STIMSON

THE LURE & PITFALLS OF MIRVs

From the First to the Second Nuclear Age

Edited by Michael Krepon,
Travis Wheeler and Shane Mason

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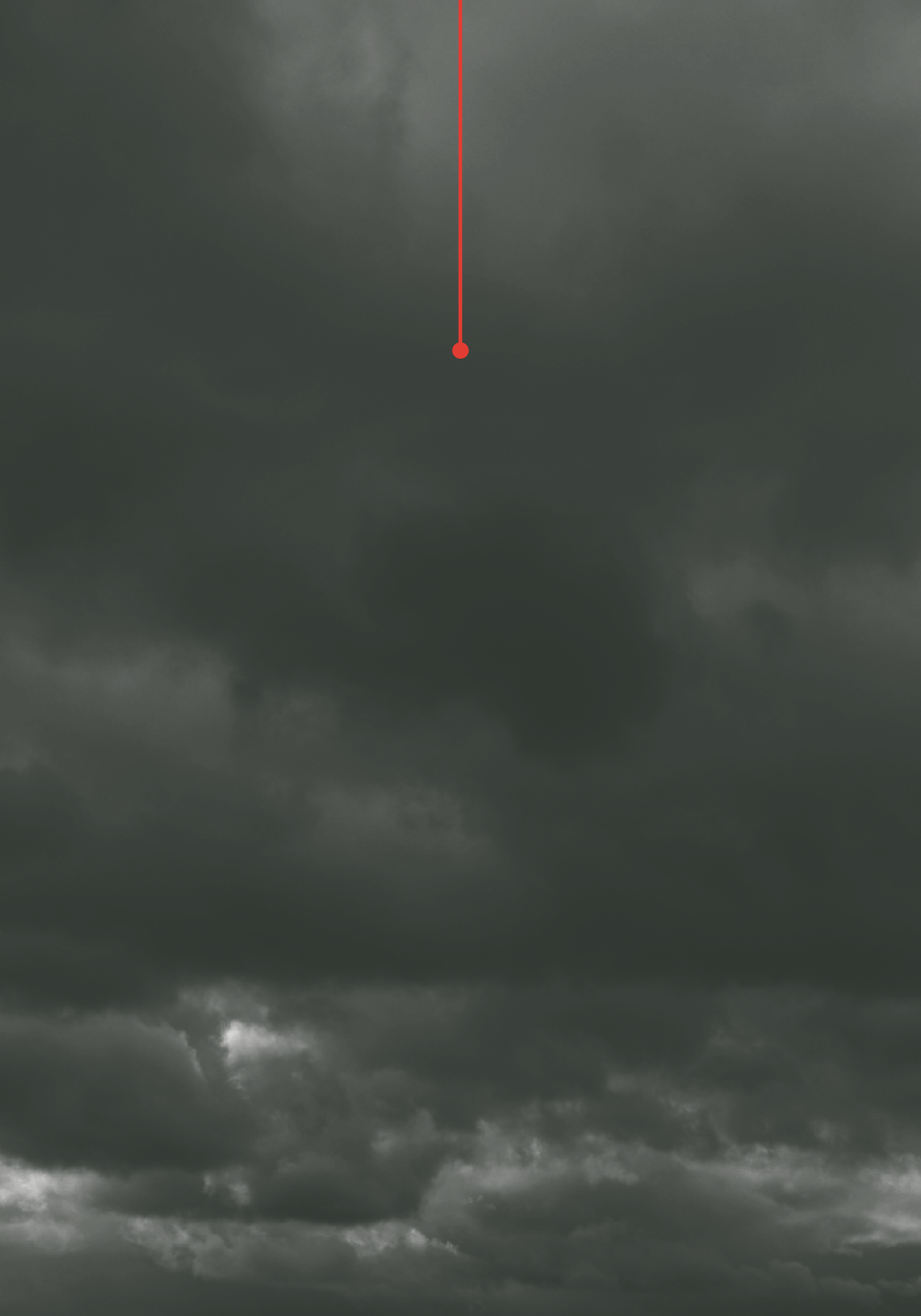

PREFACE

I am pleased to present the latest publication of the Stimson Center's South Asia program, *The Lure and Pitfalls of MIRVs: From the First to the Second Nuclear Age.* This monograph begins with expert analyses of the internal and external factors that led the United States and the Soviet Union to affix multiple warheads atop their longest-range missiles. Then three essays assess whether and how China, India, and Pakistan might embrace multiple independently targetable re-entry vehicles (MIRVs). As with previous Stimson publications, we expect that *The Lure and Pitfalls of MIRVs* will be read carefully by government officials, serving and retired military officers, senior and rising strategic analysts, and students interested in how the second nuclear age will play out in India, Pakistan, and China.

For more than 25 years, the Stimson Center has generated policy-relevant scholarship on nuclear deterrence and crisis management in South Asia. In recent years, Stimson's South Asia program has gone from strength to strength, including a website, *South Asian Voices* [http://www.southasianvoices.org], dedicated to providing a forum for rising strategic analysts in India and Pakistan. In 2016, we will launch a new Stimson initiative — an open online course on "Nuclear South Asia." This free course benefits from the input of more than 70 notable strategic analysts, scholars, and diplomats from India, Pakistan, and the United States. It will become the go-to course on South Asia's nuclear history, Indian and Pakistani nuclear doctrines, deterrence and crisis stability, as well as the subcontinent's alternative nuclear futures.

The Stimson Center is deeply indebted for programming on nuclear issues in South Asia from the National Nuclear Security Administration, the Carnegie Corporation of New York, and the John D. and Catherine T. MacArthur Foundation. The editors also wish to thank: Stimson's communications team, led by Jim Baird and Miles Abadilla; Stimson's administrative team, especially Oksana Bellas, Lacie Rawlings, Nakia Bell, and Will Brown; Julia Thompson, a former research associate in the South Asia Program; Akriti Vasudeva, a visiting fellow in the South Asia Program; Stimson interns Joseph Kendall, Mariah Hays, and Poorvie Patel; copy editor Jenny Moore; and graphic designer Lita Ledesma.

Sincerely,

Brian Finlay
President and CEO, Stimson Center

EXECUTIVE SUMMARY

In the second nuclear age, no less than the first, there are no realistic prospects for banning multiple-warhead missiles. China has started to deploy such missiles, and India and Pakistan are likely to cross this threshold as well. The motivations behind these steps will determine how extensively nuclear arsenals will grow and how pernicious the effects of stockpile growth will become.

Success in dampening the negative repercussions of multiple-warhead missiles will rest on two foundations. The first is improved bilateral relations among the contestants. One of the responsibilities of states that possess nuclear weapons is to pursue nuclear risk reduction measures (NRRMs) with other nuclear-armed states, especially those with which they have previously fought wars. By this yardstick, China, India, and Pakistan can be found wanting.

A willingness to improve bilateral relations is measurable in many ways. It is affirmed by: the absence of firing across and aggressive patrolling nearby unsettled borders; the avoidance of violent acts emanating from one country's soil that can lead to intense crises; failing that, the successful judicial prosecution of higher-ups; engagement in meaningful strategic dialogue that produces NRRMs; and preventing increased trade or improved relations from being held hostage to issues that are not ripe for settlement. Here again, all three states can be found wanting.

The second foundation for dampening the negative consequences of multiple-warhead missiles in Asia is to resist a progression from countervalue to counterforce targeting strategies of nuclear deterrence. This metric, as with the willingness to improve bilateral relations, is measurable in several ways, including: the retention of no first use (NFU) doctrines by China and India; proceeding slowly with limited numbers of multiple-warhead missiles; and being more transparent about strategic modernization plans and programs.

China will set the tone for this competition. India will likely indulge in technological advances as well. And Pakistan, the country least equipped to engage in an accelerated competition, is most susceptible to this dynamic as it seeks to keep pace with India. Unlike the first nuclear age, it is possible to dampen the extent of warhead increases due to multiple-warhead missiles. But even modest increments in multiple-warhead missiles — resulting in perhaps 200 warheads among the competitors over the next 10-15 years — will ratchet up the triangular, interactive nuclear competition in Asia.

If the growth of warhead totals and missile accuracy presages moves by Beijing and New Delhi toward warfighting strategies of deterrence, then the second nuclear age will become far more dangerous, and prospects for reducing the salience of nuclear weapons on international affairs will be undermined. If decisionmakers in China, India, and Pakistan wish to avoid repeating the missteps of the United States and the Soviet Union during the first nuclear age, they will limit the extent to which multiple warheads are placed atop missiles, they will proceed at a slow pace, and, most important, they will reject the lure and pitfalls of counterforce targeting strategies.

KEY TERMS & ACRONYMS

ABM	Anti-Ballistic Missile
ALCM	Air-Launched Cruise Missile
ASAT	Anti-Satellite
BMD	Ballistic Missile Defense
CEP	Circular Error Probable
CTBT	Comprehensive Nuclear-Test-Ban Treaty
C3	Command, Control, and Communications
DAE	Department of Atomic Energy (India)
DRDO	Defence Research and Development Organisation (India)
HTK	Hard-Target Kill
ICBM	Intercontinental Ballistic Missile
INF	Intermediate-range Nuclear Forces
IRBM	Intermediate-range Ballistic Missile
ISPR	Inter-Services Public Relations (Pakistan)
ISR	Intelligence, Surveillance, and Reconnaissance
LACM	Land-Attack Cruise Missile
LNO	Limited Nuclear Options
MAD	Mutual Assured Destruction
MIRV	Multiple Independently Targetable Re-entry Vehicle
MaRV	Maneuverable Re-entry Vehicle
MRV	Multiple Re-entry Vehicle
NCA	National Command Authority (Pakistan)
NESCOM	National Engineering and Scientific Commission (Pakistan)
NFU	No First Use
NPT	Non-Proliferation Treaty
NSA	National Security Advisor
NSG	Nuclear Suppliers Group
OSD	Office of the Secretary of Defense (United States)
PBV	Post-Boost Vehicle
PLA	People's Liberation Army (China)

PMO	Prime Minister's Office (India)
PSA	Principal Scientific Advisor (India)
RV	Re-entry Vehicle
SAC	Strategic Air Command (United States)
SALT	Strategic Arms Limitation Talks
SFC	Strategic Forces Command (India)
SIOP	Single Integrated Operational Plan (United States)
SLBM	Submarine-Launched Ballistic Missile
SNF	Strategic Nuclear Forces
SP	Special Projects (United States)
SPD	Strategic Plans Division (Pakistan)
SPS	Strategic Program Staff (India)
SRF	Strategic Rocket Forces (Soviet Union)
SSBN	Ballistic Missile Submarine
START	Strategic Arms Reduction Treaty
SUPARCO	Space and Upper Atmospheric Research Commission (Pakistan)
USSR	Union of Soviet Socialist Republics

INTRODUCTION

Michael Krepon and Travis Wheeler

The dawn of the first nuclear age came as a great shock. The assumption of waging wars by "ironmongery," with the outcome determined over time by remorseless acts of cumulative punishment, was immediately upended. With stunning effect, the "absolute" weapon was unveiled. The Bomb could be used as a war-winning weapon or, paradoxically, it could be too powerful to be used in war.[1]

Other shocking technological advances followed the "atomic" bomb in quick succession: far more destructive "hydrogen" bombs, the intercontinental ballistic missile (ICBM) that could devastate cities less than 30 minutes after launch, and the ballistic missile-carrying submarine that could shorten even those flight times. During this harrowing progression, the fear of surprise attack dominated public discourse and strategic analysis. Vulnerability never seemed so great.

The nuclear arms race between the superpowers didn't stop there; these technological advances were mere preludes to an even more intensified strategic competition marked by the advent of MIRVs — multiple independently targetable re-entry vehicles — atop land- and sea-based missiles. MIRVs propelled vertical proliferation more than any other technological advance during the first nuclear age.

The growth of warhead numbers begged the question of what the warheads would target. A countervalue target, such as a city, has value to an adversary but does not present a military threat. A counterforce target, such as a missile garrison, has military value to an adversary and presents a military threat. If the accuracy of a missile and warhead are sufficient, and if the location of a target is well known, a warhead can be used for countervalue as well as counterforce targeting. Having an arsenal of relatively inaccurate warheads in limited numbers does not place an adversary's nuclear capabilities at risk and is consistent, therefore, with countervalue targeting. By contrast, possessing many warheads that can be delivered with high accuracy is consistent with counterforce targeting. Increases in multiple re-entry vehicles (MRVs) that are not independently targetable would allow for the expansion of countervalue targeting. Increases in MIRVs and missile accuracy would allow for the expansion of counterforce targeting.

During the Cold War, the ideological and geopolitical contest between the United States and the Soviet Union generated vast nuclear arsenals, far more than were sufficient for countervalue targeting. Among the constituent elements of stockpile growth, tactical nuclear weapons to be used on battlefields were, by definition, counterforce weapons. Weapons that could be dropped from strategic bombers could be used for countervalue or counterforce targeting. The warheads of greatest consequence for arms racing and deterrence stability were those placed atop long-range missiles. The advent of MIRVs and increases in missile accuracy enabled sophisticated counterforce targeting by means of prompt hard-target-kill (HTK) capabilities. When deterrence of nuclear attack is predicated on the ability to attack opposing forces quickly, it becomes very hard for national leaders to stabilize political relations and proceed with arms control. Nuclear warfighting strategies of deterrence during the first nuclear age resulted in heightened insecurity and a nuclear arms race.

The second coming of MIRVs has now begun in Asia, with reports of China's placement of multiple warheads atop its DF-5B ICBMs.[2] While the United States and Russia continue to modernize existing arsenals, they do so within limits set by the New Strategic Arms Reduction Treaty (New START). The locus of competition in the second nuclear age has shifted from Europe to Asia, where there are no treaty constraints. The second nuclear age, unlike the first, is multipolar rather than bipolar. Nuclear dynamics are asymmetric rather than rigidly symmetric. The second nuclear age is still hierarchical, but its dominant axis is horizontal rather than vertical. Among the Asian states with nuclear weapons, one — North Korea — is an outlier. Three — China, India, and Pakistan — are engaged in a unique triangular competition with an external driver, as the actions taken in Washington affect Beijing's choices. The least advantaged of these states — Pakistan — has taken pages from the US playbook in dealing with a conventionally stronger adversary, including the embrace of tactical, or battlefield, nuclear weapons. Its neighbors — China and India — have far more capability to invest in nuclear capabilities, but have done so in a relaxed, distinctly non-Western way.

Nuclear dangers in the second nuclear age emanate primarily from contested borders that national leaders have been unwilling or unable to resolve. These contested borders have led to border wars. Wild cards in the form of unpredictable leaders and non-state actors are primary concerns, a divergence from the formulaic arms racing that characterized the first nuclear age. Stockpile growth is certainly present in Asia, but at a pace far slower than in the first nuclear age. The two rising powers of Asia — China and India — are accruing power through economic growth and market dynamics, not by the accouterments of nuclear weapon stockpiles. They have moved to accumulate nuclear weapons at a pace that confounds deterrence strategists drawn to prompt HTK capabilities and counterforce targeting — hallmarks of the first nuclear age.

While the interactive competition among China, India, and Pakistan will be far less intense than the competition between the United States and the Soviet Union, it will still reflect the action-reaction syndrome and other familiar dynamics from the first nuclear age. Nuclear enclaves, wherever located, are inherently sensitive to advances by their neighbors, and all have powerful backing.

The advent of MRVs or MIRVs in Asia will have ripple effects. For example, the authors of the case studies in this volume argue that as China pursues multiple-warhead missiles at a modest pace, India is likely to as well. And if India pursues multiple-warhead missiles, Pakistan is likely to follow. Three key questions lie ahead: What are the implications of the second coming of multiple-warhead missiles? Are states fully sensitive to potential negative repercussions related to the advent of multiple re-entry vehicles? If so, will they be able to limit negative repercussions?

We have edited this monograph to help bring attention to downstream risks and consequences. This ground has not been previously covered. To help provide context and connective tissue between the first and second nuclear ages, we offer five case studies — two that harken back to the superpower competition of the Cold War, and three that look ahead to the triangular competition in southern Asia.

Brendan Rittenhouse Green and Austin Long's essay, "The Geopolitical Origins of US Hard-Target-Kill Counterforce Capabilities and MIRVs," addresses why the United States pursued MIRVs and HTK capabilities during the Cold War, even though many believe such actions adversely affected strategic stability vis-à-vis the Soviet Union. In the authors' view, successive US administrations sought HTK capabilities because they perceived that US strategic restraint would have undermined US national security and alliance management. Without MIRVs, the perceived nuclear balance would have tilted in Moscow's favor, raising problems with allies and the possibility of nuclear coercion. In addition to these reasons for MIRVing, US policymakers had the view that HTK capabilities possessed actual military value, enabling limited nuclear options, nuclear warfighting plans — if approved by the president — and damage-limitation capabilities. In the final analysis, US decisionmakers felt that American HTK capabilities helped to deter aggression and coercion, reassured NATO allies and other security partners, and reinforced perceptions of US power. Green and Long nonetheless warn Chinese, Indian, and Pakistani decisionmakers to be wary of HTK, as nuclear competition in the 21st century will take place under a different set of circumstances than those of the 20th century, and excessive prioritization of counterforce could bring with it risks associated with the Cold War competition.

In “The Impact of MIRVs and Counterforce Targeting on the US-Soviet Relationship,” Alexey Arbatov and Vladimir Dvorkin contend that both countries’ development and deployment of MIRVed ICBMs fostered a costly arms race, undermined strategic stability, and hurt arms control efforts. The authors discuss a number of factors that spurred Soviet production of MIRVs, first among them the desire to achieve strategic parity with the United States, which had taken the technological lead in MIRVing. They argue that Washington’s commitment to maintain a technological edge, combined with its interest in counterforce targeting, galvanized an action-reaction phenomenon in which Moscow committed to translate its advantage in missile throw weight to significant investments in MIRVs and counterforce targeting. They conclude, as do many US analysts, that MIRVs effectively sabotaged the process of strategic arms limitation. Not until the first Strategic Arms Reduction Treaty (START I) in 1991 did negotiators begin to roll back the negative effects of MIRVing. Arbatov and Dvorkin argue that, had efforts to constrain MIRVs succeeded in the late 1960s and early 1970s, the US-Soviet nuclear rivalry would have been far less intense and dangerous.

Jeffrey G. Lewis’ essay, “China’s Belated Embrace of MIRVs,” assesses Chinese nuclear capabilities and intentions in light of the outfitting of the DF-5B with multiple warheads. Lewis assesses whether this long-belated advent of MIRVing might foreshadow a shift in Chinese nuclear posture away from “assured retaliation” toward counterforce targeting and a race to parity with the United States. He cautions against Western mirror-imaging of Chinese strategic intentions, arguing instead that China’s relaxed pursuit of MIRVs has been motivated more by requirements to demonstrate technical mastery than to pursue counterforce targeting requirements. In the author’s view, Beijing has invested in qualitative rather than quantitative advances. Chinese thinking about nuclear weapons could change, he argues, if the People’s Liberation Army’s Rocket Force gains greater autonomy or if there is significant turbulence in US-China relations. Lewis anticipates the likelihood of a gradual evolution in Chinese strategic posture, influenced by increases in perceived US threats and technological advances.

The essay by Rajesh Basrur and Jaganath Sankaran, “India’s Slow and Unstoppable Move to MIRV,” examines the foreign and domestic drivers that could foster the gradual incorporation of MIRVs into the Indian nuclear arsenal. The authors argue that the main external driver for India’s relaxed pursuit of MIRV technology has been China’s strategic modernization program. On the domestic front, the authors argue that the primary driver has been segments of India’s military and scientific research and development establishment that advocate for New Delhi to jettison a minimalist approach to deterrence in favor of a more "credible" doctrine and posture. Basrur and Sankaran doubt that MIRVing will augur a shift to counterforce targeting and a large increase in warheads. Rather, they contend that MIRVs are likely to be fielded out of technological momentum and the deference of decisionmakers to the defense-technical establishment.

In "Pakistan, MIRVs, and Counterforce Targeting," Feroz H. Khan and Mansoor Ahmed argue that Pakistan's enduring rivalry with India is likely to extend to deploying multiple-warhead missiles, especially if India obtains such missiles and pursues limited ballistic missile defenses. The authors argue that Pakistan's competitive response would be steered by resource constraints and by limitations on its fissile material production capacity. The authors conclude that Pakistan will undertake countervailing measures while seeking to avoid an even more costly arms race.

The second coming of MIRVs will be far less intense and destabilizing than the first. But even modest perturbations in the triangular competition among China, India, and Pakistan can have undesirable and unintended consequences. In the final chapter of this collection of essays, "Summing Up and Looking Ahead," Michael Krepon concludes that the advent of multiple-warhead missiles in the second nuclear age can compound negative nuclear dynamics in southern Asia. One key to avoiding a nuclear competition compounded by MIRVs is the continued inclination by Chinese and Indian leaders to invest in other measurements of national power while avoiding the lure and pitfalls of counterforce targeting. Pakistan's military feels this lure more than its nuclear-armed neighbors, but has the weakest financial base and space-based capabilities — two constraining factors to extensive counterforce targeting. China and India are not nearly so constrained, but have yet to invite open-ended nuclear requirements by indulging significantly in counterforce targeting.

This triangular nuclear competition — as well as its sensitivity to external drivers — will characterize the second nuclear age. We hope that this collection of essays conveys cautionary messages about the lure and pitfalls of MIRVing.

Endnotes

1. These consequences were first predicted in Bernard Brodie, ed., *The Absolute Weapon: Atomic Power and World Order* (New Haven: Yale Institute of International Studies, 1946).

2. Office of the Secretary of Defense, "Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2015," US Department of Defense, April 7, 2015, http://www.defense.gov/Portals/1/Documents/pubs/2015_China_Military_Power_Report.pdf.

UNITED STATES

Brendan Rittenhouse Green and Austin Long

The Geopolitical Origins of US Hard-Target-Kill Counterforce Capabilities and MIRVs

By the mid-1960s, it seemed fleetingly possible to stabilize the Cold War strategic arms race. The Soviet Union numbered its intercontinental ballistic missile (ICBM) force in the hundreds, and had begun to harden these missile silos to protect them from attack. Moscow had also begun to build ballistic-missile-carrying submarines. The basic parameters of the US strategic program had also been publicly set: 1,054 ICBMs and 656 submarine-launched ballistic missiles (SLBMs) on 41 submarines. The expectation of roughly comparable force sizes, well defended from blast or hard to find at sea, seemed to offer little probability that either side could destroy enough of the other's nuclear arsenal to avoid society-destroying retaliation.

After the Berlin and Cuban missile crises, the two superpowers might have been sufficiently chastened to avoid an intense strategic competition. In 1963, Washington and Moscow signed a treaty banning atmospheric nuclear tests. The superpowers reached a tacit bargain to respect the division of Europe, with Washington implying it would maintain North Atlantic Treaty Organization (NATO) military deployments in perpetuity in West Germany to ensure that Bonn would never obtain nuclear weapons. In return, the Soviet Union indicated it would respect the West's exposed outpost in Berlin.[1] In 1967, Washington and Moscow worked together to negotiate the Outer Space Treaty. The following year, they worked in tandem to negotiate the Non-Proliferation Treaty (NPT). In the early 1970s, the superpowers began to negotiate strategic arms limitations. They welcomed détente and sought to regulate their political rivalry.

But the objective of strategic stability proved illusory. The advent of multiple independently targetable re-entry vehicles (MIRVs), more powerful warhead yields, and improved missile accuracy enabled both superpowers to target hardened military facilities. MIRVs and the resultant "hard-target-kill" (HTK) capabilities offered a cost-effective alternative to the massive construction of new missile launchers. By the end of the Cold War, both superpowers had accumulated five-digit-sized stockpiles of deployed warheads. Both undertook significant strategic modernization programs. The emphasis on HTK

Common domestic political explanations for America's adoption of HTK nuclear capabilities are much overstated.

capabilities clearly motivated many of the doctrinal and programmatic decisions that elevated the strategic arms race to new heights. Even though both superpowers were able to destroy each other, the stalemated state of their competition prompted them to spend vast sums to increase their nuclear destructive powers many times over.

One common explanation for the rise of HTK and counterforce capabilities in the United States is rooted in domestic politics. Powerful domestic constituencies and key legislators supported the acquisition of HTK capabilities in a kind of "cartelized" politics: coalitions of material interests and ideological entrepreneurs emerged who supported offensive military strategies in order to gain political power and parochial advantages for themselves. Hawkish politicians rallied public and elite opinion around the procurement of weapons systems proposed by economic and industrial interests that stood to benefit from making them, or from the active foreign policy they incentivized. The rise of the Reagan coalition of Republicans and defense-minded Democrats during the second half of the Cold War is often interpreted in these terms, with HTK counterforce uniting hawkish intellectuals, right-wing politicians, and sectoral interests into a potent political force.

Another explanation is rooted in organizational theory, which stresses that militaries tend to prefer offensive doctrines because they reduce uncertainty in their environment. Taking the offensive allows military organizations to structure the character of battlefield engagements and enhances autonomy from their civilian masters.[2] It also enhances organizational size and wealth, capturing resources by dint of a purported need to procure cutting-edge equipment. During the Cold War, the US Air Force was an enthusiastic backer of counterforce strategies and HTK modernization, and many would point to the organization's post-World War II struggle to break free of the army, maintain its autonomy, and dominate inter-service politics as the key motivation for these preferences.

In this essay, we argue that these common domestic political explanations for America's adoption of HTK nuclear capabilities are much overstated. While military preferences and ideological politics surely played a role in shaping

American nuclear strategy, on balance these factors worked against the pursuit of HTK, with internal variables periodically restricting counterforce plans throughout the period. At the same time, external environmental pressures seriously motivated US officials. Policymakers believed that the nuclear balance would shape the political choices of other states — the Soviet Union, NATO allies, and third parties — even in the era of nuclear plenty, and might even be critical to deterring war in a crisis. American leaders also believed that perceptions of the strategic balance abroad might influence international politics to the detriment of US national and international security — even when those perceptions were not rooted in military realities.

In sum, it was international politics, not domestic politics, which killed hopes for nuclear stability. Successive administrations discovered that the threat of retaliation and the existential risk of nuclear escalation posed by stability doctrines were not a sufficient military solution for their perceived geopolitical challenges. They therefore grasped — haltingly, in periodic bursts, and against domestic opposition — for something more. Counterforce and HTK capabilities were at the heart of several rationales proposing to accomplish internationally what policymakers feared nuclear restraint might not.

We pursue these claims by examining evidence from the Nixon, Ford, and Carter administrations, the eras when the most important decisions on HTK capabilities were made. We begin by describing the technical bases for HTK counterforce and the development of different elements in the American HTK force posture. We then assess the major internal explanations for American HTK capabilities. Next, we catalogue and evaluate the various external strategic rationales for the same developments. We conclude by exploring the implications of America's Cold War embrace of HTK counterforce for contemporary nuclear powers.

