from technological barriers, including the precision of the sensors and their susceptibility to weather effects, and the difficulty of processing and understanding the data, given the technological constraints of the time. As academics and policymakers began to grapple with the possibilities offered by nonmilitary imagery satellites, commercial imagery offered a resolution of roughly four times less than would be necessary to collect detailed information on military movements.⁴³ By the 1990s, with the experience of the Open Skies Treaty, the use of commercial sensing remained real, if just out of reach. One prophetic volume on the impact of commercial imagery noted that commercial imagery could “play an important role in arms control and non-proliferation monitoring”; that “new imaging satellites could bolster global transparency by collecting timely images that focus international attention on war preparations among regional adversaries”; and that “despite the barriers of cost and the lack of technical expertise, the availability of commercial satellite imagery is likely to be a powerful tool for NGOs.”⁴⁴

This century, however, has witnessed an explosion in the ubiquity and resolution of sensors, especially remote-sensing technology. By the start of the twenty-first century, one analyst noted new and emerging systems that would “collect data of much higher spatial resolution (less than 5 m) than the 10-30 meter resolution that were the best earlier civilian observation satellites offered.”⁴⁵ At the same time, according to another analysis offered in the same volume, the United States might put greater constraints on synthetic aperture radar, perhaps going so far as to limit resolution to 5 meters.⁴⁶

The availability and resolution of commercial imagery today is a quantum leap from earlier standards. The private-sector company Planet, for example, uses a constellation of more than 175 satellites, in combination with other data streams, to take daily pictures of every spot on the planet, from resolutions at 3 meters and 72 centimeters, according to the company’s website. The US-based firm Digital Globe has received clearance from the US government to offer commercial customers the ability to view images at a resolution roughly high enough to identify specific kinds of vehicles, a level already met by several non-US providers.⁴⁷ The availability of both optical and synthetic aperture radar (SAR) imagery is expanding even further as the introduction of nano-satellites and the proliferation of cost-sharing schemes further diminishes the price of imagery, and as reduced restraints by the United States on the commercial availability of SAR increases its availability.⁴⁸ SAR capabilities are particularly relevant because they allow for monitoring in weather and light conditions that would challenge optical sensors, making it possible to guarantee the observation of military movements during poor weather and at night. As more sensitive optical sensors are launched into space, it is not an understatement to say that on-demand imagery of any part of the world is an increasing reality—the functional equivalent of a near-persistent view of every place on earth.

The real-world applications of this leap in quality are already emerging, especially for disaster relief and humanitarian assistance. Despite the obstacles of cost, cloud cover, the periodicity of satellite coverage, the reliability of data and its analysis, satellites have been used from Sudan to Burma for a variety of humanitarian projects since 2006, frequently by alliances of nongovernmental organizations and commercial imagery providers. In one striking example, the Satellite Sentinel Project—a joint venture between the commercial satellite firm Digital Globe and the human rights advocacy group Enough—published a 2013 analysis showing where Sudan and South Sudan were violating the terms of a demilitarization agreement. An excerpt from this report is instructive in highlighting the insight into the movement of a handful of military vehicles that commercially available imagery makes possible:

DGA [DigitalGlobe Analytics] has determined that an SAF [Sudan Armed Forces] tank- and artillery-supported infantry unit has been present at Keri Kara for more than two years. New imagery dated June 3, 2013, confirms that the artillery howitzers remain within the compound despite the demilitarization pledge which forbids all weapons. Since a tent was erected where the tanks have historically parked, DGA cannot confirm or deny that presence of tanks under the tent. Additionally, at least 100 tents and other small structures are still located within the SAF earthen-berm defensive position. DGA concludes that these types of tents and structures ... are consistent with a military, rather than civilian presence.⁴⁹

Several initiatives at US-based organizations reflect the increasing use of commercially available imagery to illuminate military and strategic development. The Asia Maritime Transparency Initiative, run by the Center for Strategic and International Studies, uses imagery provided by Digital Globe to assess developments in maritime Asia—investigating subjects, to use two recent examples, from airfield improvements to the specific arrival and departure of military vehicles on a Chinese base in the Paracels.⁵⁰ Another project, 38 North, uses commercial satellite imagery of sufficient detail to identify relatively small changes to and construction at North Korean military and strategic sites.⁵¹ The Institute for Science and International Security uses satellite imagery—including in-depth analysis of construction and military activity at specific sites—to assess nuclear developments in South Asia and more broadly worldwide. In addition, a retired Indian military veteran and satellite imagery expert frequently posts on Twitter imagery-derived assessments of Chinese, Pakistani, and other Asian military developments.⁵² The American Association for the Advancement of Science noted in 2014 that the level of widely available high-resolution imagery “is ideal for analyzing conflict areas, where small houses and other structures are often destroyed by violence ... but cannot capture individual people because their dimensions, when viewed from above, are smaller than most imaging resolutions.”⁵³

In short, commercially available satellite imagery is both already widely available and of high-enough resolution for third parties to discern and report on some military movements and construction in detail. As the technology continues to mature—driven by private-sector demand—the availability, timeliness, and resolution of these products will only increase. The raw tools, then, exist to create an environment that would mimic a bilateral transparency arrangement. However, the creation by a third party of a transparency regime for India and Pakistan that does more good than harm in the region faces serious obstacles.