The Technology and History of Hard-Target Kill

The ability to destroy a heavily protected, fixed target by nuclear attack depends on three variables: the accuracy of the attacking missile, the yield of the attacking warhead, and the hardening of the protected target. In this equation accuracy matters the most, for if the awesome power of a moderate-to-high-yield nuclear blast is close enough, it will destroy a hardened target. The overall efficacy of a counterforce attack on multiple enemy silos depends upon three additional factors: the balance of attacking warheads to hardened targets, the absolute number of defending forces, and a doctrine for exploiting counterforce advantages.

Because it takes more than a single warhead to assure destruction of a hardened silo with high confidence, the attacker needs a numerical advantage. And since few attacks will be 100 percent effective, the absolute number of surviving ICBMs (and other strategic nuclear-delivery vehicles at sea and in the air) determines the size of any potential retaliatory strike. Finally, if a counterforce strike is to have any pretension at utility, the attacker needs some doctrinal “story” for what the attack will achieve and how to execute it successfully. Early missile types carried single large warheads, but were wildly inaccurate, meaning that even modest levels of hardening could effectively protect launchers. By the late 1960s, the numbers of launchers on each side were roughly equivalent. Thus, even if counter-silo attacks could be executed effectively, it was hard to envision how an attacker could avoid “dynamic disarmament,” where the attacker expends warheads faster than the adversary’s strategic forces are destroyed. Moreover, the absence of missile accuracy invited a devastating retaliatory response because the absolute number of an adversary’s residual warheads would remain so high. At this stage of the superpower strategic competition, counterforce doctrines were implausible.

But the competition did not stop in the late 1960s. Instead, innovations that improved missile guidance and accuracy — and thereby exchange ratios — were pursued, enabling HTK counterforce doctrine. Arms control agreements that would limit strategic nuclear delivery weapons were also in the offing, which came with technical limitations in the amount of hardening that could be achieved at fixed sites. Consequently, beginning in the 1970s, three major sources of American HTK capabilities came into place: technical innovations for improved targeting, innovations in nuclear doctrine, and the restrictions on launchers as a result of arms control agreements.

American modernization featured three important technical advances relevant to HTK. First, the invention of MIRVs dramatically improved the force ratio for a potential attack. Once a launcher could carry multiple warheads, its numerical advantage over a defending force grew exponentially. With MIRVs, a defender’s arsenal might be heavily damaged by only a portion of an attacker’s overall force, leaving the attacker a significant amount of force to deter a response. Second, the accuracy of ballistic missile guidance increased dramatically, dropping from more than a nautical mile of circular error probable (CEP) to less than a hundred meters. Third, after a sharp initial decrease in yield from multi-megaton weapons, American warheads possessed increased yields. The combination of moderately increased yields, vastly increased accuracies, and multiplying warhead totals due to MIRVs provided the backbone of HTK capabilities.

From the mid-1960s onward, American force modernization featured two new ICBMs developed by the air force, and three SLBMs developed by the navy. The Minuteman III ICBM was deployed in 1970, with marginally better accuracy than its predecessor, the Minuteman II. It could carry three MIRVs, but at a much reduced yield: 170 kilotons (kt) compared to 1.2 megatons (Mt) for earlier ICBMs. The Poseidon SLBM was deployed in 1971. Poseidon doubled the accuracy of the Polaris missile it replaced, making it roughly as precise as Minuteman III. Poseidon was a much heavier missile, however, and could carry up to 14 MIRVs. These warheads, with individual yields of 40 kt each, were more accurate, though less destructive, than the Polaris, which could carry three un-MIRVed 600-kt weapons.

Both missiles received upgrades during the 1970s. The guidance system on Minuteman III was replaced, doubling its accuracy. And by the end of the decade, 300 of the 550 Minuteman IIIs were refitted with new warheads with a yield of 330 kt. Meanwhile, the Trident I C4, a completely new SLBM, began to replace the Poseidon. The Trident I was as accurate as Poseidon at twice the range, implying much greater accuracy at shorter distances. By the early 1980s, Secretary of Defense James Schlesinger's Improved Accuracy Program (IAP) doubled the accuracy of the Trident I at longer distances, making it approximately as accurate as the upgraded Minuteman III.[3] The Trident I carried fewer warheads (10), but higher-yield (100 kt each).

HTK counterforce capabilities continued to grow. The air force's MX missile entered development in the mid-1970s. Later dubbed the "Peacekeeper," the MX achieved remarkable accuracies, roughly doubling that of the upgraded Minuteman III. It also carried 10 300-kt warheads, making it a powerful hard-target killer. The navy's analogous program, the Trident II (D-5) missile, provided equal accuracy with greater firepower, with the potential to carry 10 475-kt warheads. The MX encountered extended political controversy — it was approved by both Gerald Ford and Jimmy Carter and then twice pulled back over basing issues — before finally being deployed in 1986 in fixed silos. The Trident II went to sea in 1990. The origin of both programs could be traced back to the end of Richard Nixon's administration.

Two major doctrinal changes during the 1970s had a direct bearing on the American embrace of HTK capabilities. In 1972-1974, the Nixon administration undertook an examination of limited nuclear options (LNOs) in a study ordered by National Security Study Memorandum (NSSM) 169. The resulting assessment affirmed the utility of the selective, limited use of nuclear weapons — including counterforce attacks — in order to control escalation if deterrence failed. In 1974, LNOs were codified in US Nuclear Weapons Employment Policy (NUWEP-74), guidance issued by Schlesinger to war planners. A series of long-running studies during the Carter administration generated another doctrinal innovation. These studies suggested the possibility of protracted nuclear exchanges that were

The unwillingness of both sides to accept serious limitations on MIRVs and missile modifications greatly exacerbated the counterforce calculus of both sides.

tightly integrated with conventional operations. They culminated in Presidential Directive 59 (PD-59), in July 1980. Both innovations gave US nuclear-weapon employment policy a more "warfighting" cast. The advent of the Strategic Arms Limitation Talks (SALT) also contributed to the advent of HTK capabilities by limiting launchers and by providing added impetus to MIRV programs. The initial SALT I Interim Agreement left MIRVs uncontrolled, as America's qualitative compensation for the Soviet Union's numerical superiority in launchers. The paradoxical effects of arms control contributing to the rise of HTK were especially evident in the late 1970s, when President Carter sought to negotiate the SALT II Treaty. Increases in missile accuracies and warhead yields were not the subject of SALT; MIRVs were, and by failing to dramatically limit or prevent them, significant increases in HTK became a reality. The unwillingness of both sides to accept serious limitations on MIRVs and missile modifications greatly exacerbated the counterforce calculus of both sides. The process of formulating arms control positions provides a window into the US government's understanding of the nuclear balance, as well as the influence of domestic and external factors on nuclear choices.

Following SALT I, two major arms control events stand out in debate over HTK counterforce. In November 1974, President Ford agreed to an agreement with Soviet leader Leonid Brezhnev at Vladivostok, which set the general parameters of a SALT II agreement: an upper limit on aggregate delivery vehicles, a sub-limit on MIRVed delivery vehicles, and non-inclusion of US and NATO forward-based systems (FBS) in Europe. Carter initially pursued a more aggressive arms limitation strategy, one that would have limited heavy MIRVed missiles and slowed down or halted modernization programs on both sides. When the Kremlin rejected these proposals, Carter quickly fell back to adjusting the Vladivostok framework. When SALT II was finally signed in June 1979, its terms were similar to those negotiated at Vladivostok, with the addition of some restrictions on cruise missile development.

Internal Factors: Domestic Politics and Hard-Target Counterforce Capabilities

Two internal sources of American nuclear force posture are notable for their potential impact. First, militaries are often held to be strong supporters of offensive counterforce nuclear strategies. Second, congressional and presidential politics have been connected frequently to debates on nuclear force acquisition. A group of conservative hawks in Congress, led by Senator Henry "Scoop" Jackson (D-WA), publicly exerted pressure for nuclear force modernization and against nuclear arms control in the 1970s. The same ideological coalition made its presence felt nationally through the 1976 and 1980 presidential campaigns of former California Governor Ronald Reagan.

In the section that follows, we briefly outline the common internal explanations for the development of nuclear force posture. We then weigh the evidence for and against these explanations, concluding that their impact was less important than commonly imagined. Domestic political forces played an important, but mostly secondary, role in shaping American HTK capabilities. Indeed, domestic politics were more often an impediment to HTK acquisition than an accelerant. The military's interest in HTK programs was usually secondary compared to other priorities, and important elements in the navy worked outright against placing more emphasis on counterforce. Congressional doves, meanwhile, initially held their own against congressional hawks in influencing nuclear force posture, substantially altering or delaying the HTK aspects of important nuclear acquisition projects. While the doves ultimately lost their battle, it was not because they were overwhelmed by a more powerful hawkish coalition in Congress — it was because the executive branch consistently pushed for HTK capabilities.

Domestic Organizational Interests

The air force was a dedicated advocate of counterforce nuclear strategies and HTK programs in particular. Basic air force doctrine from the mid-1960s on stressed that "our force posture and general war plans must consider the requirement for both first- and second-strike operations," which required the ability to hit hardened Soviet nuclear targets.[4] For this reason, the air force was initially attracted to large-yield warheads, and subsequently to increased accuracy and MIRVs. The five-fold increase in the accuracy of the Minuteman II was a reflection of air force preferences. The development of the MX missile demonstrates that the air force was concerned first and foremost with building a highly accurate, heavily MIRVed ICBM with high-yield warheads, and was only secondarily concerned with the invulnerability of the missile.[5]

A generalized military interest in larger budgets, newer systems, and greater procurement also influenced the development of American nuclear force posture. The Joint Chiefs of Staff (JCS) used the SALT process as a tool to push for their favorite systems. As Secretary of State Henry Kissinger noted, "We haven't heard a word from our military since they figured out how SALT could get them a bigger military establishment. It's the best legitimization of Trident they have."[6] The same logic applied to other HTK systems as well. Air force General David Jones, chairman of the JCS under President Carter, believed that MX was essential for the air force, and had declared publicly in 1978 that "this is not a matter of debate." It is probably not coincidence that the JCS did not endorse the SALT II agreement until a week after the decision to procure MX was publicly announced.[7]

Ideological Coalitions

Electoral pressure from hawks — either in Congress or on the presidential campaign trail — had at least some impact on American HTK capabilities. In 1976, for instance, President Ford took a great deal of pressure from his right in the form of Ronald Reagan and his hawkish allies in Congress. As one senator told Ford, "I am bugged by much of the rhetoric going around by people saying we need a military second to none. I see this as a statement of weakness. We are either number one or we are not. We must face the fact that we are in fact in an arms race."[8] In a private meeting with advisors later that week, Ford agreed: "I don't think the president should say we are slipping. I can say we need to redouble our efforts. I don't want to say we are getting behind. I'll say we have a challenge, we have rough equivalence and we've got to keep up." Kissinger advocated for an even stronger message: "I think the posture to take is that Reagan doesn't know what he's talking about and he's irresponsible."[9]

Public pronunciations of America's tough nuclear posture also had their counterpart in backroom political dealings. Ford's Secretary of Defense Donald Rumsfeld, in explaining his plan to go along with hawkish congressional moves to accelerate Minuteman improvements such as the Mark (Mk)-12A warhead, said: "It was not in there [the budget] originally because this is a political year and we wanted to avoid the possibility of a gratuitous debate and to wait until after the election. But now I think we should give up our opposition to going ahead and we should respond favorably to the Committee initiative. It will contribute to the counterforce dialogue." Kissinger also believed that "this is not a bad year in which to provoke a debate" on counterforce.[10]

The Carter administration was subject to similar influences. Several key members of the administration, most notably Secretary of State Cyrus Vance, flipped their opposition to MX after they decided it was necessary in order to secure the Senate's consent to ratify SALT II.[11] And PD-59's public release was timed in part to respond to pressure from Reagan in the 1980 general election. As National Security Council (NSC) staffer General William E. Odom wrote to National Security Advisor Zbigniew Brzezinski in his covering memorandum for PD-59, "You should also know that the Republican platform includes a lot of nuclear war-fighting doctrine. The issue may or may not come up in the campaign, but from a national security and foreign policy viewpoint, the PD is needed to clarify our policy and leave no room for confusion."[12]

Domestic Organizational and Political Forces against HTK

Air Force Programs: Important elements of the air force were initially deeply resistant to putting a MIRVed capability on Minuteman III missiles. Strategic Air Command (SAC) was concerned about the targeting effectiveness of trading warhead yield for more warheads. Some "were reluctant to rely on a complicated gadget to guarantee target kill," and others were reluctant to downsize warhead yields, doubting the operational significance of accuracy improvements.[13] Moreover, the air force staff understood that MIRVs dramatically undercut the air force's case for a larger Minuteman force; only when it became obvious that "its case for more Minuteman was hopeless did it turn to MIRV as the only available option for increasing the number of warheads."[14] Outside of the ballistic missile program office, "the rest of the air force had to be brought along or bought off."[15] The service was "brought along" through a sustained campaign of civilian pressure from the Office of the Secretary of Defense (OSD), and "bought off" by the OSD's agreement to fund the multi-megaton Mk-17 warhead for later deployment.[16]

Elsewhere in the air force, resistance to missile-based HTK programs could be found among supporters of strategic bombing via manned aircraft. Donald Mackenzie argues that "the single dominant concern of the air force [was] to forge a convincing strategic rationale for the manned bomber, even in the wake of the missile revolution."[17] Greenwood notes that "those who thought that spending for strategic missiles was taking money that should be spent on aircraft were naturally apprehensive about new technical developments in the missile field," hindering acceptance of MIRVs and other HTK advances.[18] In this vein, John Edwards reports that the air force office in charge of developing MX saw itself as "fighting a daily, precarious struggle to extract funds for missile development from an air staff that would rather spend the money on pilots and planes."[19]

The air force's pro-bomber bias manifested itself in ways great and small. On the milder side, it organized a full-court press in favor of the B-1 at the end of the Ford administration, while deprioritizing the much more potent MX missile. Through the OSD, the air force released a B-1 white paper that the State Department noted "is intended to be an advocacy argument for a B-1 production decision by the next Administration" and aimed to get "a good deal of publicity and more than usual attention" for the program.[20] The air force also sent the OSD a blistering 19-page, paragraph-by-paragraph rebuttal to the navy's unfavorable assumptions about the future of strategic bombing in a 1976 "strategic issues" paper, with the comparatively mild note that "the issue of future ICBM capabilities is… complex and far-reaching," requiring further discussions with the OSD before upcoming budget decisions.[21] When MX later became an issue of public controversy, some former bomber generals joined left-wing intellectuals in publicly doubting whether missile accuracy could actually be known with any reliability.[22] In short, while the air force supported the MX, it was much more interested in strategic bombers than in HTK capabilities.

More seriously, air force backers on Capitol Hill entered into an improbable alliance with congressional doves to delay the MX program. The Ford administration had requested funding in 1976 that would have set the path to initially deploy MX in silos until a more secure basing mode could be found. Congressional doves cut a deal with Senator Barry Goldwater (R-AZ), a reserve air force officer and long-time booster of the service's "bomber faction." They would support the acquisition of B-1 if he would agree to support language ensuring that MX could not be deployed in silos. The difficulty of finding invulnerable land basing for ICBMs was well understood by that time, and the deal doomed the MX to seven more years in the wilderness. Congressional opposition to mobile versions of MX also played a major role in extending the delay.[23]

Navy Programs: As with the air force, HTK capabilities in navy programs were primarily the result of civilian intervention. Even more than the air force, elements within the navy actively resisted HTK capabilities. "Most officers in the navy," Greenwood recounts, "considered the Polaris force and the mission of fighting all-out nuclear war as an appendage, perhaps an unwelcome one, to their central mission" of conventional naval warfare.[24] They feared that funding Poseidon, the Polaris follow-on missile that would carry MIRVs, would take money from their shipbuilding budget and force structure. Secretary of the Navy Paul Nitze was forced to bring outside pressure to bear in order to break the institutional logjam and get Poseidon approved.[25]

Once the existence of Poseidon was assured, civilians in the OSD and the navy's "Great Circle" group of strategic planners concentrated on giving it counterforce capabilities. They wanted both increased accuracy and higher-yield warheads, with the optimal plan for the Poseidon to carry three Mk-17 re-entry vehicles (RVs), the air force's favored warhead for Minuteman. In part for these reasons, the

OSD insisted that the size of the missile be increased to use the entire volume of the submarine's launch tubes. Secretary of Defense Robert McNamara even went so far as to single out the HTK role for Poseidon in his annual posture statement, noting that in addition to its assured destruction mission, it "could be used to attack a hardened point target with greater accuracy and a heavy warhead."[26]

However, the navy's Special Projects (SP) office — in charge of developing navy SLBMs including Poseidon — was deeply resistant to making it an HTK weapon. SP was motivated by a combination of bureaucratic and technological conservatism. Bruising fights from the 1950s over nuclear roles and missions led SP to seek to avoid new battles with the air force, while its own service viewed its budget requests skeptically. Consequently, SP was wary of pursuing technical risks associated with counterforce capabilities, especially those associated with new "stellar-inertial" guidance and the Mk-17 warhead program co-managed with the air force. Resistance was so great that some members of the Great Circle group suspected SP of making "a deal with the air force not to try to gain counterforce capability."[27]

The result was a masterpiece of bureaucratic infighting. In order to relieve pressure from the OSD, the head of SP promised to double Polaris' accuracy on Poseidon, but only as a "goal" and not a program "requirement" — meaning that SP could not be faulted if accuracy objectives were not met. Then, in order to avoid being chained to an Mk-17 program it could not control, SP sponsored a study showing that Poseidon could be as effective against moderately hard targets with a much smaller warhead through improved accuracy by means of stellar-inertial guidance. Assisted by arguments that a large number of smaller warheads (up to 14) would be better able to penetrate anti-ballistic missile (ABM) defenses, SP gained permission to drop the Mk-17 in favor of the Mk-3 RV's 40-kt warhead. Finally, in the *coup de grace,* SP made common cause with congressional doves against counterforce. The doves pressured Richard Nixon into publicly disavowing counterforce intentions, forcing him to abandon his initial plans for stellar-inertial guidance for Poseidon to increase its accuracy.

This pattern continued with the Trident I and II missiles. For Trident I C4, the OSD forced SP to provide greater accuracy by disguising it as a requirement for greater range: "system accuracy of the C4 at 4,000 nautical miles should be as good as Poseidon at 2,000 nautical miles." This required that SP finally embrace stellar-inertial guidance, against its original plans. The OSD also forced the new, more powerful 100-kt W76 warhead onto the Trident C4, which SP accepted only because "they recognized the political benefit of agreeing with OSD."[28] Similarly, Secretary of Defense Schlesinger was able to engineer a compromise with SP that produced the IAP, an effort to discover and fix the sources of guidance inaccuracies. In return for once again making accuracy requirements for Trident C4 a goal rather than a requirement, SP pledged

The most important drivers of US HTK capabilities were the strategic incentives produced by the international system.

to use anything it learned to improve accuracy on Trident II D5 and to backfit any innovations onto Trident C4. When the time came to build the D-5, the OSD demanded MX-level accuracy as a program requirement, and moved to replace the 10 W76s with 10 475-kt W88 warheads. SP fought against these moves, but this time they lost the battle to the OSD.[29] The broader navy was happy to support any configuration for Trident II once it became clear the program would not interfere with other shipbuilding dollars.

In sum, internal domestic factors were a much stronger force against HTK capabilities than they were a source of political support. In both the military and political realms HTK had at least as many detractors as advocates. But even where internal factors did play a role in the development of American nuclear force posture, they were accompanied by even more powerful influences from the external environment.

External Factors: Strategic Rationales for HTK

The most important drivers of US HTK capabilities were the strategic incentives produced by the international system. Specifically, decisionmakers across administrations believed that HTK was a source of several political benefits that would: help deter the Soviet Union from initiating war; influence Moscow's broader diplomatic approach, especially with regard to détente and the SALT talks; and shape the foreign policy of America's allies and partners in favorable ways, particularly those in NATO.

However, there was less consensus about the causal mechanism by which HTK would provide political gains. The relative importance of different mechanisms varied over administrations, individuals, and time. Two basic rationales for HTK were most evident. First, most policymakers believed in the reality and importance of the nuclear balance even under generalized conditions of mutual assured destruction (MAD). Since the strategic competition was dynamic, at issue was whether the United States would be relatively advantaged or disadvantaged. HTK capabilities were believed to be essential indicators of military strength in this equation, helping to prevent and, if necessary, prevail in a central strategic war. They would therefore cast a political shadow based on their posited military utility in certain kinds of nuclear war. Three proposed missions were popular among different policymakers: limited nuclear options, protracted nuclear warfighting, and damage limitation.

Even those policymakers who denied that the nuclear balance mattered under MAD believed that international *perceptions* of the balance were of pivotal importance for American interests. By conveying signals of military strength and political resolve, the character of American nuclear forces reassured friends and induced caution for adversaries. For instance, various metrics for taking stock of the nuclear balance — throw-weight comparisons, aggregate RVs, equivalent megatonnage — held widespread currency among strategic analysts. HTK became a crucial metric for comparing US and Soviet nuclear forces, and could therefore produce political effects even if the perceived military rationales for HTK were weak.

In the section that follows, we first describe the various political gains American policymakers hoped HTK would provide in international politics. Next, we describe the different mechanisms by which it was hypothesized HTK would produce favorable or adverse political effects. Finally, we make an attempt to weigh the relative importance of each political objective and nuclear mechanism in explaining the development of American HTK capabilities.

Political Benefits of HTK

Every major nuclear study from the Nixon to the Carter administrations stressed the importance of deterrence and escalation control as the first and most obvious goals of American nuclear force posture, including HTK capabilities. These objectives included, according to NSSM 169, "to deter, first and foremost, any use of nuclear force against the United States," but also "to contribute to the deterrence of … conventional attacks on the United States, its allies, or its forces overseas." Rounding out American goals were the inhibition of coercive nuclear threats and conflict termination "at the lowest possible level with minimum loss to the United States and its allies" if deterrence should fail.[30] NSSM 246 under President Ford confirmed these goals and set out competing criteria for what force characteristics were necessary to ensure stable deterrence.[31]

The Carter administration reinforced these basic political aims in PD-18, arguing that American nuclear forces must "insure [sic] that the Soviet Union cannot use strategic forces for political leverage and coercion and so that the strategic balance will not deter the United States from taking conventional military action where its interests dictate."[32] National Security Advisor Brzezinski summarized the link between nuclear means and political ends by saying that requirements for certain nuclear capabilities "could only be understood if we discussed the roles they would play in crisis bargaining scenarios."[33]

The pursuit of HTK through strategic modernization programs reflected ambitions beyond deterrence. The nuclear balance was widely recognized as a key feature in shaping, confining, or enabling broader Soviet diplomacy. It was important, Secretary of State Kissinger argued, for arms control to produce an acceptable nuclear balance for no "reason other than our concern for the evolution of Soviet policy and what will happen to our foreign policy in China, Europe and the Middle East if we get into a confrontation with the Soviet Union."[34] The more favorable the nuclear balance was for the United States, the more it would restrain Soviet positions across the gamut of international politics. In the same vein, Secretary of Defense Schlesinger argued that "US bargaining power lies in stirring up the American people and persuading the Soviets that… [i]f they won't bargain, we will start a major program, which will lead to instability and will end détente."[35] The acquisition of HTK capabilities and other nuclear force characteristics could be used as carrots or sticks to mold Soviet grand strategy in a more favorable direction.

HTK capabilities would be particularly useful in incentivizing the Soviets to cut a favorable SALT II deal. As Kissinger mused, "We should look for something which gives a strategic effect and which would give the Soviets an incentive to come to a SALT agreement in the future… If we accelerate the MX program that would give the Russians some incentive to seriously negotiate down the road."[36] He also concluded that "One thing we've learned from SALT is that we need ongoing programs. The only reason we got the SALT I agreement is the fact that we had an ongoing ABM program. [The] B-1 and the Trident program give us some leverage for SALT II."[37]

The Carter administration initially embraced this logic after it assumed office in 1977, when it offered to trade the MX for a limit on Soviet SS-18s, the Kremlin's most feared HTK weapon. As Secretary of Defense Harold Brown said in an attempt to reassure the JCS, "I share the concern about giving up MX; it is a valuable card; but we can't leave it out because this [proposal] is a tightly knit narrative."[38] In short, one important argument for HTK capabilities was to build them in order to trade them away.

Finally, and perhaps most importantly with regard to HTK, US policymakers believed that American nuclear force posture would shape the perceptions and actions of allies, partners, and neutral states. Nixon frequently argued that an unfavorable nuclear balance could cause a catastrophic collapse of American alliances. If arms control could set the nuclear balance "mutually, Europe will continue to be safe." But if the United States ceased its nuclear modernization "unilaterally, with us going down and the Russians staying up, the Germans [snap]… like that and Europe's finished."[39] The Carter administration held similar concerns. As one official noted, "European support" for NATO nuclear forces with HTK capabilities "derives in large measure from a sense that, in a period of strategic nuclear parity, a deterrent strategy limited to 'assured destruction' of Soviet cities may not be adequately credible."[40] The nuclear balance needed to be shored up with counterforce capabilities.

HTK and other nuclear force characteristics mattered for alliance management and control. SALT was central to détente, and counterforce capabilities became central to SALT. As Kissinger argued, "Are we better with the Soviet Union having détente with Europe and Japan and us on the outside? Or having us play with the Soviet Union and have Europe and the Japanese worry? What have the Soviets gotten from SALT? Wheat — and that was our own stupidity."

In particular, Kissinger thought negotiating a favorable nuclear balance could rein in "the Bahrs in Germany," referring to Egon Bahr, the architect of West German *Ostpolitik* and other measures of separation from the American-led NATO system. NATO-oriented politicians like West German Defense Minister Georg Leber were far more to Kissinger's liking. Assuming a favorable deal on the nuclear balance, Kissinger believed "with détente Leber can keep Bahr under control."[41]

The nuclear balance was assumed to have an important shaping effect on the strategy of other powers as well. As Nixon rhetorically asked about his first term foreign policy: "Why were we successful? China, and in Russia even more so, it was because we were strong — and because we had something we wanted to give, as well as get."[42] Kissinger agreed, pointing out the importance of the nuclear balance for the future of relations with China: "Once China has the missile force that the Soviets have today, that's when we have a very dangerous situation. Then whichever side they choose to go with has the advantage."[43] Similarly, the Carter administration thought that PD-59 would be agreeable to China, but that "we can expect hard questions from them about how we plan to meet PD-59's tougher standards and whether a more demanding strategy is credible in view of the US-Soviet military balance."[44]

HTK, Perceptions of Power, and Military Significance

US policymakers believed that HTK capabilities could improve the nuclear balance and provide diplomatic benefits through two general mechanisms.

First, HTK capabilities might contribute to perceptions of military strength and political resolve, regardless of their military utility. Second, they might propel a real and favorable shift in the nuclear balance by providing the United States with the capability to perform certain military missions.

The degree to which American decisionmakers recognized that perceived nuclear superiority might be as meaningful as real battlefield advantage is striking. Nixon made the point well:

> The real issue is the impact what we agree on will have on the decision-makers in Washington and the decision-makers in Moscow. Our view of our advantages or disadvantages will determine whether we can pursue an aggressive or timid foreign policy. The same will be true for the Soviets. If we all recognize we are not at a substantial disadvantage as the Soviets, we have great potential and power.[45]

Other major Nixon administration officials agreed on the importance of using the characteristics of American nuclear forces to affect global perceptions of the nuclear balance. Schlesinger argued that the United States might need HTK capabilities, including higher-yield warheads, "Just so they [the Soviets] don't think they are ahead. A discrepancy of 10-fold in yield is significant."[46] Kissinger also acknowledged that nuclear perceptions could be decisive. "Our SALT II agreement can't result in serious inequalities," he argued, "if for no other reason than that other countries will look at these differences and assume we are inferior. Therefore, it will affect our foreign policy."[47]

The Carter administration had the same worries about how HTK and other force characteristics might affect perceptions of the nuclear balance. Director of Central Intelligence Admiral Stansfield Turner wrote Carter that,

> I personally do not believe that [increasing American ICBM vulnerability] means that the Soviets would be likely to be tempted to launch a strategic attack against us… But I do believe that the perception of superiority that will give to the Soviets, and perhaps to our allies and others, is unacceptable to us.[48]

Along the same lines, while discussing the development of PD-59, Deputy National Security Advisor David Aaron "noted his concern about the impact of our discussion of these issues on our own and our Allies' confidence. He suggested that many who discuss these issues give us less than proper credit for our real capabilities."[49] In sum, a wide variety of policymakers recognized that various metrics for comparing nuclear forces had the potential to take on political lives of their own, divorced from their objective military significance.

Limited Nuclear Options

In addition, there were three widely accepted arguments for why HTK capabilities objectively improved the nuclear balance for the United States. The first was that they could assist in executing LNOs. These were conceived of as attacks with a limited number of weapons to cause pain, demonstrate US resolve, and incentivize the Soviet Union to stand down in the early stages of a nuclear war. As NSSM 169 put it, these "US efforts to control escalation would show restraint in using nuclear force while seeking to convince the opponent that his limits would be exceeded if he persists." LNOs could potentially also provide "a capability to conduct discrete limited attacks on enemy forces in an immediate area to deny a local objective."[50] As Schlesinger told the NSC, "Accuracy is important for any selective targeting. For cities, it matters not at all."[51] Part of Kissinger's lack of enthusiasm about the B-1 bomber was that it was not useful for LNOs: "For selective attacks," he argued, "I would think we would use missiles." Indeed, for these reasons he approved of air-launched cruise missiles (ALCMs): "We need more. The bomber with standoff missiles is great."[52]

LNOs could also serve the political goal of reassuring US allies about the credibility of American nuclear threats, thereby shaping their behavior. Kissinger argued that "the concept that we could 'win' a war through virtually unlimited nuclear exchanges has become increasingly irrational as the Soviets acquired the capability to destroy the United States — even if the United States were to strike first. This has resulted in concern that such a strategy is no longer credible and that it detracts from our overall deterrent."[53] LNOs would provide needed back-stiffening to NATO. "Some Europeans," Kissinger said, "believe it is necessary that we guarantee our own destruction to give them the assurances they claim they need. However," in point of fact, "to deprive ourselves of options paralyzes us."[54]

Nuclear Warfighting

Second, HTK capabilities could be useful for a "warfighting" doctrine that envisaged prolonged nuclear exchanges and extensive integration of nuclear and conventional operations. While Schlesinger's concept of LNOs had anticipated prospects of non-spasm nuclear war and battlefield nuclear operations, these aspects of nuclear employment policy were developed by the Carter administration into a larger and distinct framework in PD-59. According to one of PD-59's main contributors, Brzezinski's military assistant General Odom, nuclear war could be a drawn-out series of exchanges that aimed to "destroy the enemy's army or its ability to fight" rather than demonstrate resolve or cause pain. He argued

> The connection between damage limitation and political objectives was articulated only vaguely because this subject was taboo.

that "nuclear weapons can support general purpose force operations just as bombers could support the Normandy invasion in World War II." In addition, Odom wrote that "once nuclear weapons are used, I doubt seriously that rapid escalation will occur." Rather, "I worry that theater nuclear war in Europe would lead not to escalation, but to drawn out attrition warfare because the TNF [theater nuclear forces] firepower exceeds both sides'… capabilities to use it for a decisive and early result."[55]

In a protracted nuclear war, enduring capabilities for command, control, communications, intelligence, surveillance, and reconnaissance (C3ISR) would be of utmost importance. HTK assets could be valuable in promptly destroying the enemy's buried, hardened, or mobile C3ISR. Consequently, the final draft of PD-59 demanded "a capability to choose to put the major weight of the initial response on military and control targets. Military targets must be selected for the purpose of destroying enemy forces or their ability to carry out military operations."[56]

Warfighting elements in American nuclear doctrine primarily served the political objective of deterring Soviet war initiation. Some hawks argued, widely but controversially, that Soviet nuclear doctrine demonstrated a belief that a nuclear war could be fought and won. Moreover, Soviet nuclear force modernization programs reflected Moscow's preparations to execute its doctrine if necessary. It was therefore essential to oppose the Soviets with capabilities they themselves considered important. Hawks also argued that what Soviet leaders truly valued was political and military control over their society. HTK and other warfighting capabilities placed this control system at risk. As a State Department characterization of PD-59 concluded, warfighting options worked "by demonstrating to the Soviets that we have the retaliatory capacity to destroy the political, economic, and military assets that <u>they</u> value most, and… to prevent the Soviets from benefiting from any nuclear exchange by whatever definition of 'winning' <u>they</u> may apply."[57]

Damage Limitation

A third set of arguments in favor of HTK capabilities centered on the necessity, should deterrence fail, of destroying Soviet nuclear delivery vehicles and C3 assets, thereby limiting damage to the United States in the event of a nuclear war. Damage limitation was sometimes conceived of as a second-strike mission, intended to destroy Soviet residual nuclear capability after absorbing a first strike. As Secretary of Defense Brown offered at one meeting, "a major reason to want hard-target-kill capabilities is to eliminate Soviet capabilities to reload and reuse their missile silos."[58]

However, implicitly or explicitly, it was well understood that the most effective way to limit damage was by means of a first strike. The connection between damage limitation and political objectives was articulated only vaguely because this subject was taboo. The underlying theory was nonetheless transparent. An effective damage-limitation strategy could destroy the Soviet Union while leaving the United States a functioning, if brutalized, society after nuclear exchanges. Effective damage-limitation capabilities — especially if combined with national ballistic missile defenses — could, in theory, make military victory a meaningful concept in the nuclear age, thereby contributing to deterrence, the curtailment of Soviet grand strategy, and the reassurance of friends and partners. NSSM 246, which described a number of different options for nuclear force posture, included an option based on damage limitation: "Only a full counter-silo capability can force the Soviets to choose between launching all their ICBM forces in a first strike or no attack at all. Thus, by denying them limited options and assuring ourselves of high confidence damage limitation, deterrence is strengthened."[59]

Doctrinal Differences

It is worth emphasizing that while LNOs, warfighting, and damage limitation doctrines all contain some similar elements, they are fundamentally different approaches to nuclear war with very different implications for HTK capabilities.

LNOs are based on a logic that is fundamentally compatible with "assured destruction" or "stability" thinking. The aim is to provide a credible way to raise the risks of an all-out nuclear war without automatically triggering that war, if conventional deterrence has already failed. If the war were to start because the Soviet Union thought NATO weak and irresolute, LNOs would demonstrate its miscalculation: they would temporarily erase any conventional gains and signal a willingness to escalate all the way to Armageddon. But their effect would occur entirely through assessments of resolve and risk; LNOs accomplish very little in purely military terms, and therefore do not pose very demanding technical requirements.

Warfighting doctrines, by contrast, rest on the assumption that victory and defeat will ultimately be found on the conventional battlefield. Warfighting

> Warfighting doctrines rest on the assumption that victory and defeat will ultimately be found on the conventional battlefield.

as codified in PD-59 implied that nuclear operations were going to be tightly integrated with conventional operations and that the war would be protracted, with many rounds of nuclear exchanges. Victory, in this world, would be determined by one's ability to survive and coordinate nuclear fires effectively in support of ground operations over long periods of time. Going first is not as essential to this kind of doctrine, and HTK is important but not decisive. Flexibility, endurance, and C3I, however, are hugely important.

Damage limitation is a concept that indicates winning a military victory at the nuclear level — destroying enough of the other side's nuclear forces that whatever is left to retaliate still leaves the attacker a functioning society. Targeting conventional forces is not important, nor is the ability to last very long. Striking first and HTK, on the other hand, are highly prized.

Hierarchy of Strategic Rationales

All of these underlying rationales have a significant presence in the documentary record and clearly played a role in the development of HTK capabilities. But which rationales best explain the pattern by which they evolved, as described in the historical section above? We place these rationales into two essential groups: less and more important. Less important rationales are those that, while certainly carrying causal weight at various points, are insufficient to fully account for the observed outcome. More important rationales are those that are fully congruent with the observed policy outcome, though this is not to say that they are complete or unassailable explanations.

Less Important Rationales: SALT

The idea that American strategic programs could be traded off against Soviet programs to gain a beneficial SALT deal probably did provide some diffuse support for Minuteman III improvements, MX, and Trident II in the early phases of their development. Schlesinger's theory "that only the prospect of a

US silo killing capability will bring the Soviets to negotiate seriously to limit their MIRVs" probably helped build support for MX and Trident II .[60] The State Department, which was ambivalent about both systems on their merits, was certainly enthusiastic about their utility as bargaining counters.[61] For example, in 1976 one State Department official supported the effort to accelerate MX, "precisely because it is a reminder to the Soviets of the prospects if they prove unwilling to address the problem of throw-weight disparity in SALT."[62]

Ultimately, though, arms control negotiations as a driver and a rationale for HTK capabilities is belied by the fact that nothing was traded away. The central outlines of SALT II were agreed to at Vladivostok in late 1974: equal aggregate numbers of delivery vehicles, MIRV launchers capped at 1,320, and no inclusion of American forward-based systems in Europe. Ford and Kissinger were extremely pleased to get these terms, even though it meant that both Soviet and American strategic modernization programs would remain uncontrolled. Carter's brief effort to reintroduce controls on the SS-18 in return for restraint on MX was stillborn.

In short, after their initial attempts at a substantive deal, both administrations effectively abandoned crisis stability as a goal of the SALT negotiations. As Schlesinger put it, "We can live with an increase in instability" as long as a deal improved the real and perceived nuclear balance.[63] For the Carter administration and for dovish supporters of arms control, SALT II was better than no treaty at all, even if it codified high levels of HTK capabilities on both sides. As Secretary of State Cyrus Vance and Arms Control and Disarmament Agency (ACDA) Director Paul Warnke advised Carter, "The stability represented by a SALT II agreement is as important to arms control as the content of the likely agreement itself."[64] When SALT objectives became dissociated from limitations on HTK capabilities, doves found solace in the symbolic value of treaties that became harder to defend.

Less Important Rationales: LNOs and Warfighting

American HTK programs provided added means for LNOs and buttressed warfighting doctrine. NSSM 169 sought to add coherence for the buildup of counterforce capabilities, noting that "for many years employment policy has had little influence on acquisition policy," recommending that an acquisition study should be done in light of LNOs.[65] Schlesinger used the new doctrine to publicly advocate HTK programming. Similarly, the Carter administration studies that led to PD-59 were to determine "the specific amount of hard-target-kill capability the US should maintain into the future, identifying the strategic purposes such capabilities would serve. No action should be taken to diminish US hard-target-kill capabilities pending the president's decision."[66] These doctrinal pronouncements served to buttress Minuteman III upgrades, MX, and the Trident II programs as they progressed.

While undoubtedly important, there are reasons to doubt that the pursuit of either LNOs or warfighting doctrines were the major drivers of American HTK capabilities. Neither concept is focused on destroying hard targets. LNOs aim to cause some pain, demonstrate resolve to escalate, and perhaps destroy some military targets, but hardly require digging out deeply buried silos. As Schlesinger later put it in a classified interview for a Defense Department study, "counterforce was one of the options, but not the entire doctrine of LNO. The essence of LNO was selectivity." LNOs aimed at conflict de-escalation by increasing the risks of continued warfare, a goal that does not require HTK and is not much helped by such capabilities.[67] Indeed, NSSM 169 actually went to great lengths to deny that major new HTK capabilities were necessary to execute LNOs: existing force characteristics "make it possible to implement to a significant degree the concepts of the policy in the near term," even though the American arsenal at the time lacked serious HTK weapons.[68]

PD-59 had more of a direct connection to HTK programming because of its focus on military and command and control targets. But the basic warfighting concepts represented in the document were focused on integrating nuclear detonations with conventional operations, placing emphasis on capabilities to meet "the intelligence requirements for the fast cycling of 'look-shoot-look' operations," and "for coordination with US general purpose forces in those theaters."[69] HTK was a distinctly secondary concern from this point of view.

There is also evidence to indicate that key figures responsible for advancing HTK capabilities in the Carter administration — most centrally, Secretary of Defense Brown — did not really believe in the warfighting concepts that PD-59 advanced. In private, Brown often argued directly against the warfighting line on escalation, contending at various times that "if a nuclear war ever got started, it was very likely to quickly become an all-out war;" "an all-out spasm war is the most likely possibility;" and "the most likely outcome of a limited exchange is an unlimited exchange."[70] Odom also notes in passing that Brzezinski "dragged Brown along on this PD," appeared to have been most interested in the document's deterrent effects rather than its actual warfighting capabilities.[71] It therefore seems unlikely that major HTK decisions during the Carter administration were made primarily on the basis of Odom and Brzezinski's warfighting concepts.

More Important Rationales: Deterrence and Reassurance

The twin goals of deterring the Soviet Union from initiating a war and broadly shaping the behavior of American allies and partners were major motivations for acquiring HTK capabilities. From Nixon to Carter, every major doctrinal pronouncement relevant to HTK featured both objectives prominently.[72]

Under Nixon and Ford, influencing allies and partners, especially in Europe, by means of American nuclear policy was of central importance. Nixon argued that:

> The various disparities [in the nuclear balance] that we have today are really not critical to the leadership of the Soviet Union. They'll look at the risks of any kind of a nuclear attack. If the risk of attack is too high, they won't try anything. But to our Allies and the public, appearances matter. If we appear to be Number 2, our friends will get scared.[73]

Certainly, Kissinger and Ford's resolve to exempt forward-based systems in the Vladivostok deal was based in part on its effect on NATO. As Kissinger boasted internally, "I think our allies will see this as an unbelievable achievement. We have gotten rid of the FBS problem for 10 years." Kissinger also believed that leaving major American strategic modernization programs uncontrolled in the agreement would help with China: "The more we talk Soviet strategic superiority, the more it hurts us with China. It's imperative that they not believe we are inferior militarily to the Soviets. We can make a good case here for this agreement."[74]

As détente collapsed in the late 1970s, the importance of deterring Soviet war initiation rose again to the forefront of American nuclear posture decisions. In discussions surrounding PD-59, Brown "noted that in his mind the principal purpose of being prepared to handle various war fighting scenarios is the effect such capabilities have on deterrence." Though skeptical of most such scenarios, he acknowledged that "some Soviet writers and strategists seem to recognize differences in potential nuclear war outcomes. He said that we must take such things into account when we consider how to deter the Soviets."[75] The goal of adjustments in American nuclear posture — particularly through the acquisition of HTK capabilities — was therefore "to make a Soviet victory, as seen through Soviet eyes and measured by Soviet standards, so improbable over the broadest plausible range of scenarios that the Soviets will be deterred."[76] As Brown put it later, HTK capabilities against sheltered leadership were an essential part of "targeting [that] held at risk the things that Soviet leaders valued most," especially "their personal survival and power… the social and economic and structures of the Soviet state… [and control over] the empire (including Eastern Europe)."[77]

More Important Rationale: Perceptions of Power

A major reason the United States invested so heavily in HTK capabilities was to affect global perceptions of the nuclear balance, independent of the actual military utility of nuclear warfighting options. The most powerful evidence for the importance of such perceptions is that many policymakers simultaneously believed that genuine nuclear superiority was impossible to achieve, but that states would nonetheless formulate beliefs about the nuclear balance based on various faulty metrics that would influence their policies.

Schlesinger, for instance, affirmed to Kissinger that "a [Soviet] counterforce attack is not reasonable," and that "I have never bought the Minuteman vulnerability argument."[78] Nonetheless, he argued that "As good technology ultimately becomes available to both sides, [missile] throw weight becomes the main determinant of capabilities. We can live with some disparity, but that much disparity, over five to one, is of some concern to us."[79] He later reiterated to Nixon, "We don't have to match [the Soviet Union] number for number, but with a six to one [throw-weight] advantage, their robustness in diplomatic negotiations will be such that your successor might not be able to stand up to them."[80] Schlesinger summarized the disparity between his interest in HTK capabilities and his assessment of their utility to Kissinger this way: "Simple people look at the difference in numbers and see us behind."[81]

Kissinger was often blunt in his views about nuclear stalemate: "There is no way to deal with strategic superiority. This is why I want SALT. We could never have enough for an overwhelming capability in strategic forces. This is why we should build up our conventional capability."[82] In response to concerns about Soviet MIRVs, Kissinger pointed out that "the scientific community will say this is crap — that we can kill them five times already. Even if Minuteman is vulnerable, we can kill them four times with Poseidon and our bombers." However, he also clearly regarded such criticisms as problematic both for arms control negotiations and for American strategic modernization programs. He agreed with State Department official Seymour Weiss' view: "There are two aspects to this: the strategic implications and the political implications. These could be very significant… We can't expect a deep degree of sophistication from our allies. We told them we were qualitatively superior. We can't now say that that doesn't make any difference."[83]

More Important Rationale: Damage Limitation

At the same time, many policymakers — often the same ones just mentioned — seemed to believe that effective damage limitation might become possible in a major nuclear war, and that its political advantages were very much worth pursuing. Damage limitation, especially in a first strike, was a somewhat taboo topic, and so was seldom addressed directly or at length. Even so, the historical record is replete with evidence that important policymakers considered it a potentially valuable capability.

As noted earlier, there was a long-standing interest in HTK capabilities among civilians in OSD and the navy during the 1960s. This interest resurfaced in the 1970s as the SALT talks became prominent, and the specter of Minuteman vulnerability emerged with the advent of improved Soviet missile accuracy and MIRVs on a new generation of ICBMs. In a meeting with Weiss, SALT negotiator Paul Nitze posed three possible solutions to Minuteman vulnerability. The first was to "develop an effective first-strike capability of our own." This option was increasingly plausible, as "the Minuteman III MIRV is turning out to be an even more accurate warhead than anticipated and accuracy down to .1 mile appears entirely feasible. With such accuracy the present Minuteman III warhead (175 kt) would have a 90 percent kill probability against a hardened Soviet missile."[84]

Nixon sought advances in American strategic capabilities even as he announced acceptance of nuclear "sufficiency" to negotiate SALT with the Kremlin. He believed that national ballistic missile defenses combined with counterforce capabilities "really means [a] credible threat of first strike would be much greater if they are screwing with allies." He agreed with Chairman of the Joint Chiefs of Staff (CJCS) Earl Wheeler that "if I thought it technically, fiscally feasible to [develop]… first-strike capability, I would advocate it, destabilizing or not."[85] Though Nixon understood (and lamented) that the days of a disarming capability were gone, he repeatedly displayed interest in increasing missile accuracy and warhead yields. He also disparaged the American bomber force as "obsolete as the battleship" because "for a first strike, given the response time, isn't the bomber irrelevant?" This was true, CJCS Admiral Thomas Moorer allowed, "if you are talking about a US surprise attack."[86] Moorer had himself earlier cautioned that incremental use of LNOs risked forfeiting the advantages of a major nuclear strike, where "We can do better in preemption than in retaliation."[87]

Indeed, the 1974 NUWEP endorsed clear planning guidance for the "… limitation of damage to the United States and its allies through counterforce operations…"[88] Moreover, it spelled out explicitly the requirement to plan for the United States to comprehensively target the Soviet nuclear threat in a fully generated first strike:

> In a US nuclear attack planned with fully generated undamaged forces on the Soviet nuclear threat to the United States and its allies, not less than one warhead should be applied to each ICBM site, each IRBM [intermediate-range ballistic missile] and MRBM [medium-range ballistic missile]

> site, each base for heavy, medium, and light bombers, and each base for missile-launching submarines, even if a high damage expectancy cannot be achieved or only short-term damage can be realized.[89]

Damage limitation may have motivated some of the American interest in large reductions of nuclear delivery vehicles in SALT II. For instance, in one meeting where Kissinger protested that force reductions in a world of MIRVs were destabilizing, Nitze replied, "It depends whether you look just at the survivability of Minuteman or at the whole strategic situation. It helps the latter… It reduces their throw weight and targets. We come out better on the difference between a first and second strike."[90] Indeed, as it became clearer that Soviet MIRVs could not be limited in SALT, more policymakers raised the issue of aggregate reductions and American HTK capabilities in tandem.

At a meeting to take stock of the new world of MIRVs that SALT would not effectively limit, Deputy Secretary of Defense William Clements insisted that "there have to be reductions over time." A few minutes later, he defended the JCS position of "equal numbers as a prelude to reductions" by arguing that "the technological gap is in our favor… We have the ability to develop a highly accurate mode."[91] CJCS Moorer also argued that accuracy improvements would be an important counterweight to Soviet nuclear programs, and cautioned against limiting SLBMs: "The higher accuracy of the land-based missile over the sea-based missile won't prevail indefinitely. There's no point in paying something for it."[92] Kissinger pointed out that qualitative competition meant "both sides could wipe out the other's land-based missiles in the first strike. There would be an enormous gap between the first and second strike. That's equality but not stability." Moorer responded: "We don't want inequality." Weiss offered, "We want equal vulnerability," which Nitze was fine with so long as numbers were not capped at too high a number like "1,000 missiles; that's no good."[93]

None of these individuals was cynically arguing for pursuing a "splendid" first-strike capability, but their arguments do seem to point in that direction. They were certainly aware of how HTK capabilities interacted with quantitative reductions. And policymakers were not unaware that "equal vulnerability" in ICBM forces meant better damage limitation possibilities for the United States. As Kissinger acknowledged privately, "We are the only ones who could gain in a first strike because most of their force is land-based."[94] He also stressed this argument to the Chinese. After explaining that a Soviet first strike on the American nuclear force was impossible, he then said, "Let's look at the reverse… [W]e have planned our forces for the 1980s and they have planned their forces for the 1970s. By the early 1980s, both land-based forces will be vulnerable. And 85 percent of theirs are land-based while only 35 percent of ours are land-based.

Secondly, they are making all their improvements in the most vulnerable forces, namely in the land-based forces." Furthermore, "if we launched a first strike against them we could use overseas forces" as well.[95]

Many in the Carter administration emphasized the same discrepancies for damage limitation outcomes. The State Department advised Brzezinski in 1978 that "only 20 percent of our warheads, but 70 percent of theirs, are in ICBMs. Both sides' ICBMs can become vulnerable, placing the Soviets in a worse situation."[96] In talking points prepared for a visit to reassure Japanese leaders, Harold Brown emphasized the advent of significant American HTK assets: "MX missile is under development. Trident will be entering service in the early eighties. Strategic cruise missile development is proceeding." Moreover, Brown pointed out another damage-limitation asymmetry: "We continue to lead the Soviets in ASW [anti-submarine warfare] thereby improving survivability of our SSBNs [ballistic missile submarine] while causing theirs to become more vulnerable."[97] And President Carter himself told the JCS that "essential equivalence… involves going forward with programs such as MX, cruise missiles, and Trident-type missiles" before asking for deep reductions in SALT II: "He said that we could reduce by increments going from 2,250 to 2,000 or 1,500, but he wanted something more profound."[98]

Hierarchy of Rationales

The American pursuit of HTK capabilities for perceptual and damage limitation reasons were less contradictory than they initially appear. Many US policymakers genuinely believed that nuclear superiority was illusory and that any sane leader would be deterred from escalation in a crisis or a conflict. But they also believed that perceptions of the nuclear balance would shape and propel international politics, whether or not they were tethered to material reality. And finally, it was their duty to prepare the United States against worst cases. Confrontation might come about semi-unintentionally due to surprising world events, despite the strategic nuclear stalemate. Or worse, dreaded scenarios might come about because perceptions of power had been poorly managed. Moscow might perceive itself as strong and push too far; or NATO might perceive itself as weak and begin to unravel. It was therefore possible for policymakers to believe that pursuing nuclear superiority was a waste of effort and thus seize on HTK capabilities as a metric to manage perceptions of the nuclear balance, *while* simultaneously believing that HTK and damage limitation might best secure diplomatic objectives in worst-case scenarios.

This confluence of beliefs was buttressed by the near universal rejection of the opposite point of view: that damage limitation was likely to destabilize international politics, while the best way to manage perceptions of the nuclear balance was to use declaratory policy to explain the facts of nuclear stalemate. These ideas of "nuclear sufficiency" and stalemate had only a small institutional constituency in the career diplomats and civil servants at the State Department and the ACDA, who frequently quarreled with the Pentagon and Energy Department and usually lost policy debates.

At the end of the Ford administration, for example, a major decision was made to push forward with the MX missile program (later held in abeyance for several years by the Carter administration as it looked for a secure basing mode). Two high-ranking State Department officials sent Kissinger an urgent memo critiquing this decision: "*With MX deployed*, the Soviets could expect to lose *nearly 90 percent* of their *total* strategic warheads from a US first strike in the mid-1980s. This is a reasonably close approximation of a disarming first strike and flies in the face of several statements made by this Administration that it was not acquiring this capability." After noting the USSR's asymmetric dependence on vulnerable land-based missiles, they submitted that "even *without* MX, planned improvements to Minuteman ICBMs will give the US a capability to destroy half of the USSR's silo-based ICBM force, representing a loss of about 60 percent of the Soviet's total strategic warhead capacity." If these threatening moves were not destabilizing enough, the plan also "apparently require[d] that [MX] be deployed in *fixed silos*," giving both sides preemptive incentives.[99]

Arms control advocates raised these concerns repeatedly, but to no avail. In 1972, chief SALT negotiator Gerard Smith called Kissinger to enlist him in stopping the Pentagon from "proceeding now with a hard target killer for our Minuteman as a bargaining chip for SALT II." Smith argued that Minuteman improvements would contravene Nixon's public position of not pursuing first-strike capabilities: "The arithmetic I see just [means that]… they've got almost the entire Soviet ICBM force if we go this way."[100]

The nuclear sufficiency position was also represented in the major doctrinal reports in the Ford and Carter administrations. Among the nuclear force posture options that NSSM 246 presented was one that held that "a declaratory policy which explains our own reasons for regarding any aggregate asymmetries as militarily insignificant will meet basic political sufficiency requirements. Buying forces specifically to satisfy political requirements is costly and stimulates arms competition." This point of view also held that "increasing the survivability of US strategic forces, but not their counterforce potential, is the preferred offset to increased Soviet counterforce capabilities."[101]

The targeting study done by the Carter administration as a precursor to PD-59 also presented the nuclear sufficiency line as a possible policy option. This argument maintained that "since we cannot expect to limit to low levels the damage resulting from a large scale nuclear attack… it is no longer a meaningful objective and should be abandoned." The report argued that "moving in this direction… would imply a judgment that the post-war nuclear force balance is not a meaningful measure of 'victory' and that the prospect of massive destruction is a credible deterrent for large scale attacks."[102]

However, the nuclear sufficiency view was rejected whenever it was broached in favor of options that emphasized the importance of HTK capabilities. Following the negotiation of the Vladivostok accords in 1974, Schlesinger sent a memo to Ford outlining the plans for American force posture. Minuteman III upgrades would go forward, with the barest proviso that "these improvements will not give the US a disarming first-strike capability."[103] Also in the memo were plans for research and development on a list of future HTK options, including MX, Trident II, and improved accuracy and yield programs. Kissinger endorsed these initiatives over the protests of State Department and ACDA officials, saying in the key meeting on NSSM 246 that, "I have no quarrel with the study."[104] Ford approved the MX missile for full engineering development just as he left office.