Fleshing Out Proposals

Were a third party to provide both countries with remotely sensed data from along the India-Pakistan border and the Line of Control on a regular basis, it could allay Pakistan's day-to-day concerns over the Indian conventional threat, reducing incentives for Pakistan to deploy battlefield nuclear weapons in ways that increase the chances for inadvertent escalation, theft, or unauthorized use. Such an arrangement would provide a common basis for discussion of incursions and military buildup in the border-LOC area. Provision of the imagery could also be helpful at moments of crisis if the United States were unable or unwilling to do so. It could also someday provide a bridge to more formal bilateral counterterrorism, border security, and demilitarization arrangements—but this would be an unexpectedly positive outcome, rather than the driving rationale, of such an arrangement.

If remote-sensing technology has in fact matured enough that it offers the theoretical opportunity to make one or all of these arrangements feasible, such a regime would raise difficult technical and operational questions, especially regarding the area covered by the regime; the provision, analysis, use, periodicity, and reliability of the imagery; and its use or abuse during crisis.

Area and Periodicity

A transparency regime that supported mutual withdrawal from a contested area—most notably the Siachen Glacier region, some 20 square miles (70 square kilometers)—would leverage existing commercial imagery products. For example, former Pakistani and Indian army brigadiers Asad Hakeem and Gurmeet Kanwal suggested more than a decade ago that, used in conjunction with on-site inspections and joint aerial reconnaissance, satellite imagery, available every three to four days, “with 62 cm to 1 meter spatial resolution has the ability to determine whether a large structure in a base camp has been dismantled [and] confirm the removal of medium artillery from prepared positions.”⁵⁴ Such a regime might be supported without any special arrangement, based solely on existing commercial satellite orbits.

However, regimes that sought to share imagery along the LOC would require substantially more resources to capture the movement of smaller artillery and, perhaps more aspirationally, the disposition of so-called launching pads used by militant and terrorist networks to conduct attacks from Pakistan into India. This would require optical imagery at greater detail and require more regular periodicity, perhaps with the use of synthetic aperture radar when chances for cloud cover and precipitation are highest. Such a regime would probably rely more heavily on custom (and more costly) arrangements for satellite imagery. Given the difficulty in assessing smaller artillery, squad-level movements, and incursions, this arrangement would lean heavily on the analytic tools and resources inherent in each country or provided by the same entity that provided the imagery, and might require special arrangements with satellite imagery providers for higher-resolution images.

Finally, any effort to productively diminish the threat of misunderstanding about the movement of conventional forces along the entire border would necessarily have to cover the entire border, and perhaps the LOC, and focus on regions that either country view as most susceptible to conventional threats. Given Pakistani concerns about Cold Start—and the early stated goal of launching an attack within forty-eight to seventy-two hours—a transparency regime would have to offer daily updates to create enough persistent confidence to reduce escalatory or otherwise dangerous pressures. At its most aggressive, such a regime would require persistent imagery of major cantonments on both sides of the border—or perhaps even deep enough into Indian territory for additional information on additional Indian Army and Air Force bases. Moreover, for such a regime to be robust even under difficult weather conditions, it would need to include some SAR capability to compensate for possible poorly timed cloud cover.

A second key complicating factor is that the larger the area surveilled, the greater the challenge to review and analyze imagery. Making sense of imagery requires technical skill and experience. It is also either manpower intensive or requires significant investment in artificial intelligence and machine learning scoped to the widely disparate geography of the border and LOC areas. A transparency regime that exposed the entire international border and LOC to review would almost certainly produce more raw imagery than either country would have the capacity to digest. Even limited streams would probably stress extant analytic capabilities. A transparency regime, especially a broadly focused one, would need to include analytic context and/or tools rather than just raw imagery, given the massive consequences of an incorrect assessment. A secondary challenge is the development of a storehouse of negation imagery—the historical imagery against which to compare images of the same location, at roughly similar dates and times, and from roughly similar angles, to detect and measure changes, such as construction or the arrival of military equipment. Securing a steady stream of imagery at this level, supplemented by SAR imagery at times of poor weather, may require a uniquely bespoke solution—or may be available through an amalgam of existing products and tailored analytic tools. More study is needed.