The process leading to PD-59 also affirmed damage limitation over nuclear sufficiency arguments. "From the standpoint of targeting," a 1978 report argued, "it seems clear that we ought to maintain a substantial hard target capability" to attack both ICBMs and C3. Prompt HTK was also worth the investment, which "might well improve the outcome of a nuclear exchange from our standpoint, or complicate Soviet calculations of the outcome and thereby help to strengthen deterrence." The report did acknowledge that presently "we lack the ability to limit damage to the US society meaningfully," but it professed to be "reluctant to wholly eliminate this as an objective of US strategy." The rationales were to avoid "a major asymmetry between US and Soviet policy" and take account of "important uncertainties about the effectiveness of a damage limiting strategy" depending on the circumstances of escalation.[105]

Conclusion and Implications

What lessons might Asian nuclear powers draw from the history of American HTK capabilities during the Cold War? China, India, and Pakistan, unlike the United States, rely primarily on mobile, nuclear-capable missiles in lieu of hardened silos. Under these circumstances, the pursuit of HTK capabilities to target missiles would therefore require significant C3ISR capabilities. Absent hardened silos, increases in yield and accuracy might not be necessary, but real-time targeting surveillance would be essential.

Even more important, the political and geographic context of Asian politics is dramatically different from the Cold War confrontation. The American political goals supported by HTK capabilities mostly centered on the problem of extended deterrence. Deterring the Soviet Union and reassuring allies took on such great significance in American strategy because of the difficulties inherent in trying to protect allies thousands of miles away with nuclear threats. It is vastly more credible to protect one's own sovereignty by threatening nuclear Armageddon than it is to promise a trade of "Boston for Bonn." The nuclear powers of Asia appear to have set much less demanding political and military goals, which require less sophisticated nuclear forces to achieve. Moreover, extended deterrence is not an issue — or not yet an issue — in the nuclear postures of China, India, and Pakistan.

Nevertheless, there are some enduring similarities between the American Cold War experience and the emerging international environment in Asia. China has reportedly begun to MIRV. India clearly has this capability, and Pakistan might feel impelled to pursue MIRVs as well. Competitive dynamics in South Asia will not be as intense as the superpower competition, but, as was the case during the Cold War, they could be fueled by presumed force ratios and technological drivers. China's strategic ambitions are not clear; they more expansive they are, the more this competition could ratchet up.

Chinese, Indian, and Pakistani decisionmakers would do well to consult the lessons of American Cold War nuclear policy. Avoiding a destabilizing nuclear competition is not simply a matter of well-managed civil-military relations or benign domestic politics. Stronger impulses for strategic modernization programs reside in the international environment. Damage limitation is the most intuitively plausible rationale for counterforce capabilities, and American policymakers could never bring themselves to abandon the view that these capabilities might be essential, *in extremis*. Asian nuclear powers still have the opportunity to avoid going down the path of targeting opposing nuclear forces, which would dramatically increase nuclear weapon requirements. Alternately, they could pursue scaled-down versions of HTK capabilities, following in the footsteps of the United States and the Soviet Union. But in a competitive international environment, even scaled-down damage-limitation strategies could easily become open ended.

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70. Detailed Minutes, Special Coordination Committee Meeting, "Strategic Forces Employment Policy," 3 and 5; and Department of State Cable, "NPG: Discussion of Strategic Employment Doctrine" June 11, 1980, 4, National Security Archive, GWU, http://nsarchive.gwu.edu/nukevault/ebb390/docs/6-12-80%20cable%20%20briefing%20at%20NPG.pdf.

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72. "Summary Report of the Inter-Agency Working Group on NSSM 169," June 8, 1973, 49; and NSSM 246 Study, November 30, 1976, 478 (both in *FRUS, 1969-1976*, vol. 35); and Nuclear Targeting Policy Review, Phase II Report, November 1, 1978, document 3; Jimmy Carter, "PD-59"; Office of the Secretary of Defense, "Policy Guidance for the Employment of Nuclear Weapons (NUWEP)".

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79. "Minutes of a Meeting of the National Security Council," January 24, 1974, in *FRUS, 1969-1976*, vol. 33, 161.

80. "Minutes of a Meeting of the National Security Council," March 21, 1974, in *FRUS, 1969-1976*, vol. 33, 224.

81. "Memorandum of Conversation," April 23, 1974, in *FRUS, 1969-1976*, vol. 35, 165. Note that Schlesinger's comments are not *necessarily* inconsistent with a belief in real nuclear advantage for the United States, as his comments are made in the context of assessing Soviet capabilities.

82. "Minutes of a Meeting of the National Security Council," December 15, 1976, in *FRUS, 1969-1976*, vol. 35, 583.

83. "Minutes of a Meeting of the Verification Panel," August 15, 1973, in *FRUS, 1969-1976*, vol. 33, 107.

84. Seymour Weiss, "Luncheon Conversation October 2 with Paul Nitze on SALT," to John Irwin and U.A. Johnson, October 7, 1970, 2-3, National Security Archive, GWU, http://nsarchive.gwu.edu/NSAEBB/NSAEBB43/doc12.pdf.

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86. "Minutes of National Security Council Meeting," March 21, 1974, in *FRUS, 1969-1976*, vol. 33, 213, 214. For other instances of Nixon's general interest in HTK capabilities, see, for example, Nixon-JCS meeting, December 22, 1973, in *FRUS, 1969-1976*, vol. 35, 131; and NSC meeting, June 20,

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SOVIET UNION

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The Impact of MIRVs and Counterforce Targeting on the US-Soviet Strategic Relationship

The advent of multiple independently targetable re-entry vehicles (MIRVs) had a profound impact on strategic nuclear parity and stability, the evolution of the US and Soviet nuclear triads, doctrines of nuclear deterrence, arms control talks, and treaties. During this period, MIRVs had an overall negative effect on strategic stability, particularly on the scale and rate of the arms race, calculations of the sufficiency of nuclear forces, concepts of weapons employment in a nuclear war, and the search for compromise at arms control talks.

Even half a century later, MIRVed missiles still play an outsized role in US and Russian strategic nuclear forces and are problematic in their strategic relationship for stabilizing the nuclear weapons balance, military doctrines, and arms control interaction. This will remain so for the foreseeable future, despite the introduction of advanced, long-range, conventional, precision-guided defensive and offensive weapons systems.

This essay addresses the role of MIRVed systems in US-Soviet strategic relations in three principal parts. The first covers the technical history of MIRVs, including: primary engineering problems; systems development; deployment; and targeting. The second part is dedicated to the strategic-doctrinal implications of MIRVed systems in the strategic nuclear forces (SNFs) of both sides, as well as their impact on the scale and rate of the arms race during the 1960s through the 1980s. The third part presents an assessment of the interaction of MIRVed systems with arms control negotiations and agreements between the two nuclear superpowers.

The Technical Aspects of MIRVed Systems

The development and deployment of MIRVed ballistic missiles in the United States led to multiple expansions of warhead numbers. Improved accuracy greatly enhanced the American ability to deliver a disarming strike against Soviet strategic nuclear forces — foremost against hardened missile silo-launchers and command centers. The Soviet Union had to catch up in developing and deploying MIRVed ballistic missiles of its own in order to maintain strategic parity in the number of warheads and to increase its ability to penetrate the anti-ballistic missile (ABM) system[1] that the United States was expected to develop. In doing so, the Soviet Union placed at risk the United States' hardened, silo-based missiles and command centers. This was undoubtedly welcomed by the Soviet military, but for decades it also became the major concern of the American strategic community and one of the principal stumbling blocks at strategic arms control negotiations. In parallel, the Soviet Union also set about improving the survivability of its land-based strategic missile forces by: deploying missiles on mobile launchers; creating mobile command centers; building a network of reserve airfields for its strategic aviation dispersal; and increasing the number of nuclear ballistic missile submarines on sea patrol.

Strategic stability is commonly perceived as a state of strategic relations between adversaries that excludes the objective possibility of a first strike by removing the incentives for either side to conduct one. The logic of strategic stability dictates that neither adversary can be allowed to prevent retaliation or substantially reduce its destructive consequences. Hence the notion of a first strike implies foremost a disarming strike, aimed at hitting as much of the opponent's strategic weapons as possible before their launch. Since more than one warhead is necessary to destroy one launcher of the opponent, single-warhead missiles do not present a first-strike capability in situations of approximate strategic parity (i.e., when more weapons would be used in a strike than would be destroyed on the ground).

According to this logic, the survivability of land-based missile forces in the nuclear triad depends on the average ratio of the number of an opponent's warheads to the number of one's own delivery vehicles. The more warheads installed on a missile, the more attractive it becomes as a target given the possibility of destroying more warheads than would be spent in a strike. Hence the mutual survivability of deterrent forces is greater — and the basis of strategic stability is stronger — when there are fewer warheads per delivery vehicle.

In this respect, the deployment of intercontinental ballistic missiles (ICBMs) with MIRV warheads had a serious destabilizing impact, especially on ground-based missile forces. In addition to fixed, silo-based ICBMs, mobile ICBMs (i.e., on railway launchers) equipped with up to 10 warheads became attractive targets for disarming strikes.

It was the mutual realization of this destabilizing impact of MIRV warheads that ultimately led to the second US-Russian Strategic Arms Reduction Treaty (START II) in January 1993, which banned land-based (albeit not sea-based) MIRVed ICBMs. However, this treaty did not come into force. At present and for the foreseeable future, Russia's land-based MIRVed missiles account for the bulk of the overall number of warheads in Russia's strategic nuclear forces.

The development and serial production of ground-based ICBMs and submarine-launched ballistic missiles (SLBMs) in the Soviet Union were determined above all by the following factors:

- Deployment of MIRVed ICBMs in the United States and the Soviet desire not to fall behind its adversary.
- Cost effectiveness in nuclear targeting.
- Technological progress in developing missile and warhead designs, improvement of on-board digital computers, and refinement of ballistic missile defense (BMD) penetration aids.
- Arms control treaty restrictions.

It goes without saying that this is just a schematic classification of various impacting factors, as in reality they were interlinked and influenced each other.

The Pursuit of Strategic Parity

The United States rushed ahead of the Soviet Union in technological development and began equipping missiles with multiple re-entry vehicles (MRVs) that lacked an independent-targeting capability as early as 1964. The Polaris A-3 SLBMs on George Washington–class submarines were the first to be retrofitted with three non-individually targeted (i.e., "shrapnel") W-58 warheads. In 1970, the United States introduced the first type of multiple individually-targeted warheads on an SLBM, the Poseidon C-3. These missiles carried 10 W-58 warheads, each of which had a yield of 50 kilotons (kt) of TNT. This marked a significant breakthrough in reducing the mass and size of warheads and nuclear charges. That same year, the US Air Force began deploying Minuteman III MIRVed ICBMs with three warheads, which dramatically increased the number of warheads in the US strategic nuclear triad.

In order to maintain strategic parity, the Soviet Union had to intensify its efforts in MIRVed ICBMs. The gap between the two superpowers still remained considerable. Soviet programs to increase the number of warheads while maintaining the same number of delivery vehicles resulted in the development of dispersing MRV ("shrapnel") warheads in 1967.

It was at that time that the Yuzhnoye Design Bureau in the Ukrainian city of Dnepropetrovsk began intensive work on developing a heavy R-36 (SS-9) ICBM type, equipped with MRV dispersing warheads. The missile carried three megaton-yield warheads. Flight tests of this ICBM were completed in 1970, and deployment began in 1971.

In 1969, the Soviet government approved the development of both single-warhead and MIRVed versions of heavy ICBM types based on the R-36 and R-36M designs

> The secluded nature of the Soviet decisionmaking made Robert McNamara's cost-effectiveness methods for choosing weapons systems totally inapplicable.

(RS-20, or SS-18).[2] Flight tests were completed in 1974, and the missile entered the deployment stage in 1975. These MIRVed missiles carried eight warheads. In 1976, the Soviets decided to develop an improved heavy missile known as the R-36M UTTH (also designated RS-20, or SS-18), flight tests of which were completed in 1977. The missile's accuracy was increased, which made it possible to reduce the weight and size of the MIRV warheads and bring their number up to 10. This missile's follow-on version, known as the R-36M2 Voevoda,[3] also carried 10 warheads. All modifications of this ICBM could also be fitted with a single-warhead upper stage. The first Strategic Arms Reduction Treaty (START I) classified R-36M and R-36M2 missiles (RS-20, SS-18), with a launch weight of 211 tons, as "heavy" ICBMs, while missiles with a launch weight of up to 105 tons were classified as "light" ICBMs.

Among the Soviet strategic missile programs, R-36M (RS-20, SS-18) heavy ICBMs, developed by the Yuzhnoye Design Bureau, were in a class of their own and were single sourced. Two design bureaus worked on light ICBMs. One was the Yuzhnoye bureau in Dnepropetrovsk, headed first by Mikhail Yangel and then by Vladimir Utkin. The other was the Machine-Building Central Design Bureau in Moscow, headed by Vladimir Chelomei. Each of these organizations had its own patrons in the upper echelons of the Soviet hierarchy, which only intensified the already fierce rivalry between them. This rivalry turned particularly heated when both organizations started work on developing MIRV warheads on the basis of defense contract tenders. The Machine-Building Central Design Bureau began developing the UR-100N (RS-18, SS-19) ICBM with a launch weight of 105 tons, and the Yuzhnoye Design Bureau began developing the MR-UR-100 (RS-16, SS-17) ICBM with a launch weight of 71 tons.

The Soviet leadership decided initially that, depending on the arms-procurement tender results, only one of these ICBMs would be accepted. The selection was to be made through a comparative assessment of the two design projects, but the pressure of high-placed patrons made this impossible and thus it was decided to make the selection following flight tests of both ICBMs. The secluded nature of the Soviet decisionmaking mechanism and the availability of virtually unlimited resource allocations for defense made US Defense Secretary Robert McNamara's cost-effectiveness methods for choosing weapons systems totally inapplicable. The flight tests of both ICBM types were conducted almost simultaneously from the end of 1972 through October 1975.

After the flight tests, however, a selection was not made as had been planned. Finally, following resolutions from the Central Committee of the Communist Party and the Soviet Council of Ministers, both missiles were accepted and deployed by the Soviet Strategic Rocket Forces (SRF). Military experts proposed that one of the ICBMs should not be modernized in the future, but this option to save money was also ignored. Flight tests of modernized versions of both missile systems were conducted up until 1996-1997.

The Machine-Building Central Design Bureau took a stage-by-stage approach to developing MIRVed missiles. In 1974, flight tests of the UR 100K (SS-11 Mod 2) ICBM with three non-independently targetable MRV warheads of 350-kt yield were completed and the missiles were deployed. Because of their insufficient accuracy, these ICBMs, like the R-36 (SS-18), were intended for destroying large-area administrative and industrial centers. One of the main problems with MRVs of this type was that the warheads could not be guided sufficiently far apart from each other to prevent them from being destroyed by the first nuclear warhead's detonation — the "fratricide effect." Besides, only the first warhead of the package of three at the center of the warhead flight formation could be aimed with relative precision.

At the same time, development proceeded on the UR-100N (RS-18, SS-19 Mod ½) ICBM with an increased throw weight, which, combined with the reduction in the warhead's size, made it possible to equip the missile with six MIRV warheads. This ICBM came into service in 1975. In 1977, flight tests of an improved version, the UR-100N UTTH (RS-18, SS-19 Mod 3), with the same number of warheads and a limited number of single-warhead ICBMs of this type, were completed. A total of 300 silo-based ICBMs of this type were eventually deployed. Development of the MR UR-100 ICBM from the beginning started with four MIRVs. A total of 150 silo-based missiles of this type were adopted by the SRF.

By this time, military experts had already realized that the fewer warheads per delivery vehicle the less attractive an ICBM was as a target, per the logic of general strategic parity. This explains why the preference was for MR UR-100 ICBMs with four MIRV warheads, but the Soviet leadership also wanted to have the maximum number of warheads for its nuclear triad, and this is why both types of ICBM were approved and deployed in parallel.

These decisions increased the first-strike capability of the SRF at the expense of its survivability and strategic stability, in particular given the improvements in the accuracy of US MIRVed ICBMs and SLBMs. Consequently, it was considered obligatory for the Union of Soviet Socialist Republics (USSR) to develop and deploy mobile ICBMs with higher survivability, which had much larger deployment and maintenance costs.

MIRVed Systems

The first Soviet R-27U SLBM (RSM-25, SS-N-6) with three "shrapnel"-type MRV warheads of 200-kt yield was commissioned in 1974. As noted previously, the United States had been deploying warheads of similar type and number on its Polaris A-3 missiles since 1964. The Soviet Navy adopted its first SLBM with MIRV system R-29P (RSM-50, SS-N-18) only in 1977. This missile carried three warheads, each with yields of 200 kt. There was a gap of seven years between the US Poseidon C-3 and its Soviet equivalent.

The considerable lapse of time between the development of US and Soviet MIRVed sea-based missiles was due primarily to the limited throw weight of Soviet SLBMs and the lag in developing smaller and lighter warheads. Later, Soviet SLBMs classified as R-29RL (RSM-50, SS-N-18 Mod 3), R-39 (RSM-52, SS-N-20), and R-29RM (RSM-54, SS-N-23) were generally equipped with MIRV warheads and carried up to 10 each. In contrast to the United States and in line with the Soviet defense program traditions, each missile type was designed for a new type or a new modification of submarines, which greatly increased the cost of the programs.

Comparative Destructive Capability of Various Single Warhead and MIRVed Missiles

In addition to the aforementioned problem of dispersing re-entry vehicles, another difficulty when targeting MIRV warheads was the loss of accuracy when warheads were individually aimed at distant targets. This had to be dealt with while planning strikes on both unprotected area targets and hardened point sites, like missile launch silos and command bunkers. Short distances between the targets implied the overlapping of destroyed areas, which amounted to inefficient use of the warheads' capacity.

As the work proceeded to refine MIRV warhead designs and improve the accuracy of their guidance, Soviet thinking evolved regarding the methods of destroying large targets. When targeting large administrative and industrial centers, it made more sense to identify several focus points, including important production facilities, public administration sites, and communication nodes rather than attempting to destroy the entire area as a whole. In addition, using MIRV warheads and single-warhead missiles with similar destructive power could increase the total destroyed target area. Furthermore, using MIRV warheads made it possible to set more rational space and time-of-flight tactics, since individual warheads could be guided to targets located tens or hundreds of kilometers (km) apart.

Improving the Construction of Missiles, Re-entry Vehicles, and On-board Digital Computers

The development of more efficient warheads was facilitated by the increase in the destructive power of nuclear explosive devices and improvements in construction of the warheads. These advancements included reductions in their size and weight and the use of advanced on-board digital computers, which coincided with improved warhead guidance and accuracy. These methods gave the warheads added speed in the needed direction, and dispersed them in order to hit targets several kilometers apart or to strike a single target in sequence.

Warheads of this type were developed for Soviet RSD-10 (SS-20) intermediate-range ballistic missile (IRBM), RS-20 (SS-18) ICBMs, and the US Polaris A-3 SLBM. The use of MIRV warheads implied installing a two-tier platform on the missile's upper stage for attaching the warheads, their dispensing mechanism, special low-thrust rocket engines for orienting the whole platform, and the on-board guidance system. If the missile's extended flight range was to be ensured, this required either increasing the overall throw weight considerably or reducing the size and weight of the mechanisms and devices in the missile's upper stage.

The first Soviet ICBMs with a range of up to 10,000 km had a considerable launch weight and could be equipped with only one warhead with a powerful charge. The R-36 ICBM (SS-9), for example, had a launch weight of 184 tons and a throw weight of up to 5.8 tons, and could carry only one warhead with a yield of 10 megatons or more. Warheads of this kind were designed primarily to destroy hardened silos and command centers hardened to 100 kg per square centimeter (about 1,300 pounds per square inch, or psi). Within these launch- and throw-weight parameters, it was subsequently possible to equip the R-36 ICBM with three MRV warheads. But to equip the R-36 with MIRV warheads, the missile's launch weight had to be increased to 211 tons and the throw weight to 8.8 tons. This modified missile was put in service in 1983 under the designation

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of R-36M2 and it is still in service in the Russian SRF today.

One of the distinguishing features of developing higher-throw-weight missiles for the Soviet SNF was the use of liquid fuel as a propellant, as the Soviet Union lagged considerably behind the United States in the development of solid-fueled missiles. The main measure of ICBMs' energy and weight efficiency is the ratio of throw weight to launch weight, as calculated for a standard range (10,000 km) with optimal flight trajectory and taking into account adjustments to the launch-weight value. Using this measure, Soviet liquid-fueled, heavy ICBMs achieved a ratio of 4.17 percent, and the ratio was even higher for SLBMs. Innovative solutions were found to make maximum use of the inner space of the missile's upper stage. This made it possible to take the ratio of throw weight to launch weight to more than 5 percent for Soviet SLBMs.

The ratio for Soviet solid-fueled ICBMs was around 3 percent; for US MX ICBMs, it was around 4 percent. (It should be mentioned that the throw weight to launch weight ratios for intermediate and short-range ballistic missiles differ considerably from those of the ICBMs). Liquid-fueled ICBMs were deployed in fixed-silo launchers that, despite their hardening, became increasingly vulnerable as US land- and sea-based missiles improved their accuracy. In order to increase the Soviet nuclear forces' survivability, it was necessary to develop solid-fueled ICBMs for basing on mobile launchers. The considerable advances in the accuracy of MIRV warheads made it possible to reduce their yield. Accuracy was improved by reducing the error rate of on-board gyroscopes and by using powerful digital computers to decrease methodological errors of on-board guidance systems during the missile's boost and warhead-dispensing phases. The throw-weight reserves of the ICBMs and SLBMs made it possible to resolve the crucial task of installing at the upper stage various BMD penetration aids packages, including active jamming devices, dipolar reflectors, and light and heavy decoys.

Development and deployment of MIRVed ICBMs and SLBMs in the Soviet Union, along with other programs aimed at achieving and then maintaining strategic nuclear parity during the Cold War, required tremendous efforts in many different technological fields in order to create weapons of unprecedented destructive power. This in turn accelerated the advance of fundamental science and research, the development of new technologies to improve ballistic missiles' technical characteristics, and the technological refinement of nuclear warheads, engines, powerful on-board digital computers and software, and effective BMD penetration aids. Efforts were made to speed up flight tests of MIRVed ICBMs and SLBMs and to modernize manufacturing plans for the serial production of strategic missiles and their platforms and launchers.

A Defense Establishment–Driven Buildup

What were the Soviet strategic concepts behind those crash buildup programs, and after them? No direct response to this question exists since in the USSR there were no analogues to mechanisms in the United States that were guiding documents and declarations on the subject. Soviet political and military leadership did not have to justify military programs and force levels in the legislature to receive corresponding appropriations, or to placate foreign allies on the subject of consistency of nuclear security assurances. There was no need to set a strategic reference framework to enforce civilian rule over the interests of top military agencies, or to make rational choices among weapons systems that were promoted by armed services and industrial corporations.

Hence, the public military doctrine of the USSR was framed by propagandistic and ideological scholastics that reiterated Marxist-Leninist dogmas and promoted the notion of a peace-loving Soviet policy versus the aggressive propensities of the United States and North Atlantic Treaty Organization (NATO). Besides that, there were only top-secret operational plans (Plan Udara, also known as the Soviet Strike Plan), aimed at delivering maximum destructive power on the opponent in the course of either a first- or a second-retaliatory strike upon receiving authorization from the "military-political leadership."

Moreover, there was never any discussion of the possible impact of various Soviet approaches to nuclear force posture on the probability of war and its escalation. It would have been heretical to suggest in the high quarters of the government that maximum Soviet counterforce capability might make war more probable by provoking US preemption. Similarly, the notion that counterforce investments might prompt corresponding American expenditures in new weapons programs was not considered, even though such a response would accelerate the arms race and increase the military burden on the Soviet economy.

Soviet military planners were operating in a confined world of nuclear exchange scenarios and relative damage assessments. As a result, they constantly searched for warfighting advantages without regard for their effect on war probability. They assumed that it was the job of the "military-political leadership" to make decisions on the initiation of combat operations, while the military's duty would be to conduct the war with maximum efficiency. They failed to recognize that some strategic plans and weapons systems might severely limit the options of policymakers in a crisis situation and could lead to disaster. For example, this was the reason why the concept of launch-on-warning was readily accepted as soon as technologies made it possible. Its implications regarding the possibility of war by miscalculation or technical error (i.e., a false alarm of the early-warning systems) was never accepted in the USSR or later by the Russian Federation, despite arguments of some responsible generals and civilian experts.

As for civilian political leaders, they mostly relied on the military in matters of war planning, and on the top brass and defense industries in the choice of weapons systems within the set budget ceilings. With few exceptions, they were the captives of the defense establishment and could not, therefore, capitalize on the analysis of well-qualified independent experts. This kind of policymaking model was alien to the Soviet political regime, and was only marginally and for a short time adopted by the Russian government in the 1990s.

Nonetheless, for the sake of objectivity it should be mentioned that during the 1950s the same kind of military mentality, strategies, and weapons programs were predominant in the United States. Moreover, since the early 1960s the USSR was largely following the lead of the United States in the development and deployment of major strategic weapons systems, trying to catch up with the opponent after each American "jump" forward in the arms race and to negate its attempts to gain strategic advantages. The Soviet Union had to absorb huge financial expenditures on developing and deploying mobile land-based ICBMs, organizing permanent sea-patrol of missile-carrying submarines, and developing an extensive network of airfields for wider dispersal of strategic bombers. Likewise, the United States had to make huge technical and financial efforts to sustain survivability of its land-based missile forces and command-control infrastructure, and to match the USSR in hard-target-kill capability.

The new weapons systems were simply added to the Soviet arsenal to enhance the two basic strike plans vis-à-vis changing US capabilities. It was only in the late 1980s that Soviet strategic thinking started to incorporate the philosophy of strategic stability, acknowledged mutual concerns, and assessed the impact of force postures on war probability. Moreover, in the early 1990s Russian military doctrine started defining nuclear strategy in more credible, concrete, and sensible public formulas.

Unfortunately, given the massive generational change of political leaders, bureaucrats, and military officers after 2000, combined with the conservative transformation of Russian domestic and foreign policies, the state's defense policymaking has largely returned to a traditional approach.

MIRV Programs and Doctrinal Implications

The interaction of ballistic missiles and MIRVs with strategic doctrines of the United States and the Soviet Union deeply affected the military relations of the two powers for at least a quarter-century and precipitated two rounds of a highly expensive and threatening arms race — with dire implications for international security. This unique historical experience should be taken into account by other nuclear powers contemplating the development of MIRVed systems, which could profoundly destabilize their strategic relationships, entail large financial expenditures, and increase the probability of nuclear conflagration.

Strategic Origins of the Arms Race's Mad Momentum

The strategic genesis of MIRVs is impossible to understand without analyzing the history of the US-Soviet strategic interactions under the Kennedy-Johnson and Khrushchev-Brezhnev administrations. In March 1961, the newly appointed secretary of defense, Robert McNamara, initiated the revision of President Eisenhower's guiding document "Basic National Security Policy," which corresponded to the doctrine of massive retaliation. Its latest version, adopted by the Joint Strategic Target Planning Staff (JSTPS) in Omaha and embodied in the first Single Integrated Operational Plan (SIOP-62), called for using all alert strategic forces on all listed targets, including opponent cities.[4] This strike would have to use 1,850 long- and medium-range bombers to deliver, in a single wave, about 4,700 nuclear bombs.

McNamara appointed Daniel Ellsberg, William Kaufmann, Paul Nitze, and Henry Rowen to a working group to lead the revision process. Their project stipulated the necessity of various nuclear attack scenarios, prompting the group to make various revisions to the SIOP: the targets of the other side's armed forces were separated from its cities on the target list; a strategic reserve was to be kept in the course of the war; the US command-control system was to ensure controlled nuclear attacks; China and other communist states were separated from the USSR; and the Soviet system of command and control was to be spared from nuclear strikes at the initial stages of war. The new operational plan, SIOP-63, included five basic strike options: (1) on Soviet strategic forces (missile sites, bomber airfields, and submarine pens); (2) on Soviet air defenses covering US bomber routes and on conventional forces (the result of which should have

> The logical conclusion drawn from these arguments was the senselessness of a further arms buildup in order to attain nuclear superiority.

left the Soviet Union with, at most, seven divisions and the other Warsaw Pact countries with 10 divisions); (3) on Soviet air defenses around major cities; (4) on Soviet command and control sites; and (5) on population and industrial centers. The overall strategic target list was expanded to 6,000 sites. The Joint Chiefs of Staff (JCS) approved SIOP-63 in December 1961.[5]

Addressing Congress in January 1962, Secretary of Defense McNamara for the first time announced the new strategic concept in US nuclear strategy that was called "counterforce." On June 16, McNamara delivered his famous speech in Ann Arbor at the University of Michigan, which became a historic turn in the history of nuclear strategy. In particular, he stated:

> The US has come to the conclusion that, to the extent feasible, basic military strategy in a possible general nuclear war should be approached in much the same way that more conventional military operations have been regarded in the past. That is to say, principal military objectives in the event of an atomic war… should be the destruction of the enemy's military forces, not of his civilian population. In other words, we are giving a possible opponent the strongest imaginable incentive to refrain from striking our own cities.[6]

However, despite McNamara's public references to a "retaliatory counterforce strike," the Pentagon's real plans envisaged disarming first attacks. Now, when the Soviet Union acquired an initial ICBM capability for retaliation against the United States, it was considered necessary to destroy the maximum portion of this Soviet capability to prevent retaliation. US ICBMs looked quite attractive for this mission because of their short flight time (30 minutes compared to 9 to 11 hours for bombers). Besides, at that time the USSR did not have any early-warning radars (the first stations were commissioned in 1971), or launch-detection satellites (first orbited in 1977), and this created the opportunity for a total surprise attack. The first generation of Soviet ICBMs (R-7, or SS-6, and R-9, or SS-8) were few in number (20 to 30 rockets), vulnerable at launch positions, and had long readiness times (several hours). The same was true of bombers at airfields and the first diesel-powered missile submarines, which spent most of their time in ports. Finally, the first US reconnaissance satellites of the SAMOS and CORONA (Discoverer) series provided much better targeting information on the location of Soviet strategic forces.

The US nuclear arms buildup of 1961-1967 was unprecedented. Having come to power in January 1961, the Kennedy administration inherited from its predecessors 12 first-generation liquid-fueled Atlas ICBMs. Two atomic-powered submarines (the George Washington and the Patrick Henry) had been commissioned, each carrying 16 Polaris A-l missiles.

By late 1967, the number of launchers in US missile forces had grown 40-fold. The United States had at its disposal 1,000 Minuteman I and Minuteman II ICBMs, 54 Titan II heavy missiles, and 41 nuclear-powered submarines with 656 Polaris A-2 and Polaris A-3 SLBMs. The actual scale of the arms race in the 1960s was still greater, taking into consideration more than 500 Atlas, Titan I, Polaris A-l, and Minuteman I ballistic missiles, which were replaced by more effective systems, and 200 B-52 and B-58 bombers deployed after 1961. The number of delivery vehicles in the US strategic forces grew from 1,850 to 2,500, and the number of thermonuclear warheads and bombs approached 5,000. Most important was the radically rebuilt structure of US strategic forces. Whereas earlier these forces had been composed almost entirely of medium- and long-range aviation, now about 75 percent of the strategic launchers were ballistic missiles based in hardened silos or on submarines.[7]

Nonetheless, by the mid-1960s the logic of the counterforce concept was becoming more dubious as a result of the continued high rate of deployment of more sophisticated Soviet ICBMs in hardened silos and the construction of better ballistic-missile submarines.[8] By 1964, there were already about 100 silo-based missiles and eight project 658 atomic-powered submarines (Hotel I and II classes). Maintaining the counterforce targeting objectives would have required an open-ended buildup of US strategic forces. That was exactly the goal of the air force and its congressional and industrial allies.

In order to formulate clearer strategic criteria upon which to base decisions on the desirable levels of missile forces, a working group was formed under the leadership of General Glenn Kent in the summer of 1962. It presented a report with the proposal to adopt a new strategic concept of "damage limitation."[9] That doctrine gave the civilian leadership of the Defense Department an opportunity to retreat officially from the open-ended financing of a counterforce strategy. On November 5, 1964, the secretary of defense announced a decision to limit the deployment of Minuteman missiles by a ceiling of 1,000 together with a decision to replace the

Minuteman I missiles with the more effective Minuteman II system, instead of procuring 200 additional Minuteman I missiles as demanded by the air force.

Nonetheless, with the continued buildup and qualitative improvement of Soviet strategic forces, McNamara paid increasingly less attention to the concept of damage limitation, thus indirectly acknowledging the impossibility of limiting the destruction of a potential American first strike on Soviet strategic forces. By 1967 the USSR had about 800 silo-based ICBMs, including a few hundred of R-16, R-9A, R-36, and UR-100 types (correspondingly SS-7, SS-8, SS-9, and SS-11) and launched a big series (34 boats) of project 667 (Yankee I and II) missile submarines, designed to sustain permanent sea patrol.

McNamara again shifted emphasis, this time to another concept: "assured destruction." In the military budget report for Fiscal Year 1968, he emphasized:

> As long as deterrence of a deliberate Soviet (or Red Chinese) nuclear attack upon the United States or its allies is the overriding objective of our strategic forces, the capability for Assured Destruction must receive the first call on all of our resources and must be provided regardless of the cost and the difficulties involved. Damage Limiting programs, no matter how much we spend on them, can never substitute for an Assured Destruction capability in the deterrent role.[10]

In 1967, McNamara defined assured destruction as a capability of surviving US nuclear forces to destroy, in the course of a retaliatory strike, up to 25 percent of the population and around 70 percent of the industry of the opponent.[11] For this, it was considered sufficient to detonate 400-megaton-equivalents of nuclear weapons over a corresponding number of the enemy's largest cities.

Despite these changes in framing US nuclear doctrine, the actual plans for using US nuclear forces changed very little. A new SIOP, adopted in February 1967, along with the subsequent one, included the very same five basic versions of nuclear attacks as in SIOP-63. The target list was expanded to 10,000 sites, adding the newly constructed Soviet ICBM silos, submarine pens, command centers, intermediate-range nuclear forces, conventional forces, and centers of growing Soviet industry and infrastructure.[12] This reflected a huge surplus of strategic power exceeding the criteria of assured destruction. At the same time, in view of the growth of the number, readiness, and hardness of the USSR's strategic forces, the emphasis on counterforce strikes was by necessity reduced in the SIOP, and the set criteria for the destruction of hard targets significantly lowered.

The new views of McNamara and his civilian Pentagon strategists on nuclear weapons were most systematically put forth in a speech to representatives of

United Press International in San Francisco on September 18, 1967.[13] McNamara stressed the importance of deterring a "deliberate nuclear attack upon the United States and its allies by maintaining a highly reliable ability to inflict an unacceptable degree of damage upon any single aggressor, or combination of aggressors, at any time during the course of a strategic nuclear exchange, even after absorbing a surprise first strike."[14] At the same time, McNamara acknowledged that "the blunt, inescapable fact remains that the Soviet Union could still — with its present forces — effectively destroy the United States, even after absorbing the full weight of an American first strike."[15]

The logical conclusion drawn from these arguments was the senselessness of a further arms buildup in order to attain nuclear superiority. Nevertheless, the arms race, in McNamara's words, had acquired an intrinsic dynamic of its own:

> "Whatever be their intentions, whatever be our intentions, actions — or even realistically possible actions — on either side relating to the buildup of nuclear forces, be they either offensive or defensive weapons, necessarily trigger reactions on the other side. It is precisely this action-reaction phenomenon that fuels an arms race."[16]

To escape from this sinister closed circle, McNamara advanced the idea of negotiations between the great powers:

> We do not want a nuclear arms race with the Soviet Union — primarily because the action-reaction phenomenon makes it foolish and futile… Both of our nations would benefit from a properly safeguarded agreement first to limit, and later to reduce, both our offensive and defensive strategic nuclear forces… We believe such an agreement is fully feasible, since it is clearly in both our nations' interests.[17]

The historic importance of this speech was that it laid down the principal tenets and the foundation for strategic arms control, which still define its intellectual framework up to the present: the non-ideological action-reaction dynamics of the arms race; its dangers and wastefulness; first-strike/second-strike criteria; mutual second-strike assured destruction as the basis of strategic stability; and strategic stability as the common ground for US-Soviet arms control agreements to enhance national security.

The evolution of the strategic balance in the 1960s had set the material framework of the US-Soviet strategic relationship, including: setting benchmarks for numerical levels, classes, and types of strategic forces; clarifying asymmetries in the respective triads; and making operational specifications. During the ensuing 45 years, weapon types, tactical characteristics, and force levels changed, but the fundamental properties of the strategic balance remained largely the same.

McNamara's San Francisco speech rightly focused on new threats to strategic balance and stability that were looming on the horizon. The secretary of defense publicly mentioned one: the ABM system. Another was neither named nor recognized as a threat, but eventually had a great impact on the strategic balance: MIRVed systems for strategic offensive ballistic missiles.

The Birth of MIRVs

In 1966, a massive campaign was launched in the United States about the prospective deployment of an advanced ABM system in the USSR. (This projected threat was completely overblown; in fact, a very limited-capability A-35 ABM system around Moscow was deployed only in 1974). Domestic pressures to respond by developing and deploying an American system, the Nike-X, were growing.

In the eyes of McNamara and a number of his assistants, the ABM system became a symbol of a futile arms race that, in the interests of strategic stability (as elaborated in his San Francisco speech) needed to be put under definite control. McNamara thought that scrapping the construction of the then-developed Nike-X ABM system would provide an opportunity to conclude an agreement with the Soviet Union on limiting strategic arms. The deployment of ABM systems could, in his opinion, destabilize the military balance without providing the United States with any real defense. Opposing the Nike-X ABM program, McNamara contended that MIRVed systems could overwhelm any anti-ballistic missile defense. Therefore, the correct response to the construction of Soviet ABM was to equip US missiles with multiple warheads, not to create the United States' own ABM system.

President Johnson and Secretary of Defense McNamara were also attracted by the fact that equipping missiles with MIRVs would render a manifold increase in the aggregate number of warheads and would, therefore, eliminate the necessity of further building up missile forces. In November 1965, a decisive meeting of senior Pentagon officials on the navy's MIRV program took place. They decided to equip the Poseidon C-3 SLBM with 10 to 14 Mark (Mk)-3 MIRVs. In early 1966, it was also decided to begin the accelerated engineering development of the improved Minuteman III ICBM with three Mk-12 independently-targetable warheads.

This decision, which at that time was known only to a narrow circle of US military and civilian officials and seemed to them a purely technical move, turned out to be a turning point in the evolution of the Cold War strategic competition. Taken to enhance strategic stability, the decision actually severely undercut it and provoked the action-reaction phenomenon against which McNamara had warned in San Francisco. Moreover, it entailed long-term destabilizing consequences, and negatively affected arms control negotiations and US-Soviet relations as a whole.

Despite McNamara's efforts, President Johnson — under strong domestic pressure — decided to approve the deployment of an ABM system, designated Sentinel, in 1967. Paradoxically, national ABM systems were to be stringently limited in just five years by a US-Soviet treaty, but MIRVed systems, advocated foremost as ABM-killers, went on to full-scale deployment.

First-Generation MIRVs: Deployment and Strategy

President Nixon inherited the Johnson administration's Sentinel ABM program. The president and his advisors considered the program's continuation necessary to guarantee the United States a "strong position" in the planned Strategic Arms Limitation Treaty (SALT) negotiations with the Soviet Union. The name of the Sentinel system was changed to Safeguard, and rather than deploy an area defense, the plan was to build a system in the first phase for defending a wing of US land-based ICBMs in North Dakota to enhance assured destruction capability.[18]

The Nixon administration also inherited the MIRV programs from its predecessors. In March 1968, Lockheed Corporation and Autonetics received contracts to build Poseidon missiles. On June 10, General Electric obtained a contract to develop the warheads for the Minuteman III ICBM. The following year, the manufacture of the new technology had already moved to production lines.

Meanwhile, in Congress, in some scientific circles, and in some media outlets, anxiety about the MIRV program increased. However, in 1969 liberal opposition was unable to force the administration to halt the testing of MIRVs before ruling out the possibility of prohibiting these systems through negotiations. That option went unrealized, as discussed below.

The US leadership concluded that it was necessary to maintain the superiority of US nuclear potential in a number of parameters. In the face of an approximate quantitative balance between the USSR and the United States in launchers, a buildup of MIRV-type warheads was chosen as the main way to maintain such a lead. Throughout 1969, in the National Security Council (NSC) and the Pentagon, a series of studies was conducted to revise strategic planning in light of the anticipated introduction of many thousands of MIRV nuclear warheads to US strategic forces. In the words of the American scholar Ronald Tammen, "the result was a dramatic expansion of the targeting list to include even relatively insignificant and tertiary targets and the overlaying of more important targets with multiple strikes."[19] By 1971, the target list had grown to approximately 16,000 sites and was subdivided into four basic categories: Soviet strategic forces; command and control points; Warsaw Pact conventional forces; and war-supporting industry. These categories corresponded to the priority of missile strikes in the SIOP.[20]

In June 1970, the first flight of 10 MIRVed Minuteman III ICBMs was declared operational at Minot air force base in North Dakota and transferred to Strategic Air Command (SAC). In March 1971, the ballistic missile submarine (SSBN) James Madison, carrying 16 Poseidon C-3 missiles with MIRV warheads, went on sea patrol. In June 1975, the deployment of the third wing of Minuteman III ICBMs was completed, with the last of the 550 multiple-warhead ICBMs brought to combat readiness at the Grand Forks air force base and transferred to SAC. The Daniel Webster, the 31st and final Lafayette-class SSBN, left dry-dock in the spring of 1978.

In all, as a result of deploying MIRVed systems in 1970 through 1978, and without adding to the planned force structure, the United States brought an additional 5,000 thermonuclear warheads into the arsenal, increasing the total number of strategic warheads to almost 10,000. In comparison with 1970, this represented a growth of approximately 100 percent.

The Nixon administration placed new emphasis on the utility of flexibility as a strategic concept for this greatly expanded arsenal. In his message to Congress on February 9, 1972, Nixon stated:

> Our forces must also be capable of flexible application. A simple "assured destruction" doctrine does not meet our present requirements for a flexible range of strategic options. No president should be left with only one strategic course of action, particularly that of ordering the mass destruction of enemy civilians and facilities. Given the range of possible political-military situations which could conceivably confront the United States, our strategic policy should not be based solely on a capability of inflicting urban and industrial damage presumed to be beyond the level an adversary would accept. We must be able to respond at levels appropriate to the situation.[21]

Retargeting

Following this philosophy, James Schlesinger — the new secretary of defense and an alumnus of the RAND Corporation — announced the new shift in US nuclear strategy in January 1974. "City-bashing," in his words, was no longer a sufficient or appropriate deterrent. "It should not be the only option and perhaps not the principal option available," he said. US nuclear strategy had "to develop a wider variety of options... in crisis situations." Accordingly, Schlesinger introduced a new strategic concept called "retargeting:" moving a portion of US missiles from administrative-industrial center targets to other targets to implement "certain counterforce options for nuclear strikes."[22]

Secretary of Defense Schlesinger noted in his budget report that a fundamentally new situation had been established in the strategic balance by the mid-1970s. On the one hand, he emphasized that US superiority had disappeared in almost all categories. On the other, the Soviet Union had acquired the indisputable capability for a devastating retaliatory strike, as the overwhelming portion of its nuclear potential had become invulnerable to a hypothetical US first strike. In this situation Schlesinger called for a revision of the US nuclear strategy of assured destruction: "In the meantime, I would be remiss if I did not recommend further research and development on both better accuracy and improved yield-to-weight ratios in our warheads. Both are essential… for a more efficient hard-target-kill capability."[23]

Thus, for the first time since 1963, a US official had openly declared the policy to increase the counterforce potential of nuclear forces, despite Washington's official assertions to the contrary over the course of previous years. The principle of "selective" nuclear strikes for conducting "limited nuclear war" at both the theater and intercontinental levels was advanced, supposedly to strengthen deterrence in the conditions of the new balance of strategic forces. To justify these plans, Schlesinger cited information that the Soviet Union had begun testing MIRVed ICBMs, and that this had taken place much sooner than the United States had expected.

In fact, as described previously, the USSR began testing its own MIRVed ICBMs in response to US MIRV programs, which were in an intensive deployment state. The eventual deployment of MIRVed missile systems in the USSR gave it a largely expanded capability to cover US military and civilian targets. However, this did not change the essence of the Soviet strike plan. A disarming strike against the US strategic forces remained infeasible, since American submarines were still invulnerable at sea. With MIRVed systems, Soviet planning just expanded the scale of massive strikes against all targets.

Starting around the mid-1970s, the USSR initiated the introduction of the concept, technologies, and procedures (including military exercises) of launch-on-warning (*otvetno-vstrechnyi udar*) with the commissioning of long-range-missile warning radars (Dnestr and Dnepr types) and early-warning satellites (Kosmos type), along with the deployment of silo-based ICBMs with short launch-readiness times. This strategy might have been adopted anyway in view of available technical possibilities, but surely the revival of the US emphasis on counterforce concept and hard-target-kill capabilities tangibly elevated the priority of this new Soviet strategy — with all its implications for inadvertent

US initiatives to develop MIRVed systems provoked Soviet MIRVed responses, which in turn prompted US countermeasures.

nuclear exchange as a result of a false alarm or political miscalculation in a crisis situation.

In accordance with McNamara's logic of the action-reaction phenomenon, US initiatives to develop MIRVed systems provoked Soviet MIRVed responses, which in turn prompted US countermeasures. From late 1973 to early 1974, Secretary Schlesinger drove the action-reaction dynamic with assertions of a prospective counterforce gap with the USSR.[24]

In the budget report for Fiscal Year 1976, Schlesinger declared quite bluntly that:

> Since both we and the Soviet Union are investing so much of our capability for flexible and controlled responses in our ICBM forces, these forces could become tempting targets, assuming that one or both sides acquire much more substantial hard-target-kill capabilities than they currently possess. If one side could remove the other's capability for flexible and controlled responses, it might find ways of exercising coercion and extracting concessions without triggering the final holocaust.[25]

Giving force to Schlesinger's arguments were asymmetries in force structures: ICBMs constituted the largest leg of the Soviet triad and the smallest leg of the US triad. New MIRVed systems provided the USSR with larger target coverage and greater prompt hard-target-kill capability against US ICBMs. This could easily have been anticipated after MIRVs were not banned in the 1972 SALT accord. It was not surprising that Soviet strategic planners viewed the Pentagon's pursuit of MIRVs as a way to reverse the game in the United States' favor by placing at risk the bulk of the USSR's strategic power — its ICBM force.

On the basis of a number of studies carried out upon Schlesinger's arrival at the Defense Department, an important document, National Security Decision Memorandum (NSDM) 242, was drafted, and President Nixon signed it in January 1974. In comparison with the period from the late 1960s to the early 1970s, the emphasis was increased on hard-target-kill capability and on expanding the set of programmed strike options on a wide range of other military and economic targets. Options were broken down in much more detail, right down to the use of several warheads.

In addition, the other side's industry was subdivided into "industry-supporting military activities" (military plans, petroleum refineries, transportation centers) and the "industry of postwar recovery" (coal and steel industry, power stations, etc.) as special target sets. Political leadership centers were not supposed to be destroyed in the initial exchanges, but remained targeted by reserve strategic forces.[26]

In accordance with these points, a new version of the Nuclear Weapons Employment Plan was developed in the Pentagon, which Schlesinger signed in April 1974. A new SIOP was drawn up on this basis. It included four basic categories of operations: major attack options (on industry); selected attack options (on military targets); limited attack options (on single targets); and regional attack options (on separate areas). In view of the hardening of the USSR's ICBM silos, improving missile accuracy and introducing the tactics of cross-targeting were of paramount importance.[27] The new SIOP was approved in December 1975 and entered into computers of the JSTPS at Omaha in January 1976. Its corresponding target list was expanded to 25,000 targets on the territory of the socialist countries.[28]

Secretary of Defense Schlesinger intensified technological efforts to improve the accuracy of US strategic missiles. In January 1974, the Pentagon announced a program to increase the counterforce potential of existing Minuteman III missiles. An improvement of their inertial guidance systems allowed accuracy to be doubled. Schlesinger planned to begin installing the missiles' new guidance systems in 1977. In addition, the miniaturization of thermonuclear warheads at Lawrence Livermore Laboratory provided an opportunity to approximately double the yield of the warheads without changing their weight or size. In February 1974, Schlesinger recommended the development of a new warhead type, the Mk-12A, in order to begin retrofitting Minuteman III missiles with it by 1979.

More consequential was Schlesinger's plan for a new ICBM type, labeled the MX. Initial studies for this next-generation ICBM system had been in progress since the late 1960s. The MX program began in 1972, and in 1974 Schlesinger put it at the center of his selective counterforce strike concept. According to the plans of the air force's Space and Missile Systems Center (SMC), the MX was to be a much larger three-stage ICBM than Minuteman with almost three times the launch weight, and quadruple the throw weight (to four tons). Officially, Schlesinger justified the MX as a way to reduce the vulnerability of US land-based missile force by means of its anticipated mobility. Moreover, in his view, the MX's increased hard-target-kill capability would assure counterforce parity with the Soviet Union in the 1980s.

Another major US initiative related to sea-based forces. In early 1974, the Pentagon announced its intention to begin construction of the new Ohio-class (Trident) submarines at a rate of two per year (in 1975 this schedule was changed to two every three years). The first 10 Ohio SSBNs were planned to become operational from 1979 to 1985. In addition, the Pentagon intensified work on various long-range cruise missile systems and accelerated development of new nuclear weapons for theater military operations — beginning with the extended-range, highly accurate Pershing II IRBM, for which a new guidance system and nuclear warhead were produced.

High priority was given to increasing the survivability and reliability of command, control, and communications (C3) systems by introducing the E-4 improved airborne command post and a "command data buffer" system based on new computer technology, which permitted the rapid retargeting of ICBMs to different targets. Such a capability had great significance in plans for controlled counterforce strikes, since it permitted surviving missiles to assume the tasks of destroyed ICBMs and offered the possibility of retargeting missiles from the enemy's empty silos to unused ones. Finally, Program 647 — geosynchronous satellites — promised to guarantee the observation of relevant regions and of possible missile launches "in real time" — that is, it would simultaneously transfer information to receiving stations.[29]

In November 1975, President Gerald Ford removed Schlesinger from his post and appointed in his place Donald Rumsfeld, the White House chief of staff and former US representative to NATO. Henry Kissinger forfeited the post of national security advisor and became secretary of state. Kissinger's deputy, retired General Brent Scowcroft, was appointed to the position of national security advisor.

In the Ford administration's final budget report (Fiscal Year 1978), the strategy of "limited nuclear war" received further elaboration. The capability "to hold at risk a significant number of military and industrial targets" and thus to "substantially undermine the USSR's capability to recover after a nuclear exchange" was enunciated as the basis of US nuclear strategy. Rumsfeld's refinements developed and supplemented Schlesinger's doctrine, further reorienting the requirements of "deterrence" toward capabilities to gain a comparative advantage in strategic nuclear warfighting. The concepts of post-strike exchange ratio and counter-recovery raised fundamentally new tasks in the strategic nuclear rivalry and opened the broadest scope for military programs.

The Countervailing Doctrine and the MX Missile System

In February 1977, soon after President Jimmy Carter's inauguration, an interdepartmental group was created under the aegis of the National Security Council, which elaborated an analysis of Soviet-US relations (Presidential

Review Memorandum 10, or PRM-10), and served as a basis for another document — Presidential Directive 18 (PD-18) — as guidance for US military policy in subsequent years.

The new secretary of defense, Harold Brown, held basically the same views as former Pentagon chief Robert McNamara in the late 1960s. On the whole, Brown adhered to the doctrine of assured destruction in combination with certain "selective nuclear strike" options, including Soviet military targets. The PRM-10 study drew a conclusion that was very different from the previous administration — namely, that the strategic balance of forces remained acceptable for the United States, and that a Soviet nuclear strike on US ICBMs would leave the Kremlin worse off as a result of the ratio of remaining missiles and warheads.[30]

In PD-18, the strategic goals in the SIOP were reprioritized. As one White House official noted, under Schlesinger and Rumsfeld the emphasis had been on "the efficient destruction of targets," with the most effective warheads dedicated to destroying Soviet hardened ICBM silos and command bunkers. Now, a greater emphasis was placed on spreading warheads over a broader set of targets[31] — in particular Soviet and Warsaw Pact conventional forces — both in Central Europe and in the Far East. As Brown noted, the United States should have the capability of delivering controlled strikes against a wide range of targets, "including theater nuclear and conventional forces, lines of communication, war-supporting industry, and targets of increasing hardness: from aircraft runways and nuclear storage sites to command bunkers and ICBM silos."[32]

Analyzing alternative arms programs, Brown and his colleagues gave priority to the air element of the triad, in particular air-launched cruise missiles (ALCMs). He was attracted by this system's comparatively low cost and by the ability to rapidly produce and deploy thousands of new weapons on various types of aircraft. Besides, ALCMs had a significant capability to destroy hard targets owing to the combination of their number, high accuracy, and sufficient warhead yield. At the same time, they were not suitable for a surprise attack on ICBM silos in view of the long flight time of the aircraft-launcher and the subsonic speed of the missiles themselves.