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Who?

Provision of potentially inflammatory imagery of military deployments and other sensitive issues would create a set of difficult and complex issues. Yet several possibilities exist for who might fulfill the role of a trusted third party.

The United States would be an obvious candidate to establish a transparency regime given its historical role as a mediator during crises. Systematic US use of imagery would not be unprecedented.⁵⁵ However, the increasingly close relationship between the United States and India and the decade-long downward drift in US-Pakistan relations suggest that it may not be feasible for the United States to persistently provide its own imagery to both countries. Each may also be wary that the United States would limit the dissemination of certain images in a crisis.

Another country or group of countries with access to commercial imagery and analytic capacity could take the role instead. However, the list of such countries is short, and each has its own complications and entanglements in South Asia. Similar concerns about the ulterior motives of the providers would present problems, particularly during a crisis, when either India or Pakistan or both might try to question or threaten the providers, implicating sovereign concerns in what is intended to be a neutral effort.

An international governmental organization such as the United Nations could conceivably leverage available imagery. Yet it is difficult to imagine a scenario more likely to draw an unconditional refusal to participate from New Delhi than a perceived expansion of the mandate of the United Nations Military Observer Group in India and Pakistan. The specter of India's reaction to formal international encroachment further into or beyond the LOC is probably enough to fatally wound any such proposal.

A third-party nongovernmental organization could arrange for the imagery or analytic product, or both, to be provided on a limited basis to identified government experts in each country. As noted, precedent is ample and no explicit requirement is in place for the countries in question to approve such an arrangement. However, an NGO would almost certainly lack immediate access to commercial imagery and, most important, institutional understanding of the tools and techniques used to analyze imagery products. If a viable NGO can be found—or invented for the purposes of this effort—this is probably the optimal option.

In short, any of the three proposed transparency regimes would need to be provided by a third party that was not the United States and did not implicate Indian concern about formal international intervention into the contested region between India and Pakistan.

Concerns and Questions

It is worth emphasizing that none of the described options to reduce the nuclear danger of the India-Pakistan rivalry will conclusively bring peace to South Asia. By design, these proposals are weighted more toward reducing risks posed by security competition than they are toward eliminating competition in the first place. However, several questions are beyond the initial scope of this study and require additional review.

Cost

The scale and scope of monitoring regimes that would cover the Line of Control or the India-Pakistan border would likely each require arrangements with either satellite imagery providers or firms providing analytic tools and support, or both. For the LOC, the demands would require the highest imagery capabilities commercially available. A transparency regime that sought to diminish misunderstanding over conventional force deployments would face

important challenges regarding the size of the region, the need for credible and powerful analysis and analytic tools, and the requirements for periodicity and the capability to avoid weather effects. These factors would all increase the cost and complexity of any regime.

Utility

None of the regimes described require either India or Pakistan to take affirmative steps of approval. But it is difficult to see either the LOC regime or the broader border arrangement working in the face of determined opposition. To that end, regimes would have to be designed to meet—or at least conclusively not to harm—the security interests of either state. Additional research, for instance, is needed to ascertain whether a broad border transparency regime could provide enough information to Pakistan to productively diminish uncertainty over the threat of a Cold Start-like attack—yet not harm Indian security interests, especially relative to China.

Moreover, any third-party transparency regime would need to not provoke a crisis. In studying UN operations in Cyprus, one analyst notes that “the provision of transparency faces barriers when there are large amounts of ingrained bias, or when adversaries already know much about each other.”⁵⁶ Beyond misinterpretation, one state or the other could simply use the transparency regime for belligerent but not overtly threatening behavior—a variation or elaboration of the cross-border violations that persist today. Additional study and simulation could be used to stress test a given arrangement under either crisis conditions or potentially combustible moments, such as a large-scale military exercise near the border.

However, if a third-party transparency regime is able to reduce the prospects for a nuclear confrontation and diminish tactical concerns that could cause Pakistan to deploy its nuclear arsenal in ways that endanger regional and US interests, or to provide a common basis to discuss LOC incursions, other cease-fire violations, and separate issues of concern along the border, the arrangement could be well worth the difficulty.

In light of these questions, potential next steps might include interviews with decision makers and analysts in India and Pakistan to gauge resistance or interest in such an arrangement, a detailed feasibility study to gauge the costs and modalities of each of the arrangements described, and simulations or exercises to model how limited transparency arrangements might be used or abused during large-scale exercises or at moments of high tension between the two countries.

Notes

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