In the Carter administration's amendments to Ford's proposed military budget for Fiscal Year 1978, there were cuts in appropriations for the five main "counterforce" programs (the Mk-12A warhead, the MX ICBM, the advanced ballistic re-entry system, the Trident II SLBM, and programs for increasing SLBM accuracy). At the same time, $450 million was added to accelerate the development of cruise missiles and related programs.[33] Brown's most controversial decision was the cancellation of the B-l program in June 1977.

As for the land-based leg of the US triad, by early 1977 the air force's SMC had practically completed research and development of the MX missile in the so-called hybrid-trench basing system.[34] According to plans for the system, the United States would have 100 such missiles by the mid-1980s, and, if necessary, around 300 by the end of the decade, at an overall cost of approximately $35 billion. In view of its major technical and economic flaws, the hybrid-trench basing system was canceled in November 1977.[35] However, beginning in late 1977, US strategic arms policy again began to reemphasize prompt counterforce capabilities, reflected in the so-called "countervailing" targeting concept. The Pentagon's strategic emphasis appeared to reaffirm requirements for nuclear strikes on missile silos, underground command centers, and other targets that were called "primary (time-urgent) hardened targets." Secretary of Defense Brown endorsed the US capability to destroy hard targets with at least one reliable warhead and to have the retargeting capability necessary to permit reallocation of these warheads, either to a smaller number of crucial hard targets or to other targets on the list.

The Department of Defense explained this shift by citing intelligence data about a significant increase in the accuracy of Soviet MIRVed ICBMs, not only of the RS-20 (SS-18)-type heavy missiles, but also of the RS-18 (SS-19)-type light missiles, which were deployed at a high rate and by that time accounted for almost 500 launchers (more than 3,000 warheads).

Another reason for the strategic shift was connected to arms control diplomacy. Having failed to secure Soviet consent to a revised Vladivostok proposal as the basis for a second SALT Treaty in March 1977, the Carter administration concluded that it was necessary to develop and deploy the MX system in order to apply pressure on the Kremlin. Administration officials advised Congress that "the development of this system… may help to persuade Soviet leaders of the futility inherent in the present competition, of the capacity of US technology to outpace Soviet advances, and of the United States' will to utilize that capacity as necessary."[36]

Domestic factors played a role, too. A public campaign in the United States over the "window of vulnerability" caused by the Soviet MIRVed missile buildup had its intended effect. A report released by the Committee on the Present Danger, strongly influenced by Paul Nitze, asserted that the envisioned SALT II Treaty would allow the USSR such an "overwhelming advantage" that 90 percent of the Minuteman force would become vulnerable well before the mid-1980s.[37] The central factors of the US evaluation of the strategic balance were, as Nitze and others forecast, Soviet counterforce strikes on ICBM silos and the subsequent threat of the destruction of cities in the event that the United States retaliated against Soviet administrative-industrial centers with its sea- and air-based forces.

It was apparent from Brown's explanations that, in contrast to SLBMs and ICBMs, cruise missiles did not have an assured capability to penetrate the enemy's defenses; in comparison with SLBMs, they could not preserve their survivability for a long time and, together with their aircraft-launchers, were vulnerable at air bases without the timely warning of a nuclear strike. In comparison with ICBMs in fixed underground silos, bombers in flight would not have a sufficiently reliable link with command authorities and would lack the capability to execute flexible retargeting and deliver a rapid strike on "time-urgent" targets.[38]

In accordance with the new strategic "countervailing" targeting concept, land-based ballistic missiles moved more distinctly into the foreground, as highlighted in the Pentagon's January 1979 report:

> There are… several reasons why it would be unacceptable not to take measures to correct our impending vulnerabilities [of land-based missiles]. Although the total number of warheads in the US force will be increasing with the deployment of Trident and ALCM, the destruction of the ICBM force could result in a net loss of second-strike target coverage with our forces on day-to-day alert, decrease our ability to attack time-urgent targets, and reduce the flexibility with which we could manage our surviving forces.[39]

By December 1978, in line with the "countervailing targeting doctrine," work was concluded on a new SIOP where the criteria for sufficiency and the target list expanded from 25,000 to 40,000 sites.[40] After the cancellation of the hybrid-trench basing system in November 1977, an examination under the direction of Dr. Michael May recommended a basing mode for the MX of multiple protective shelters (MPSs). This basing mode sought to address vulnerability through multiple vertical silos, among which the missiles would periodically be transported on the surface by transporter-launchers. One option was to deploy 200 MX missiles in 4,500 vertical shelters.[41] The basing scheme was unattractive on technical, economic, and arms control grounds. In December 1978, Deputy Secretary of Defense William Perry chaired a meeting rejecting the MPS concept. Several months later, in June 1979, the Pentagon announced its preference for the largest and most powerful version of the MX missile.[42] The first 100 missiles would be deployed with Mk-12A warheads and improved guidance systems; subsequent modifications would include still more effective warheads.[43]

In September 1979, the Carter administration proposed another basing mode for the MX — the "racetrack" — in which horizontal shelters would be constructed in the deserts of Utah and Nevada, with missiles periodically moved among them by transporter-launchers. Deployment of the MX, in whatever basing mode, would entail a 20 percent increase in the number of nuclear warheads in US strategic forces in comparison with 1979, and a 300 percent increase in prompt hard-target-kill capability.[44]

Presidential Directive 59 (PD-59), signed by Carter in July 1980, supposedly added another, even more destabilizing element to US strategic targeting. PD-59 reportedly gave higher priority to targeting the Soviet Union's political and military leadership, command-control-communications centers, and early warning infrastructure.[45] The Kremlin viewed such early targeting, long presumed to be in the SIOP, with alarm. It feared that, as a result of US strategic modernization programs and the increase in prompt, hard-target-kill capabilities, the Pentagon was now considering "decapitation" strikes prior to targeting Soviet military power and urban-industrial centers. PD-59 also directed upgrades in the survivability, flexibility, and effectiveness of the US command, control, communications, and intelligence (C3I) system.

The Kremlin viewed PD-59 in the prism of growing international tensions after the Soviet invasion in Afghanistan, the demise of the SALT II treaty ratification effort, and the capture of American diplomats by Iranian revolutionaries. The Soviet leadership considered the leak of PD-59 to be a serious effort at political blackmail against Moscow. The leak was viewed as an instrument of intimidation to make sure the Soviet leadership did not harbor any hopes of surviving in a nuclear war and ruling over postwar recovery.

The Carter administration began with efforts to enhance strategic stability, but ended by further degrading it with provocative concepts and counterforce arms programs. The Reagan administration picked up the pace of US counterforce programs, resulting in dangerous challenges to the nuclear balance, fueled by accelerated deployment of MIRVed systems and rising international tensions. These strategic steps by the United States, along with the deterioration of US-Soviet relations, had the provocative effect of making the USSR more reliant on the concept of a first strike or launch-on-warning in a crisis situation, thus raising the possibility of inadvertent nuclear war. This dangerous scenario arose soon after, in September 1983, when Cold War tensions once again reached a high mark.

The Reagan Administration's Nuclear Warfighting Posture

The Reagan administration prompted extensive transformations in the strategic weapons sphere. For this, a study group was organized in the Pentagon (under the direction of Deputy Secretary of Defense Fred Iklé and Assistant Secretary of Defense Richard Perle), which undertook a review of US strategic doctrine and operational plans within the framework of the study "Fiscal Year 1984-1988 defense guidance." A commission of experts from the military-scientific community led by University of California physicist Charles Townes was given the task of reforming strategic weapons development and deployment programs.

The revision of US strategic concepts was completed by the summer of 1982 and released in a series of official documents, signifying yet another serious turn in US strategic policy. As some commentators noted, the defense guidance put forward the idea of a protracted nuclear war, wherein the United States needed to be able to prevail and compel the Soviet Union to seek, as early as possible, a termination of the conflict on conditions favorable to the United States. This defense guidance also included plans for "decapitating" the USSR with a nuclear strike on the sites of Soviet political-military leadership. The targeting of Soviet strategic forces, command and control, and political leadership, were not novel, as they were included in the above-mentioned NSDM-242 in 1974 and PD-59 in 1980. At the same time, as Walter Slocombe, former deputy undersecretary of defense during the Carter administration, said in the spring of 1982:

> I think the place where there is a discontinuity is that if there are people in the present administration who think that you can fight and win a nuclear war, and that it is reasonable to plan on doing so in the same way the British plan to fight and win a war in the Falklands — if there are people who believe that, then there was nobody at a politically responsible or politically significant level in the Carter administration who thought that.[46]

Deputy Secretary of Defense Frank Carlucci stated to the Senate Armed Services Committee (SASC): "I think we need to have a counterforce capability. Over and above that, I think we need to have a war-fighting capability."[47] The US budget for strategic forces, announced in October 1981, was increased by nearly 150 percent in comparison with the budget estimates of the Carter administration. The Reagan administration revived the B-l bomber program canceled in 1977 by President Carter, with a modified B-1B. The Townes Commission rejected the MPS or racetrack basing mode and called for the eventual introduction into the arsenal of 100 MX ICBMs with a new basing mode to be designed later. The deployment of 40 MX ICBMs in "superhardened" Titan or Minuteman missiles' silos was initially recommended to begin in 1985. However, Congress, echoing its 1976 decision, prohibited the deployment of missiles in existing Titan II silos or upgraded Minuteman III silos in early 1982. Another Pentagon working group then proposed a closely-spaced basing scheme, nicknamed "dense pack." This proposed basing mode relied on the fratricide effect rather than a proliferation of aim points to improve survivability. MX silos were to be spaced so close to each other and to be so hardened that, regardless of the yield of the attacking warheads, each explosion would not so much destroy silos as "shield" them from being destroyed by accompanying warheads. Theoretically, this should have guaranteed the survival of more than 50 percent of the ICBMs in the event of a hypothetical Soviet attack.

This proposed basing mode, like its predecessors, was subjected to technical, public, and congressional criticism. A number of experts, including Townes himself, expressed a lack of confidence in the feasibility of dense pack. US military leaders also did not like the idea of deploying one of the main strategic systems while relying on controversial and theoretical calculations that were unverifiable in practice. Many independent experts expressed deep reservations. Congress balked at funding the MX program in conjunction with the dense pack basing mode.

President Reagan then authorized still another commission under the leadership of retired General Brent Scowcroft, Kissinger's former assistant and his successor as the national security advisor under President Ford. Released in April 1983, the report of the Scowcroft Commission recommended the deployment of 100 MX missiles in the existing Minuteman silos in the second half of the 1980s, and the development of a new single-warhead light ICBM — the Midgetman — in significant quantities (around 1,000 missiles) on mobile launchers in the first half of the 1990s.[48] According to some estimates, guaranteeing survivability for the Midgetman system would require dispersing 1,000 missiles in an area approximately equal to the size of the state of Oklahoma, and the cost of deploying such a system could reach $46 billion in initial costs and $107 billion over the course of 20 years.[49] The Scowcroft Commission linked its deployment with the acquisition of a powerful "bargaining chip" at the arms control negotiations with the Soviet Union, and with providing means of a "controlled limited attack on hardened targets."[50] Congress approved this plan in May-June of 1983.

Overall, the Reagan administration's strategic program in the 1980s reflected the action-reaction phenomenon of the arms race that McNamara warned against, with Washington reacting to the Soviet reaction to the US MIRVed systems of the 1970s. In replacing old systems with new ones in all three legs of the US triad, the emphasis was placed not on increasing the number of strategic launchers (as was the case in the 1950s and the first half of the 1960s), but on increasing the number of nuclear warheads that were deliverable per launcher. From 1979 through 1983, the number of strategic delivery vehicles had dropped from 2,280 to 2,000, but the total number of individually targetable warheads was to grow from 8,800 in 1983 to 14,000 in 1990 — that is, by 60 percent.

The core of this strategic modernization program was the buildup of warheads with hard-target-kill capability, i.e., warheads on launchers possessing the necessary combination of increased yield and accuracy to destroy hardened strategic targets. The number of such warheads on the MX, Midgetman, and Trident II missiles, the Tomahawk SLCM, and the B-1B, B-2A Stealth, and B-52 bombers (with ALCMs) grew from approximately 2,000 to 6,000 in 1990, and to 9,000 in 1996.[51] The main emphasis was on an expansion of counterforce weapons on invulnerable launchers: from about 1,500 warheads in the early 1980s, this level grew to almost 4,000 by 1990, and to 6,500 weapons by 1996.[52]

Much of this capability resided in prompt counterforce capabilities with short flight times. By 1990, US strategic potential was to be increased six-fold, and by 1996, almost 20-fold (from 150 warheads to 890, then to 3,470). Sea-based forces, in particular the accurate and powerful warheads on the Trident II SLBMs (on 20 planned Ohio-class submarines), and prospective Midgetman ICBMs played prominent roles.

The Ohio-class submarines were commissioned starting in 1981, each with 24 Trident I and later with Trident II SLBMs (altogether, 18 boats were built). After 1986, a force of 50 MX/Peacekeeper ICBMs, each of which carried 10 warheads, were deployed in modified Minuteman silos. Also in 1986, the B-1B bombers entered the air force (eventually 95 were deployed) to be followed by B-2 stealth bombers starting in 1993 (the final number was 20 airplanes). Besides, 108 Pershing II and 464 ground-launched cruise missiles (GLCMs) were deployed in NATO states in Europe starting in 1983.

To Soviet leaders and strategic planners, the Reagan administration's strategic policy implied a radical restructuring of its strategic arsenal, giving it qualitatively new strategic and operational possibilities. The significant shift of emphasis in US nuclear strategy to sea-based missile forces as the means for rapidly striking Soviet strategic forces was a new development in the Pentagon's strategic doctrine and operational plans. As first-strike weapons, sea-based missile forces — provided the proper combination of command-communication, warhead yield, and accuracy — could have substantial advantages. Since the flight time of an SLBM is on average half as much as that of a land-based missile, the use of sea-based missile forces could guarantee greater surprise. Submarines could, moreover, deliver strikes from different azimuths, that is, from unexpected directions.

The Reagan administration had also devoted attention and resources — nearly $20 billion — to improving C3I capabilities. Besides expanding and accelerating the previous administration's programs, the longer-term objective was to create a survivable C3I complex for ensuring extended combat operations in accordance with the protracted nuclear war concept.[53] In addition, the action-reaction dynamic was evident in the development and testing of various anti-satellite (ASAT) weapon systems. In 1985, an F-15 fighter launched a missile at an altitude of about 20 km that was capable of destroying satellites at an altitude of up to 600 km.

Then, in March 1983, President Reagan unveiled his infamous Star Wars initiative, in which he endorsed an "astrodome" defense of the United States — perhaps with space-based lasers and other kinds of multilayered anti-ballistic missile defenses. This caused extreme concern in Moscow.[54] The Soviet response, in line with its economic system and decisionmaking mechanism, was massive, excessive, and staggeringly expensive. It was also, as usual, an average of five years behind American strategic programs. Besides deployment of modified versions of UR-100 (SS-19) and R-36 (SS-18) silo-based ICBMs, in 1987 the new RT-23 (SS-24) Molodetz[55] missile — the analogue of US MX/Peacekeeper — entered deployment phase in silo and rail-mobile basing modes; 46 missiles were eventually deployed. In addition, a total of 360 ground-mobile, PT-2PM (SS-25) Topol ICBMs were deployed from 1985 onward. Beginning in 1981, the Soviet analogue to the Ohio/Trident system was commissioned. The Project 941 (Typhoon)-type SSBN — 50 percent larger than the Ohio class — was nicknamed Akula (Shark). Each submarine carried 20 R-39 (SS-N-20) SLBMs with 10 warheads. Altogether, six boats were built. In parallel, a smaller SSBN system, Project 667 BDRM (Delta IV), entered service beginning in 1985, each equipped with 16 R-29 PM (SS-N-24) ballistic missiles. Eventually, seven boats were built. As for strategic aviation, the Soviet Union modified Tu-95 (Bear) heavy bombers and pursued an analogue to the B-1B — the Tu-160 (Blackjack) bomber — all equipped with ALCMs. Theater nuclear forces were equipped with medium- and short-range ballistic missiles and GLCMs.

Soviet responses to the Reagan administration's Strategic Defense Initiative (SDI) followed the same pattern of multiple, redundant programs. These included offensive missile systems with enhanced penetration of possible US space-based and ground-based ballistic missile defenses; options for a drastic increase in ICBM numbers (up to 1,700 missiles); developing land- and space-based ASAT systems for attacking US space-based BMD platforms; and developing Soviet land- and space-based BMD systems on kinetic and directed energy principles.[56]

The superpower arms race, sparked by MIRVed systems, counterforce capabilities, and SDI, reached its apogee during this period. These technological drivers, new weapons systems, and warfighting strategic concepts dramatically degraded strategic stability. The arms race and the slide downwards in superpower relations were avoided because of profound political changes within the Soviet Union and in international relations after the mid-1980s. Starting in 1987, a series of historic breakthroughs in nuclear arms control were achieved. Soon thereafter, the Cold War itself was ended. The predicate to these historic accomplishments was laid in prior arms control negotiations — the subject of the next section of this essay.

MIRVed Systems and Arms Control

SALT I

The first interaction of MIRVed systems and arms control took place in the early 1970s. In June 1969, the Nixon administration announced its readiness to begin SALT negotiations with the Soviet Union. On the eve of the talks, the Nixon administration refused to suspend testing of MIRVs, contending that the question of MIRV limitations should be resolved only on a mutual basis in the course of the negotiations. When these negotiations began, Washington proposed to prohibit MIRV testing, but this was unacceptable to the Soviet Union because during the two previous years the United States had tested MIRVed systems but Soviet MIRV testing had yet to begun. Prohibition would have prevented the USSR from catching up. Moreover, Washington advanced a proposal linking constraints on MIRVs with on-site inspections, which at the time would have revealed information about top-secret missile upper stage and warhead designs. Intrusive on-site inspections for strategic forces only became obtainable in 1991, with START I. In 1972 these methods were not acceptable, as many Western experts recognized at the time.[57] The Kremlin viewed these proposals as a diplomatic ruse, deliberately designed to elicit rejection.

Two and a half years after the beginning of negotiations, the first historic strategic arms control agreements were achieved. Signed in Moscow in May 1972, the unlimited-duration Treaty on the Limitation of Anti-Ballistic Missile Systems (ABM Treaty) prohibited national ABM systems for territorial defense, except for two complexes specifically mentioned in the agreement. Furthermore, the treaty prohibited certain qualitative improvements of ABM systems. Another achievement was the interim agreement on Certain Measures with Respect to the Limitation of Strategic Offensive Arms, signed on the same day. In accordance with the interim agreement, the USSR and the United States were obliged not to construct additional fixed, land-based ICBM launchers as of June 1, 1972. The period of the agreement was five years. In the same period, the increase of the number of SLBM launch tubes and the construction of new missile submarines above those that were already operational and under construction at the date of the signing of the agreement were prohibited (with some qualifications and reservations).

In a sense, US MIRVed systems, soon to be followed by the Soviet MIRVs, helped to achieve the ABM Treaty, inasmuch as the prospective deployment of thousands of nuclear warheads rendered national BMD systems highly ineffective and impractical. With respect to the interim agreement, deploying MIRVed missiles reinforced ceilings on missile launchers. But soon thereafter, arms control and multiple warheads got on a collision course.

Vladivostok Accords

In November 1972, the SALT negotiations resumed in Geneva. US representatives raised the question of establishing equal overall ceilings in Soviet and US strategic launchers, including bombers. It also proposed establishing equal limits on the aggregate throw weight of both powers' strategic forces. In this way, the US representatives sought to limit the deployment of MIRVed ICBMs in the USSR and to secure a reduction of Soviet heavy missiles. In turn, the Soviet Union again raised the issue of counting US forward-based nuclear forces in the equal numerical ceilings. In the fall of 1974, the Soviet leadership decided to put aside the issue of US forward-based forces until the future, and the United States backed off its demand to limit throw weight.

This permitted both sides to reach an understanding on limiting strategic offensive weapons systems in November 1974, at a meeting between Leonid Brezhnev and Gerald Ford near Vladivostok. In particular, both sides would have the right to set the total number of land- and sea-based ballistic missile launchers — plus their strategic bombers — at 2,400. In addition, both sides were to have in their force structure no more than 1,320 MIRVed land- and sea-based ballistic missile launchers.

US opponents of the proposed Vladivostok accord initiated a campaign against it. Some of them, including Paul Nitze and Melvin Laird, had been deeply involved in the SALT I agreements. They contended that the proposed Vladivostok Accord gave the Soviet Union unilateral advantages in heavy missiles, throw weight, and the likely future number of powerful MIRV warheads. Senator Henry "Scoop" Jackson (D-WA) urged lowering the limit on strategic launchers from 2,400 to 1,760 and placing equal sub-ceilings on both sides of no more than 800 ICBMs, 560 SLBMs, and 400 strategic bombers. Due to the asymmetric structures of the two states' strategic forces, these measures would have affected the Soviet Union much more than the United States.

In 1975-1976, the two principle issues of discord for a follow-on to the 1972 interim agreement were US cruise missiles, which Moscow wanted to ban or limit, and the Soviet Tu-22M3 medium-range bomber (the Backfire), which

Washington included in its strategic launcher count. In January 1976, Kissinger negotiated a compromise: counting bombers with cruise missiles under the sub-ceiling on missiles equipped with MIRV systems (1,320). Simultaneously, the deployment of ground- and sea-launched cruise missiles with a range of greater than 600 km would be prohibited. But a final decision remained elusive. Secretary of Defense Donald Rumsfeld, with the unanimous approval of the JCS and Fred Iklé, the director of the Arms Control and Disarmament Agency (ACDA), opposed the compromise. MIRVed systems were a significant sticking point, since the inclusion of aircraft with cruise missiles in any significant quantity in the MIRVed missile sub-limit would have required the reduction of a corresponding number of existing MIRVed ICBMs and SLBMs. The campaign against the Vladivostok Accord in the United States blocked the conclusion of negotiations. Thus, the first victim of MIRVs was a possible treaty on the basis of the Vladivostok framework.

SALT II Negotiations and Debates

The Carter administration at first attempted far deeper reductions from the 1974 Vladivostok Accord. In March 1977, the US negotiating delegation arrived in Moscow and proposed: reducing the total number of strategic launchers to between 1,800 and 2,000; cutting heavy ICBMs by half; limiting MIRVed ICBMs by a level of 550 launchers; and banning the development, testing, and deployment of any new ICBM. When the Kremlin rejected this proposal as one-sided, a review of US policy in the strategic arms area was begun anew in Washington.

Long and difficult US-Soviet negotiations ensued, and were ultimately crowned by the SALT II Treaty signed at the Vienna summit in June 1979. A compromise solution of the numerical issues established an ultimate ceiling of 2,250 total launchers for each side, with a 1,320-launcher sub-ceiling for MIRVed ballistic missiles and heavy bombers with long-range cruise missiles. Within this sub-ceiling, each side could have no more than 1,200 MIRVed ballistic missiles, and no more than 820 of them could be MIRVed ICBMs. The SALT II negotiations dwelled on limits for increases in the number of nuclear warheads on launchers and the introduction of new missile types. In May 1978, the SALT II delegations discussed the possibility of prohibiting the development, testing, and deployment of new types of ICBMs, without any exceptions. This might have been a major arms control step, but it would have interfered with the continuation of the MX program. From 1978 onward, the MX was considered by the Carter administration as an indispensable means of increasing US counterforce potential against Soviet MIRVed ICBMs. Also, in light of the growing criticism of the negotiations from hard-liners in the United States, protecting the MX was seen as an obligatory condition for the Senate's consent to ratification. Eventually, a compromise solution prohibited new types of ICBMs, except for one light system for each side, with either single or multiple warheads.

The delegations ultimately agreed to limit the number of warheads on land-based missiles (known as fractionation). For each existing missile type, it was prohibited to increase the number of warheads beyond the maximum number with which missiles of that type had been tested by that time. No more than 10 warheads were permitted on the one new light type of ICBM. The parties also agreed to quite strict limitations on the modernization or modification of existing types of ICBMs according to the number of launcher stages, length, diameter, launch and throw weight of the missile, weight of the warheads, and also the type of propellant in each stage. The parties also agreed to prohibit the development and deployment of new types of SLBMs with more MIRV warheads than the greatest number on systems already deployed (i.e., 14, as on the Poseidon missiles).

Together with the compromises on air-launched cruise missile numbers, and counting the rules on the Soviet Tu-22M3 bombers, the SALT II Treaty constituted a great breakthrough in numerical and qualitative arms control. The protocol to the SALT II Treaty prohibited the deployment of ground- and sea-launched cruise missiles with a range of more than 600 km, as well as the testing and deployment of ICBMs on mobile launchers and of MIRVed air-to-surface ballistic missiles. The protocol was in force for a short period (until December 31, 1981), but it created a precedent for future negotiations on these questions in the context of SALT II, as was pointed out in the joint statement.

After the treaty was sent to the Senate in June 1978, the greatest criticism of SALT II was connected not so much with its provisions as with the strategic balance on which the treaty was based. The JCS, former President Gerald Ford, Henry Kissinger, and Senators Henry Jackson and John Tower (R-TX) all expressed the view that, without an annual real increase in the defense budget of 4 to 5 percent, the SALT II Treaty would not merit their support. In December 1978, President Carter yielded to this pressure and announced that the military budget for FY 1981 requested from Congress would surpass the previous budget by 5 percent in real terms. The Pentagon's FY 1981 budget report indicated that the executive branch's defense budget requests would increase at an annual rate of 4 to 5 percent over the next five fiscal years, resulting in more than $1 trillion in additional defense spending during that period, and bringing the annual request total to $224 billion by FY 1984.[58]

This concession did not placate critics of the SALT II Treaty, whose attacks intensified. The Committee on the Present Danger published a report in which it was argued that a 5 percent annual real increase in military spending could not address trends toward "Soviet superiority." Former ACDA Director Iklé contended that the United States needed military appropriations of $1 trillion not over five years, but every year.[59] The Carter administration's decisions on the MX missile system confirmed, in the view of its critics, the crucial issue of US ICBM vulnerability. For their part, supporters of SALT II were greatly disappointed that increases in funding for strategic modernization programs, especially the MX, nullified the limitations contained in the treaty.[60]

The treaty's significance for strengthening strategic stability and turning the corner on MIRVed missiles and counterforce capabilities was significantly diminished by criticism on Capitol Hill, by think tanks, and in the mass media. As Paul Warnke, the former director of ACDA noted, the Carter administration had begun to regard arms control as a burden and a liability.[61] On January 3, 1980, against this domestic background and under the impact of the shock of Soviet invasion of Afghanistan, President Carter recommended to the Senate that consideration of the ratification be set aside indefinitely.

There is no doubt that, besides the growing international tensions, the campaign against the SALT II Treaty centered on asymmetries in the strategic balance, which the treaty could only partially mitigate, but not remove. The greatest asymmetry resided in the counterforce potential of Soviet ICBMs and the vulnerability of US silo-based missiles. Hence, in a strategic sense, the SALT II Treaty was yet another victim of MIRVs and counterforce capabilities that the United States initiated a decade earlier, to which the Soviet Union responded in full measure.

Conclusion

Almost 20 years were lost for strategic arms control between the SALT I accords of 1972 and the first START accord of 1991, largely due to the introduction of MIRVs and the growth of counterforce capabilities. Against the backdrop of ups and downs of US-Soviet relations and shifts in American domestic politics, the introduction of MIRVed systems was the main driving factor behind two decades spent in a massive and expensive strategic arms competition. This period was marked by dangerous warfighting concepts for nuclear weapons and greatly expanded targeting lists, which lowered the nuclear threshold and increased the threat of inadvertent war through false alarm or political miscalculation.

This sorry history could have been different. With an early suspension of MIRVed programs, either unilaterally or via bilateral agreements, the superpower arms race could have been tangibly contained. Treaties on the basis of Vladivostok's parameters and/or SALT II could have entered into legal force in the late 1970s.

In this event, the first START accord, enabled by the end of the Cold War, could have proceeded from much lower levels of strategic nuclear forces. Instead, because of MIRVs and the expansion of counterforce capabilities, practical START I reductions began from levels of between 10,000 and 12,000 warheads.

The negative effects of MIRVed systems lingered well after the end of the Cold War. The START II Treaty signed in 1993 envisioned reductions down to 3,000 to 3,500 warheads while banning MIRVed ICBMs. This was seen as a badly unequal agreement in Russian political and strategic communities, as it codified a huge advantage to the United States in MIRVed SLBMs. Hence, the treaty ratification process was frozen for seven years in the Russian State Duma. START II never entered into legal force, just like SALT II and the START III framework agreement of 1997, which would have provided for further reductions down to 2,000 to 2,500 warheads. If it were not for MIRVed systems, mankind would probably be living with much smaller nuclear weapons numbers than the approximately 16,000 weapons in nine nuclear-armed states that exist today.[62]

Endnotes

1. In recent decades, an alternative term, ballistic missile defense (BMD), has been commonly used.

2. In this essay, the names of Soviet missiles are presented first in their original design classification, then in the SALT/START designation, and finally in the US designation.

3. The new generation of Soviet systems since the late 1970s were given "lyrical" names, like American ones. This one means "military chief" in Russian medieval lexicon.

4. Fred Kaplan, *The Wizards of Armageddon* (New York: Simon & Schuster, 1983), 269.

5. Ibid., 279; Milton Leitenberg, "Presidential Directive 59," *Journal of Peace Research* 18, no. 4 (1981): 312; and US House Committee on Armed Services, *Hearings on the Fiscal Year 1968-1972 Defense Program and 1968 Defense Budget*, 90th Cong., 1st sess. (1967), (statement of Robert McNamara, Secretary of Defense).

6. US Department of State, *Bulletin* 47, no. 1202 (July 9, 1962): 67.

7. Desmond Ball, "The Strategic Missile Programme of the Kennedy Administration," Ph.D. dissertation (Canberra: University of Australia, 1972), appendices 1-3.

8. Vladimir F. Tolubko, *Raketnyevoiska* (Moscow: Voenizdat, 1977), 24; and Sergei G. Gorshkov, *Morskaiarrwshch' gosudarstva* (Moscow: Voenizdat, 1976), 293.

9. US House Committee on Appropriations, *Hearings on Department of Defense Appropriations for 1965, Parts 1-3*, 88th Cong., 2nd sess. (1964).

10. US House Committee on Armed Services, *Hearings on the Fiscal Year 1968-1972 Defense Program and 1968 Defense Budget*.

11. CJ Conover, *US Strategic Nuclear Weapons and Deterrence* (Arlington: RAND Corporation, 1977).

12. Leitenberg, "Presidential Directive 59," 314-15.

13. Robert McNamara, *The Essence of Security: Reflections in Office* (New York: Harper & Row, 1968), 51-67.

14. The Historical Office of the Office of the Secretary of Defense, "Robert S. McNamara," http://history.defense.gov/Multimedia/Biographies/ArticleView/tabid/8347/Article/571271/robert-s-mcnamara.aspx.

15. Ibid.

16. Ibid.

17. John M. Clearwater, "Johnson, McNamara, and the Birth of SALT and the ABM Treaty, 1963-1969," Ph.D. dissertation (London: King's College, 1996), 10.

18. Andrew Futter, *Ballistic Missile Defence and US National Security Policy: Normalisation and Acceptance after the Cold War* (New York: Routledge, 2013), 12-13.

19. Ronald L. Tammen, *MIRV and the Arms Race* (New York: Praeger, 1973), 114.

20. Ibid.

21. Richard M. Nixon,"Third Annual Report to the Congress on United States Foreign Policy," in *Public Papers of the Presidents of the United States: Richard M. Nixon, 1972*, 307 (Washington, DC: US Government Printing Office, 1974).

22. Alexey Arbatov, *Lethal Frontiers: A Soviet View of Nuclear Strategy, Weapons, and Negotiations* (New York: Praeger, 1988), 40.

23. James Schlesinger, *Department of Defense Annual Report, Fiscal Year 1975* (Washington, DC:

US Government Printing Office, 4 March, 1974), 38, 40-41.

24. *Limited Strategic Options and the Rise of the Counterforce Threat*, Adelphi Paper No. 175 (London: International Institute of Strategic Studies, 1982), 14-16.

25. Donald Rumsfeld, *Department of Defense Annual Report, Fiscal Year 1976/1977* (Washington, DC: US Government Printing Office, 5 February, 1975), II-4.

26. Leitenberg, "Presidential Directive 59," 314-15.

27. In cross-targeting, MIRV warheads of different missiles are targeted on the same point to increase the reliability of its destruction.

28. US Senate Committee on Foreign Relations, *US-USSR Strategic Policies: Hearings before the Committee on Foreign Relations*, 93rd Cong., 2nd sess. (1974).

29. Desmond Ball, *Deja-Vu: The Return to Counterforce in the Nixon Administration* (Los Angeles: California Seminar on Arms Control and Foreign Policy, 1974).

30. *New York Times*, July 8, 1977, Al, A4.

31. *New York Times*, December 16, 1977, A5.

32. Harold Brown, *Department of Defense Annual Report, Fiscal Year 1979* (Washington, DC: US Government Printing Office, 2 February, 1978), 53-55.

33. William H. Kincade and Jeffrey D. Porro, eds., *Negotiating Security: An Arms Control Reader* (Washington, DC: Carnegie Foundation for International Peace, 1978), 64.

34. This basing mode was a network of concrete tunnels with an overall length of hundreds of kilometers, along which would move transporter-erector-launchers (TELs) carrying MX missiles. The missiles were to be launched directly from the tunnel through openings broken out at certain roof sections by the TEL.

35. US Senate Committee on Armed Services, *Defense Authorization for Appropriations, FY 1980, Part 6: Hearings before the US Senate Committee on Armed Services*, 96th Cong., 1st sess. (1979).

36. US Senate and House Joint Committees on Foreign Relations and Foreign Affairs, "FY 1979 Arms Control Impact Statements" (Washington, DC: National Security Council, 1978).

37. Strobe Talbott, *Endgame: The Inside Story of SALT II* (New York: Harper & Row, 1979), 99-100, 136-38.

38. Harold Brown, *Department of Defense Annual Report, Fiscal Year 1980* (Washington, DC: US Government Printing Office, 25 January, 1979), 118.

39. Ibid.

40. Desmond Ball, "Developments in US Strategic Nuclear Policy under the Carter Administration," ACIS Working Paper no. 21 (Los Angeles: University of California, 1981), 10.

41. US House Committee on Appropriations, *Defense Appropriations, FY 1980, Part 3: Hearings before the Committee on Appropriations*, 96th Cong., 1st sess. (1979).

42. Ibid.

43. US Department of the Air Force, Final Environmental Impact Statement: MX, Milestone II, 1981, Pt. 1-15.

44. Lawrence Korb, *The FY 1981-1985 Defense Program: Issues and Trends* (Washington, DC: American Enterprise Institute, 1980), 45-46.

45. Desmond Ball, "Counterforce Targeting: How New, How Viable?," *Arms Control Today* (February 1981), 7.

46. Robert Scheer, *With Enough Shovels: Reagan, Bush, and Nuclear War* (New York: Random House, 1982), 135.

47. US Senate Committee on Armed Services, *Nomination of Frank C. Carlucci to be Deputy Secretary of Defense: Hearings before the Committee on Armed Services*, 97th Cong., 1st sess. (1981).

48. US Congressional Budget Office, *Modernizing US Strategic Offensive Forces: The Administration's Program and Alternatives,* (Washington, DC, 1983), 58, 72.

49. Brent Scowcroft et al., "Report of the President's Commission on Strategic Forces," April 6, 1983 (Washington, DC: US Government Printing Office, 1983), 18.

50. Ibid.

51. Congressional Budget Office, "Modernizing US Strategic Offensive Forces," xiv, 22-24.

52. In the early 1980s, there were around 1,500 such weapons (gravity bombs and ALCMs) on bombers, which were slow-flying systems. Minuteman III missiles with Mk-12A warheads — totaling 900 warheads — also possessed hard-target-kill capability, but doubts existed as to their survivability. See: Congressional Budget Office, "Modernizing US Strategic Offensive Forces," 22-24.

53. Ashton Carter, "Assessing Command System Vulnerability," in Ashton Carter, John Steinbruner, and Charles Zraket, eds., *Managing Nuclear Operations* (Washington, DC: Brookings Institution, 1987), 577.

54. "President's Speech on Military Spending and a New Defense," *New York Times*, March 24, 1983, 8.

55. Molodetz translates to "Good Guy" while Topol translates to "Aspen."

56. Vladimir Dvorkin, "Space Weapons Programs," in Alexey Arbatov and Vladimir Dvorkin, eds., *Outer Space, Weapons, Diplomacy and Security* (Washington, DC: Carnegie Endowment, 2010), 30-47.

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CHINA

Jeffrey G. Lewis

China's Belated Embrace of MIRVs

On September 3, 2015, China celebrated the 70th anniversary of Japan's surrender and the end of World War II with a massive "Victory Day" parade.[1] During the course of the parade, China displayed new ballistic missiles, including one labeled the DF-5B. Chinese announcers stated that the DF-5B missile carried multiple nuclear warheads. This was a first for China. Until recently, the US intelligence community assessed that each Chinese ballistic missile was armed with only a single nuclear warhead. China's missiles are generally too small, and its warheads too large, to accommodate more than one warhead per missile.

The DF-5 was long understood to be a possible exception to this rule. It is China's largest intercontinental ballistic missile (ICBM) and is massive, with a throw weight of a few thousand tons. The re-entry vehicle (RV) for China's smallest nuclear warhead, developed for the road-mobile DF-31 ICBM, weighs 500 kilograms (kg). US analysts have long noted that China might be able to place three or possibly four such warheads on the DF-5. The appearance of the DF-5B during the September 2015 parade suggests that China has done it.

China's decision to place multiple warheads on its DF-5 missiles was probably driven by improved accuracy and a desire to replace 1980s-vintage warheads. But Chinese defense analysts are also aware that any surviving DF-5 missiles would pose a greater challenge to US missile defenses, especially if some of the room left over from replacing the large, multi-megaton thermonuclear warhead could be used for penetration aids. Given China's apparent desire to overwhelm US missile defenses, it is not surprising that multiple warheads — whether independently targeted or not — would become a feature of Chinese deterrence. The surprise is that it took so long for them to be fielded.

China has been able to deploy multiple warheads on the DF-5 for nearly two decades. The decision to do so therefore represents a change from past behavior. It is natural to ask whether the decision to place multiple warheads on the DF-5 is a harbinger of yet other multiple-warhead missiles. China is also developing a new solid-fueled ICBM, reportedly called the DF-41, which might be large enough to accommodate multiple nuclear warheads.

Chinese leaders have sought to match the technical achievements of other nuclear powers, without necessarily replicating the number of weapons or adopting foreign doctrines.

China's nuclear policy, forces, and posture have long appeared unusual from an American perspective. In general, there has been a long-standing tendency among Western strategic analysts to assume that China's nuclear forces will increasingly mimic familiar patterns. Technical advances are often depicted as harbingers of China's decision to build a larger force. To be sure, China's nuclear forces are evolving. But, at least to date, they have evolved within a particular framework. The oft-repeated Chinese assertion that China will not be drawn into an arms race appears to reflect only questions of quantity, not quality.

For decades, Chinese leaders have sought to match the technical achievements of other nuclear powers, without necessarily replicating the number of weapons or adopting foreign doctrines.[2] One Chinese official has characterized this behavior as the pursuit of the "minimum means of reprisal" — a concept that Western academics have come to describe as "assured retaliation."[3] One element of this approach is that Chinese decisionmakers have tended to emphasize China's possession of the same technologies as other powers. The credibility of China's deterrent depends at least in part on the perception that it is modern. From the 1950s, China has sought to develop thermonuclear weapons that could arm ICBMs rather than, say, a regional force of theater nuclear weapons. Chinese leaders have viewed deterrence as arising more from the possession of equivalent nuclear capabilities than from the numerical calculations of exchange ratios and windows of vulnerability that have dominated Western discourse.[4] Chinese experts, to be sure, are aware of the possibilities created by new technologies, but at least until the present, Chinese decisions about modernizing the country's nuclear forces have followed a technological trajectory marked by milestones rather than a strategic trajectory marked by requirements.

This means that China could embrace many technologies associated with counterforce targeting while not necessarily embracing that strategy or the exacting requirements to implement it. While this helps explain the slow pace of China's strategic modernization programs in the past, what has been true in previous decades might not necessarily hold true for the future. China is changing rapidly. While one can posit a sort of technological determinism behind Chinese decisions regarding the country's nuclear forces, such decisions are also subject to the same broader social and political factors that have transformed other aspects of Chinese life. China's nuclear program was distorted by the Great Leap Forward, disrupted by the Cultural Revolution, and disoriented by the period of reform and opening, as were other Chinese state endeavors. The nuclear weapons program has not been immune to the currents sweeping through Chinese society and politics over the past few decades.

This is particularly the case during periods of rapid political change, such as the current consolidation of power by President Xi Jinping. Part of the consolidation is reflected in a massive reorganization of the People's Liberation Army (PLA), a decision that was made on a much broader basis and extended beyond the confines of nuclear strategy.[5] The reorganization is sure to have real impacts since it appears to reflect diminished power of the General Armaments Department (GAD), which is broadly responsible for China's defense industry, as well as greater autonomy for what is now called the PLA Rocket Force. The ramifications of reorganization, writ large, and the specific consequences for the Rocket Force remain to be seen.

Chinese Nuclear Strategy

Western discussions of nuclear strategy often center on questions of targeting — i.e., whether to target military forces and other military targets (counterforce) or cities and other valuable, often soft, targets (countervalue). In discussions of Chinese nuclear strategy, however, it may be helpful to emphasize a different distinction: one between deterrence by punishment and deterrence by denial.[6] Deterrence by punishment presumes that deterrence will be achieved through the existence of a secure retaliatory capability that could inflict unacceptable or overwhelming damage on an adversary. Deterrence by denial posits that the war-winning capabilities of nuclear weapons ultimately produce deterrence through the ability to deny an adversary its war aims. Although US declaratory policy tends to emphasize deterrence by punishment, over the decades deterrence by denial has found its way into US nuclear planning through efforts to limit damage to the United States, destroy war-supporting industries, and prevent the rapid recovery of an adversary. These missions are driven in no small part by the requirement that the United States only use nuclear weapons against legitimate military targets and not against populations — a distinction that is easier to maintain in theory than in reality.[7]

Chinese strategic literature is rather less legalistic than its American counterpart, with Chinese materials stating that the purpose of a nuclear strike would be to create a profound psychological effect on an attacker in the service of bringing a nuclear conflict to a conclusion. This is clearly deterrence by punishment, although Chinese materials suggest that Chinese leaders might select military installations as the object of punishment in addition to civilian populations.[8]

Accordingly, the evolution of China's nuclear forces appears to have been guided more by a desire to develop similar capabilities to other powers rather than to meet military requirements. Put another way, Chinese leaders have appeared interested in achieving qualitative rather than quantitative equivalency. Chinese leaders have tended to act on the worry that their forces are not perceived as capable instead of developing plans to meet detailed requirements. For example, China's strategic forces did not begin to consider developing formal operational concepts for the country's nuclear weapons until after Mao's death and the first deployments of ICBMs in the early 1980s. At that point, they began hosting symposia and established a research committee to develop materials on nuclear strategy and operational practices. This process resulted in the production of texts, including *The Science of Second Artillery Campaigns*, one of the main sources that foreign analysts have relied upon in seeking to understand China's nuclear strategy and operational plans.[9]

In understanding these documents, it is important to remember that, in China, nuclear policy precedes strategy. For example, the Chinese adoption of no first use (NFU) is best understood as an ideological statement about the nature of nuclear weapons. It arose in the 1960s, partly as a response to developing world pressure on Chinese leaders who objected to the nuclear test ban, but also as a reflection of Maoist arguments about the primacy of ideological considerations over weapons in determining the outcome of conflicts. In the 1960s, China's leaders faced pressure, especially in the developing world, over their refusal to support an atmospheric test ban. An NFU pledge was a useful response that allowed Chinese leaders to deflect criticism of China's nuclear testing back toward the United States and Soviet Union.[10] But China's NFU pledge also arose from specific Marxist and Maoist ideas about the relative importance of ideology and material factors in determining the outcome of international struggle. When Mao derided nuclear weapons as "paper tigers," what he meant was that "it is the people, and not any weapons, that decide the outcome of a war."[11]

During Mao's lifetime and some years after, China had no formal nuclear planning in the Western sense. Simple questions, such as those regarding command and control, touched upon sensitive issues of the relationship between the Communist Party and the army, as well as the fact that the informal power wielded by individuals dwarfed the formal power attached to state offices. When China's military sought to develop operational concepts for its new ICBMs in the early 1980s, military leaders discovered that they needed to articulate a strategy that could mediate between the demands imposed by the country's nuclear policy and real-world operational considerations. Although many Chinese military officers may have their doubts about the wisdom of NFU as a policy, it is important to understand that much of the debate in China is about how to operate effectively within its strictures rather than to engage in a campaign to formally overturn the policy.

New Chinese technologies, then, are probably better understood not as signs of a changing policy, but as challenges to the existing compromises made to reconcile NFU with a desire for plausible operational concepts. For example, keeping warheads stored separately from their means of delivery was an easier decision when China's missiles were liquid fueled and not easily maintained on launch-ready status. Solid-fueled missiles, particularly mobile ones, imply different operational concepts that must be reconciled with a continuing political commitment to NFU. New capabilities, therefore, may still be harbingers of change, though perhaps not in a straightforward fashion. We might be able to predict the challenges that a new capability will pose, but not its resolution. Indeed, the participants in policy fights within China may not themselves be able to predict the outcomes in advance.

Technical Summary

China's current nuclear forces consist of thermonuclear warheads with large yields, including multi-megaton thermonuclear warheads developed for the DF-3, DF-4, and DF-5 ballistic missiles, and a several-hundred-kiloton (kt) warhead developed in the 1990s for China's current generation of solid-fueled ballistic missiles.[12]

Since its first nuclear explosion in 1964, China has developed only a small number of warhead designs. Although there is some question about this number, China appears to have developed a 15-kt fission device tested in 1966; a 3-megaton (Mt) device tested in the early 1970s for the DF-3 and possibly DF-4 missiles; a 4 to 5 Mt nuclear device completed in the 1980s for the DF-5 missile; and a several-hundred-kt warhead tested in the 1990s for China's solid-fueled missiles, including the DF-21 and DF-31. China also developed an enhanced radiation warhead during the early 1980s, which does not appear to have been deployed. These warheads are based on a relatively small number of nuclear tests (45 compared to 1,054 for the United States and 715 for the Soviet Union), the majority of which were carried out during the period before China's reform

Placing multiple warheads on Chinese missiles might require a larger missile, smaller warheads, or both.

and opening under Deng Xiaoping. China has not conducted any nuclear weapons explosions since signing the Comprehensive Nuclear-Test-Ban Treaty (CTBT) in 1996.

Within these broad technical constraints, China's strategic forces have a number of options. Most analysts have focused on multiple independently targetable re-entry vehicles (MIRVs). MIRVs require the development of a post-boost vehicle (PBV) or bus, and entail relatively accurate guidance systems. In the case of China, the accuracy — in terms of circular error probable (CEP) — implied by MIRVs is probably on the order of 300-400 meters. This level of accuracy is necessary to compensate for the loss of yield entailed by moving from a single, large multi-megaton weapon to a smaller warhead with a yield of 500-600 kt. China's final test series from 1992-1996 produced seismic signals consistent with a yield of about 100 kt. Assuming that Chinese weaponeers were testing scaled yields, they might have developed a warhead with a yield of around 500 kt. An improvement in accuracy from the one to two nautical miles of the DF-5 to 300-400 meters would offset the loss in yield.

A second possibility is that China is deploying multiple warheads that are not independently targetable. If late-era Soviet levels of accuracy are not achievable, China might value multiple re-entry vehicles (MRVs) that land in a pattern. The loss in yield entailed in replacing the larger multi-megaton warheads on the DF-5 is somewhat compensated for when one corrects for equivalent megatons — three 600-kt-yield nuclear weapons are roughly equivalent to a single 3-Mt-yield nuclear device.

A final possibility is that China will develop maneuverable re-entry vehicles (MaRVs). According to reports, the US intelligence community has been monitoring China's development of the WU-14, a hypersonic glide vehicle that has been flight-tested several times.[13] The US intelligence community believes this system is intended to help China's nuclear forces defeat US missile defenses.[14]

Additional warheads — whether unguided, independently targetable, or maneuverable — might usefully help defeat missile defenses. Although Western analysts may be inclined to see these developments as inconsistent with China's emphasis on retaliatory forces, it is easy enough to construct a plausible rationale to justify any of these options within existing parameters of China's nuclear doctrine. Any surviving missile is more likely to penetrate US missile defenses, which Chinese officials might see as stabilizing.

Placing multiple warheads on Chinese missiles might require a larger missile, smaller warheads, or both. Only China's liquid-fueled DF-5 ICBM is presently large enough to carry more than one of China's smallest warheads, the 470-kg DF-31 RV. The DF-5B that China paraded in the autumn of 2015 is believed to be a DF-5 ICBM, outfitted with a PBV and either three or four DF-31-type RVs.[15] The DF-5 is a special case, however. If China wishes to place multiple warheads on any of its other existing missiles, it would need newer, smaller nuclear warhead designs. New warhead designs might require testing. Absent testing, which Beijing stopped in 1996 after signing the CTBT, China would probably struggle to develop warheads in the challenging design space of a few hundred kilotons of yield with a few hundred kilograms of RV mass — a warhead similar to the US thermonuclear warhead, the W76. Faced with this challenge, China would have to sacrifice significant yield, reliability, or both.

China has another option — to develop new, larger missiles. The US intelligence community believes China is developing a new road-mobile ICBM that may be able to carry multiple warheads.[16] How many warheads a new missile might carry is hard to determine. Even Russia's most modern solid-fueled missiles (such as the SS-27, with a throw weight of 1,200 kg) would have trouble accommodating multiple warheads as large as China's DF-31-type RV.[17] About half of the payload of a missile that is to be armed with nuclear warheads must be devoted to a bus that can dispense the warheads. It is especially difficult to credit press reports that say China's next ICBM will carry as many as 10 RVs because the massive US Peacekeeper ICBM with a throw weight of 3,950 kg could not carry anywhere near 10 Chinese RVs.

China must also develop a PBV or bus that can accurately deliver each warhead to its target. The ability of a nuclear weapon to hold a target at risk depends much more on accuracy than on yield, particularly in the yield ranges associated with miniaturized nuclear weapons. One reason that China has historically designed nuclear warheads with such enormous yields is that the missiles themselves were inaccurate. Declassified estimates of the accuracy of the DF-4 and DF-5 ICBMs initially placed the CEP — the distance in which half of the warheads would land — at between one and two nautical miles.[18]

China demonstrated the basic technology associated with multiple warheads in 1981 during a civilian space launch in which a Long March launcher placed three satellites in orbit.[19] During the 1990s, China developed a satellite "smart dispenser" that the US intelligence community concluded could serve as the basis for the PBV.[20] In 2015, a Chinese launch vehicle reportedly attempted to place 20 satellites in orbit.[21] Although China has certainly sought to improve the accuracy of its ICBMs over time, Chinese missile accuracy appears to continue to lag behind the United States and Russia. During the 1990s, as China was developing the DF-31 and DF-31A missiles, the US intelligence community believed that the accuracy of China's large ICBMs fell short of that achieved by Soviet ICBMs like the SS-18.[22] In recent years, there have been a number of export control cases relating to Chinese firms seeking technology that would improve missile guidance.[23] The most recent case involves a Chinese citizen, Liu Sixing, who was given a prison sentence for taking files from a US company, L3, regarding a device called a disk resonator gyroscope that is used for inertial guidance systems.[24]

The technological trajectory of Soviet missile guidance capabilities may provide a useful reference for Chinese programs. Newly available data suggests that during the 1980s, the Soviet Union sought to achieve "improved tactical-technical characteristics" for the SS-18, SS-19, and SS-17 missiles by improving the PBV and the missile guidance systems. Soviet planners assessed the accuracy of the UTTH versions of these missiles, according to Pavel Podvig, at 350-400 meters.[25]

The decision to place multiple DF-31 type warheads, with an apparent yield of about 500 kt on the DF-5, probably suggests that China can achieve accuracies close to 350-400 meters — similar to what the Soviet Union was seeking in the 1980s. These accuracies are enough to compensate for the explosive yield lost by moving from a single 5-Mt warhead to three or four 500-kt devices. To the extent that China is concerned about harder targets, the reduction in yield at these accuracies might represent a modest reduction in capability against the very hardest targets — 3,500 pounds per square inch or greater.

This trade-off would be consistent with prioritizing missile defense penetration over hard-target-kill (HTK) capabilities. Even at such accuracies, and with the larger number of nuclear warheads available on a force of DF-5 and DF-41 missiles with multiple warheads, China is unlikely to be able to conduct counterforce strikes for the purpose of damage limitation or preemption. Assuming two warheads per US silo, China would need at least 800 warheads, or to deploy several hundred DF-41s with multiple warheads. This number is probably at the extreme edge of what China might deploy even with heavily MIRVed forces.

Internal Factors

Why might China seek to deploy multiple warheads atop its missiles? Some Western analysts assume that such a change would be driven by strategic considerations, i.e., a shift toward counterforce targeting.[26] As I have argued, China's nuclear posture is characterized by its emphasis on deterrence by punishment more than on placing a target set at risk. Chinese leaders seem to believe that a mix of urban and military targets might produce the psychological shock necessary to deter an adversary's nuclear attack.

Within this framework, there are other reasons that China might seek to place multiple warheads on some of its ballistic missiles. The first major internal factor that may drive change is shifts in technology. In the past, China's leaders have tended to take what might be termed a possession-oriented approach to questions of modernization. Although American deterrence strategists are fond of positing China's interest in asymmetric capabilities, China's strategic modernization has been largely symmetric as it seeks to acquire the same capabilities as other major powers.

For example, China has embraced multiple warheads as it has acquired the ability to deliver lower-yield warheads with more accuracy. China has aspired to match US and Russian accuracies, but this aspiration is probably driven by the sense that the credibility of its deterrent depends on being perceived as modern rather than by specific requirements related to operational plans. China has consistently sought to keep pace with new developments, although it has not always been able to do so in timely fashion. Once new capabilities become available, Chinese weaponeers must think through how these capabilities fit within the broader picture of China's strategic capabilities.

The decision to place multiple warheads on the DF-5 seems, in many ways, to reflect such a calculation. The DF-5 warhead itself was quite old. Replacing it with a smaller DF-31-type RV would literally leave tons of room for a PBV, penetration aids to defeat missile defenses, and additional RVs. Also, China's strategic weaponeers almost certainly were intent on increasing the accuracy of China's ballistic missiles, which presumably made MIRVing the DF-5 with lesser-yield warheads a reasonable goal. China has had the ability to take many of these steps for several years, although it seems likely that increasing missile accuracies have finally allowed China to arm the DF-5 with more modern, but lower-yield, warheads tested during the 1990s.

China would hardly be unusual in making such a decision. During the mid-2000s, US Strategic Command proposed reversing a decision to move the Minuteman III force to single warheads, thus keeping multiple warheads on a single squadron. This was not driven by targeting or other requirements, but rather by an abstract concern that the air force ought to retain a practical capability in the event that the United States were to upload multiple warheads across the ICBM force as a whole. Although the Congress ultimately rejected funding the US Strategic Air Command's proposal, the important point is that the air force had obvious interest in possessing a capability for its own sake.[27]

The second major internal factor relates to the autonomy and prestige of the PLA Rocket Force, relative to the PLA as a whole. This strategic force, known until recently as the Second Artillery Corps, was a relatively weak service. Chinese policymaking on nuclear weapons and strategic missile issues was initially dominated by a rivalry between competing bureaucracies established to oversee defense industries. These bureaucracies are sometimes described as having represented conventional and strategic forces, but their division of responsibility is probably better described as reflecting research and development on one hand and production on the other. The better-known of these entities was the National Defense Science and Technology Commission (NDSTC or COSTIND); its lesser-known and ultimately vanquished rival was the Office of Industry for National Defense. These two bureaucratic entities competed, even as both were decimated by more ideological factions in the Cultural Revolution. This initial period in the development of China's post-1949 army ended in 1998 with the abolition of the NDSTC and the creation of the GAD.

The era of the General Armaments Department reflected the growing professionalism and autonomy of the PLA. This was also the period of economic reform, in which China forced the PLA to divest itself of business activity while providing significant budgetary increases to modernize China's military. The military sought a more responsive and less parochial national defense industry in the form of the GAD.[28]

The era of this department has now ended in a massive reorganization that follows a series of corruption-related purges in China.[29] The GAD, along with other department-level entities, has been reduced in stature, while China has created new strategic services — the PLA Rocket Force and the PLA Strategic Support Force (SSF). It is too early to predict the impact of this reorganization on the autonomy and prestige of the Rocket Force, but initial assessments would seem to suggest that it has been strengthened at the expense of industry voices.

How a newly empowered PLA Rocket Force will view nuclear weapons and nuclear policy issues is unclear. Over the past two decades, the Rocket Force has generally emphasized the introduction of new conventionally-armed ballistic missiles. China's strategic force was transformed from one with a solely nuclear focus to one in which more than half of its force structure and personnel are assigned to conventional forces. A more autonomous Rocket Force might further diminish the role of nuclear weapons in favor of conventional missiles. Or it could bring China's historically restrained nuclear posture into closer alignment with the more aggressive doctrine it has promulgated for conventional missile forces.

The outcome of this story may depend at least in part on how the role of China's nuclear navy evolves. The PLA Navy is on the verge, after many years, of deploying ballistic missile submarines (SSBNs) with submarine-launched ballistic missiles (SLBMs). The navy might be able to better perform classic minimum deterrence missions than China's land-based rocket forces, pushing the Rocket Force to emphasize conventional missions. Alternatively, China's Rocket Force might seek to distinguish itself from the navy by advocating for the more expansive rationales and justifications for land-based missile forces, as was the case in the United States and Russia.

Some Chinese observers have predicted that the Rocket Force will come to control China's nuclear-armed SSBNs. This seems unlikely to occur without triggering significant institutional conflict with the PLA Navy. A related question is how China's leadership and the navy will proceed with the pace and scope of China's SLBM program. China has been developing the JL-2, which is believed to be a variant of the DF-31, for many years, during which the flight-test program for the JL-2 has been marred by a series of failures. It is possible that China will complete the JL-2 as planned, but there are other possibilities. The navy might, for example, press ahead with a new missile (a notional JL-3) or pursue an alternative, such as sea-launched cruise missiles (SLCMs).

The third major internal factor relates to the views of the Chinese leadership regarding the utility of and requirements for nuclear forces. China's leadership initially provided essential support for the nuclear weapons program, particularly during the period of austerity that followed the Great Leap Forward. During the 1950s and 1960s, it emphasized the development of ICBMs and multi-megaton thermonuclear weapons. China's leadership also imposed constraints — particularly an NFU policy — and was reluctant to allow the Rocket Force to implement command-and-control structures or develop operational concepts. These restrictions loosened after Mao died, but were replaced with a period of austerity as Deng Xiaoping sought to reform the economy.

China's strategic forces have been shaped more by broader changes in Chinese society than by strategic decisions. For example, China's decision to end fissile material production in the 1980s was driven by broad guidance to convert inefficient defense industries to civilian use rather than by a calculation about

> China's leaders feel pressure to keep pace with US technological advances.

China's long-term requirements for plutonium and highly enriched uranium (HEU). Similarly, China's decision to sign the CTBT in 1996 required intervention at the highest level, including an exchange of letters between Jiang Zemin and Bill Clinton. This decision reflected Jiang's broader foreign policy orientation, which emphasized ending China's post-Tiananmen Square isolation. Then, following the 1999 bombing of the Chinese Embassy in Belgrade, China's leadership under Jiang suddenly made significant resources available to the defense industry, investments that later yielded China's development of a hit-to-kill anti-satellite (ASAT) interceptor and a number of other defense technologies. In each of these cases, the fortunes of the defense industry waxed and waned as China's leaders made general decisions about domestic and foreign policy priorities, with the weaponeers left to adapt.

Leadership threat perceptions have been only a small part of this story. Although some Chinese leaders might change their perceptions over time, it is far more common for leaders to have durable beliefs about the nature of the international environment that remain fixed. Belief systems may endure even as policies are adapted. In the past, Chinese debates about the security environment have reflected domestic politics more than anything else. Deng Xiaoping, for example, made a series of statements about the declining risk of global war in the 1980s. Deng's arguments about the improving international environment did not reflect a change in his thinking, however. Rather, Deng's statements reinforced his long-standing support of economic reform. As Deng consolidated power, he adjusted the official assessment of the international threat to complement his own domestic agenda. While China's leaders do perceive and respond to changes in the international system, perceptions and responses are heavily influenced by durable belief systems and expediency.

China's leadership is currently undergoing a consolidation of power by Xi Jinping, including an anti-corruption campaign that is widely seen as a purge of political opponents. This campaign has targeted a number of high-ranking military officials. What Chinese leaders say about the international security environment remains likely to be in service to domestic power struggles. Appeals to elite decisionmakers by China's defense industry and Rocket Force regarding changes in operational concepts for China's strategic forces and the pursuit of more modern capabilities will succeed or fail depending on the prevailing political climate.

External Factors

External factors also shape and constrain the options available to Chinese decisionmakers. Chinese leaders and experts see themselves in an open-ended arms competition with the United States. China's leaders frequently repeat that they will not be drawn into an arms race with the United States, but it is clear that they also feel pressure to keep pace with US technological advances. Leadership views may be supported as much by confirmation bias as by actual evidence, but they are not totally divorced from reality. As a result, external factors play a role in shaping China's approach to nuclear weapons, although these factors are mediated through China's political and bureaucratic structures.

Among those external factors are the capabilities of US defense programs and the perceived drivers for the Pentagon's investment choices. Beijing appears to view US defense programs as a standard against which China must measure itself. The United States, and to a lesser extent Russia, define what "modern" nuclear forces look like. Chinese strategists are particularly sensitive to technological advances that impact the viability of Chinese military capabilities, including missile defenses, cyber and space warfare, and conventional-strike capabilities. These concerns have been well documented.[30]

The concern over US missile defenses is not merely about the impact of specific systems on exchange ratios or other measures of stability, but also about the modernization of US strategic forces more generally and the possibility that China might fall behind. These concerns have not diminished even when the actual capabilities of US missile defense systems fall short of the Pentagon's expectations. China's development of the SSF, which appears responsible for space, cyber, and electronic warfare missions, helps demonstrate the general recognition by Chinese policymakers that these areas will be essential elements of future military power.

In recent years, Chinese rhetoric appears to have shifted to emphasize concerns about US conventional-strike capabilities, especially prompt global-strike capabilities.[31] While it is possible to view Chinese concerns as disingenuous — as mere propaganda to excuse Chinese developments in the same fields, such as hypersonic capabilities — it is also possible that Chinese leaders feel an obligation to match US technological developments as a result of concerns about the development of conventional-strike capabilities in response to the viability of China's deterrent. These concerns must be weighed against an open-ended arms race in which competitors are obliged to match one new development after another. Nonetheless, conventional-strike capabilities encapsulate the broad range of technologies necessary to maintain a modern deterrent.

A second external factor is the overall status of the bilateral US-China relationship. China's strategic posture has been impacted by dramatic changes in the overall political environment. During the 1990s, the growing antipathy of congressional conservatives toward both China and President Clinton defeated Beijing's expectations for improved bilateral relations. The focal point for downturned relations was concerns about Chinese espionage. The result was the termination of laboratory-to-laboratory exchanges and the imposition of restraints on scientific and technical cooperation.

Similarly, US-China relations suffered during the NATO campaign against Yugoslavia to end ethnic cleansing in Kosovo, hitting a nadir with the 1999 aerial bombing of the Chinese embassy in Belgrade. Although many Americans argue that the 1991 Gulf War resulted in a surge in Chinese defense modernization, anecdotal evidence suggests that large-scale funding for a number of defense programs, including China's hit-to-kill ASAT interceptor program, became available after the bombing.[32]

Cause and effect are indirect: a Chinese ASAT weapon would not have prevented a strike on an embassy. But an environment in which Chinese military and political leaders felt both angry and powerless could prompt a greater willingness to unsettle the United States and its allies by pursuing a broad range of new military capabilities. In such an environment, those calling for restraint would find their arguments falling on deaf ears.

Another external factor that will shape China's nuclear posture is whether the international community, and particularly the United States, abandons formal arms control as a method to achieve strategic stability among major powers. China is not a party to any bilateral agreements that might constrain its modernization programs. US and Russian strategic modernization programs are constrained only by the generous numerical limitations imposed by the New Strategic Arms Reduction Treaty (New START). Beijing, operating without treaty constraints, maintains strategic capabilities far below those of Washington and Moscow.

Beijing is therefore free to seek deterrence how it sees fit, including by increasing the quantity and quality of its nuclear forces. What Western strategic analysts might view with alarm, their Chinese counterparts might view as modest increments necessary to strengthen deterrence. Misinterpretation has been endemic to this relationship, in part because the two communities of strategic analysts have been using different playbooks. Chinese strategic analysts, unlike their Western counterparts, have so far adopted a surprisingly relaxed view of nuclear threats, while some of their US counterparts are inclined toward envisioning worst-case scenarios.

The advent of Chinese MIRVs has led some Western analysts to see portents of China's "sprint" to parity with US strategic forces.[33] These analysts might be suffering confirmation bias, interpreting the DF-5B with multiple warheads as the harbinger of a dramatic shift to counterforce targeting. This is, after all, the direction the United States headed with MIRVs during the Cold War. Chinese leaders have also lacked understanding of how their decisions are interpreted abroad. Chinese policymakers appear to have been genuinely surprised at the international outrage prompted by their 2007 ASAT test, which caused an unprecedented amount of man-made space debris.

Misinterpretation can be addressed through strategic dialogue, but the channels for doing so are limited and shallow. Successful dialogue requires a mutual willingness to discuss sensitive topics, and the inclusion of technical experts as well as diplomats. Those in China who worry about the survivability of China's nuclear forces are a different group of people than the diplomats who convey talking points. Without formal negotiations, there does not appear to be an inter-agency process within China in which strategic decisions, such as whether to place multiple warheads on missiles, can be debated and presented to the top leadership for consideration. Chinese officials are hardly blameless in this state of affairs, as they have been cool toward substantive dialogue that could serve as the prelude to negotiations.

Although China is not a party to bilateral arms control agreements, it is a signatory to two significant multilateral regimes — the Chemical Weapons Convention (CWC) and the CTBT. China's signature on the CTBT surprised many analysts who believed that China would resist the constraints the treaty imposed. Indeed, some analysts believe that China signed only under pressure,[34] a view that probably accords better with contemporary expectations than with the historical record. The CTBT experience demonstrated that the negotiation of formal legal agreements forced the Chinese leadership to establish inter-agency consultations that resulted in disputes, some of which had to be resolved at the highest level.

The success in the endgame of the CTBT suggests that expectations about the possibility of successful arms control with China might be too narrow. Diplomatic engagement over an arms control objective can be a process in which Chinese officials address their own internal disagreements. This is, in some sense, similar to common stories told about inter-agency disputes during the US-Soviet arms control process.[35] The absence of either bilateral or multilateral arms control negotiations means that China's stove-piped systems for functions such as defense research and development and the promulgation of military doctrine are proceeding in isolation with little coordination across the Chinese government.

Assessment

Although China is upgrading its nuclear forces, this modernization is occurring within the broad parameters of China's current, well-established nuclear strategy. While there are factors that might lead China in a different direction, specific choices about modernization may be a poor indicator. In general, China's leaders have tended to make modernization decisions on technical grounds so as not to be left behind, with strategic and operational concepts to be worked out later. China's leaders have been more interested in achieving equivalence in technological capabilities rather than numerical equivalence in terms of missiles and warheads. They appear to believe that a credible deterrent is one that is acknowledged externally as being modern and capable of assuring an ability to retaliate. China's leaders have not placed a high emphasis on achieving a credible deterrent through operational plans or targeting strategies.

China's interest in multiple warheads most probably reflects a desire to deploy China's most modern warhead across its nuclear forces, while also demonstrating a high level of accuracy and technological sophistication. There is no reason at present to conclude that this is driven by military requirements associated with the pursuit of a counterforce targeting strategy.

China might deploy multiple warheads on its largest missiles, the DF-5 and DF-41. It may or may not outfit the entire DF-5 force, comprising 18 missiles, with multiple warheads. From a Chinese perspective, arming the DF-5 with multiple warheads would not be inconsistent with its current nuclear strategy or operational concepts. The DF-5 missile is quite vulnerable to attack. Placing multiple warheads atop vulnerable missiles would make them more attractive targets, while increasing only marginally the number of warheads that might penetrate US missile defenses. This inverts the traditional logic in American strategic circles, which holds that multiple warheads on vulnerable missiles increase the incentive to use nuclear weapons first. China's leaders have long been aware of the vulnerability of DF-5s in silos, having examined a number of basing modes in the 1970s. The resulting Chinese decision to keep existing silo-based ICBMs is no less arbitrary than the Scowcroft Commission's pronouncement that the vulnerability of the MX missiles based in Minuteman silos was acceptable in the context of the overall US deterrent.[36] Chinese leaders appear to accept the vulnerability of the DF-5, and to prefer that any surviving DF-5s pose the greatest challenge possible to US missile defenses.

Similarly, China may place multiple warheads on the DF-41, depending on how large this missile might be. Public information about the missile is scarce, limited to vague descriptions by the Pentagon.[37] Even the deployment mode of the DF-

41 is not yet clear; some form of mobility, whether road- or rail-mobile, would reflect concerns or prudent steps relating to survivability. Although some sources credit the DF-41 with 10 warheads,[38] this appears to be based on modeling US and Soviet missiles. Because China's warheads are much larger than US and Russian warheads, the DF-41 is likely to have only a few warheads at most.

Whether China will move toward smaller warheads depends, in part, on whether its nuclear bureaucracy and organizational culture would be comfortable with nuclear weapons designs that are based on computer simulations. In the United States, this debate has played out generationally — with younger designers more comfortable relying on models and computer simulations. Chinese descriptions of their own stockpile stewardship mirror American descriptions, including the emphasis on training a new generation of designers.[39] It is unclear how comfortable future generations of nuclear weaponeers in either the United States or China will be in relaxing "design discipline" in the absence of nuclear testing. In the near term, China is probably less likely to develop new nuclear warhead designs that have not already been tested, including smaller warheads that would greatly increase MIRV warheads.

A significant unanswered question is whether the broad modernization of China's nuclear forces will result in changes — evolutionary or dramatic — in China's nuclear posture. If this occurs, it seems more likely to stem from the growing autonomy of the PLA Rocket Force or from a dramatic change in the orientation of China's leadership. The development and deployment of advanced technologies could provide some forewarning of these decisions, but using technological developments as tests of Chinese intentions might produce significant false alarms. China appears committed to matching US and Russian technological developments, even if it does not deploy them in quite the same way or at comparable numbers. As noted previously, the oft-repeated Chinese assertion that China will not be drawn into an arms race appears to pertain to quantity, not quality.

Even so, the danger of false alarms, misinterpretation, and misrepresentation are very real. Although the parallel nuclear modernization programs underway in the United States and China may be driven as much by technology as strategy, advancing technologies create opportunities and incentives to refine nuclear postures. Advancing technologies also reduce decisionmaking timelines available to future American presidents and his or her Chinese counterparts.

The trajectory of parallel strategic modernization programs in the United States and China might yield forces that are unstable in a crisis, even without dramatic changes in Chinese nuclear posture. For most of its history, China's nuclear forces

As China's capabilities improve, its nuclear forces are increasingly at risk of what might be termed "operational entanglement" with those of the United States.

have operated in isolation from those of the United States or Russia. Although there have been a small number of serious crises, particularly with the Soviet Union in 1969, the small size and low alert status of China's nuclear forces have been more reassuring than tempting as a target. As China's capabilities improve, however, its nuclear forces are increasingly at risk of what might be termed "operational entanglement" with those of the United States — especially at sea and in space. Chinese leaders are acquiring a range of capabilities that could create incentives for the United States to launch first in the event of a conflict.

In space, China has developed hit-to-kill interceptors and lasers that might be used to target US satellites — capabilities that have, in turn, served as justifications for the prompt global-strike conventional capabilities that China finds unsettling. Former Commander of US Strategic Command James Cartwright once argued that conventionally-armed ballistic missiles would be necessary to destroy ASAT lasers based in central China.[40] US requirements are driven, in part, by Chinese ASAT capabilities that could eliminate the surveillance and intelligence upon which the United States would depend to attack mobile targets and support missile defense systems. A future US president, in a crisis, could face enormous pressure to target those systems before China has a chance to use them.

Similarly, China is on the verge of deploying nuclear-armed SSBNs. Given the small number of these submarines and the long distances they must traverse to be able to target the United States, it seems unlikely that China will sustain continuous at-sea deterrence patrols. Instead, China may do as Russia does in patrolling episodically. In a crisis, however, China might feel pressured to send its small force of SSBNs out to sea. A US president would be under enormous pressure to act before those submarines began patrols at sea. At a minimum, the US Navy would attempt to track Chinese SSBNs. The prospect of accidents at sea could well grow, particularly in times of crisis.

Even if China is not pursuing multiple warheads for the purpose of shifting to a counterforce targeting posture, it might nonetheless find itself drawn into classic forms of deterrence instability. The deployment of multiple warheads, after all, creates an incentive for the United States to use nuclear weapons early in a conflict, while China's warheads represent a smaller set of targets. This is especially so if China's warheads are deployed on mobile missiles that remain in their garrisons. This, in turn, would place a premium on moving mobile missiles out of their garrisons. China might understandably react with concern to US efforts to develop capabilities to target mobile missiles, taking steps that deepen the sense of operational entanglement and increase the pace of the arms completion. An American president would be under extreme duress when facing, in a deep crisis, the prospect of Chinese mobile missiles with multiple warheads moving out of their garrisons, submarines leaving port, and Chinese ASAT weapons poised to destroy US space assets.

These scenarios may seem overdrawn, but it is not impossible that severe crises could arise between the United States and China, which have real areas of disagreement, particularly about the status of Taiwan and maritime claims. While the salience of these disputes may seem small compared to the risks of nuclear war, crises have a way of invoking broader principles that deepen disputes and harden attitudes. The possibility of mutual misreading is high because the strategic dialogue between Washington and Beijing is so spare, and because there are no agreed "rules of the road" for the global commons of sea, cyber, and space, in which conflicts can start.

Chinese writings dwell on the importance of placing nuclear forces on alert to signal Chinese resolve and to stop the nuclear coercion by the United States that Beijing expects. Alert operations, however, are impossible to distinguish from preparations to launch. The two sides may thus be stumbling blindly into severe crisis instability and growing competition by China with respect to strategic forces. A competition between unevenly matched forces is inherently unstable.

Conclusion

American policymakers and experts are prone to infer Chinese intentions from technological advances. When China follows steps previously taken by the United States, malign purposes are presumed — as is likely to occur with China's belated acquisition of MIRVs, even when warhead numbers do not match a counterforce targeting strategy. Arbitrary and private "tests" are more likely to serve as an elaborate form of confirmation bias than as a tool for divining Chinese intentions. Chinese leaders are likely to fail the tests US strategists set for Beijing in private, prompting suspicion and preparations for worst cases. This is a recipe for diplomacy that lags far behind technological advances — a recipe with ingredients that include Beijing's unwillingness to engage in substantive dialogue on strategic issues.

The continued US pursuit of diplomatic engagement with China could take the form of arms control accords — formal or tacit — that could include nuclear risk-reduction measures and effective codes of conduct for the global commons of sea, space, and cyber. The process of negotiating such agreements would force the Chinese bureaucracy to address trade-offs and tackle the policy choices China faces. Success is likely to take the form of modest steps and half-measures. Even then, there is no guarantee of success. Nevertheless, a process of engagement can hardly be less successful than the current path Washington and Beijing are pursuing.

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INDIA

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India's Slow and Unstoppable Move to MIRV

The subject of equipping missiles with multiple independently targetable re-entry vehicles (MIRVs) appears occasionally in the Indian media, but does not excite the imagination of more than a very small circle of individuals interested in nuclear/strategic affairs. A review of the publicly available literature — not much, given the premium on secrecy around nuclear matters — and discussions with analysts and those associated with the technology make it evident that the process of research and development on MIRVing is well underway and is likely to culminate in deployable capabilities. The subject is worth closer scrutiny because it has the potential to exacerbate tensions between India and its adversaries. Doubts have certainly been expressed over the strategic rationale for MIRVed missiles. If nuclear-armed states do not fight more than minor border conflicts — typically, along the Tibetan borderlands where India and China are concerned, or across the Kashmir divide in the case of India and Pakistan — why should India seek long-range weapons and multiple warheads?[1] Yet there are strong arguments, as well as good reasons to expect, that the MIRVing of Indian missiles will proceed with little domestic opposition. This essay attempts to identify the chief external and internal drivers that push the process along, and to assess the likely strategic effects of MIRVing.[2]

Not surprisingly, both participants in and analysts of the incorporation of MIRV technology into missiles draw extensively on the US experience, which dates back to the 1960s. Most of the arguments favoring the introduction of MIRVs into the Indian arsenal echo those used by American strategists during the Cold War. In the United States, where the Cold War is the subject of a more critical appraisal, analysts who are still concerned with nuclear weapons issues — a fraction of the numbers that flourished in the heyday of nuclear strategy — are less sanguine about the positive gains of placing multiple warheads on ballistic missiles. The tension between these two perspectives will be examined in this essay.

In analyzing the process of MIRVing, it also is useful to draw on the literature that emerged from the Cold War. James R. Kurth, for instance, identifies four types of explanations for why states opt for specific weapons systems: strategic, bureaucratic, "democratic" (i.e., political), and economic.[3] Within this schema, he also incorporates the momentum of technological development processes.

A useful investigation of strategic motives that discounts the technological factor is Milton Leitenberg's study, which illuminates the close similarity between Cold War and post-Cold War thinking on MIRVing.[4]

This essay draws on these writings but goes on to explore a wider set of factors at work. We begin by examining the external influences on Indian thinking. Chief among them is the impact of developments in China and its nuclear modernization programs. A second and closely related aspect is the domestic technological imperative that has gained strength as the threat environment worsens. A third driver for MIRV technology is prestige and status, a widely misunderstood factor that is central to security dynamics generally and is of particular importance in the present case. Fourth, the Indian proclivity for a Cold War-type response to perceived threats reflects an unconscious reliance on a borrowed, largely American strategic discourse that is rooted in conventional thinking.

The domestic drivers for MIRVing are powerful. Here, we look first at the tension between the older minimalist strategic culture that has prevailed thus far in India, and the growing pressures to move toward a more operationally-driven culture. Second, we examine the nuclear decisionmaking process with regard to basic doctrinal and acquisition choices. In particular, we look at the complex relationship between the civilian authority, the armed forces, and the organizations that produce nuclear weapons and their delivery vehicles. We show that while the civilians have considerable power, they have not fully exercised it, thereby ceding a great deal of space to others. Compared to other nuclear powers, the armed forces are not as closely involved in key choices about doctrine and acquisition. However, as we will show, they do have significant inputs into the system through diverse, somewhat circuitous pathways. The nuclear scientists, who had a head start as the producers of warheads, are well placed to exercise influence over the decisionmaking process, but do not appear to have a major role in pushing for MIRVed missiles, perhaps because their scope for testing is circumscribed. The main thrust for the technology comes from the missile engineers, who have been able to develop a disproportionate degree of influence — partly because of the nature of weapons development and partly because the military is formally kept at a distance from key aspects of decisionmaking — even as the political leadership shows a relatively weak understanding of nuclear doctrine and targeting strategy.

This essay supplements the very limited literature available on MIRVing in the Indian context. Having been compiled after a series of interviews conducted in the summer and autumn of 2015, it represents the nascent views of the Indian strategic elite in regards to multiple-warhead missiles. Those favoring MIRVs focus on its benefits in bolstering deterrence; those critical of MIRVs focus on the risks and costs associated with crisis management, arms races, and potentially destabilizing shifts in doctrine. In the concluding section, we weigh the evidence and consider three crucial questions. First, how likely is it that India will adopt MIRV technology? Second, how seriously does the Indian strategic elite worry about the potential adverse effects of MIRVing? And third, what, if anything, might be done to minimize the strategic uncertainties that could arise as a result of MIRVing?

India's MIRV Decision: Technological Considerations

One rationale for MIRVs in India's strategic and tactical considerations rests on the nature of the ballistic missile defense (BMD) system that China might deploy. India's Defence Research and Development Organisation (DRDO) appears to be examining MIRVs as one possible response to defeat BMD. Ajai Shukla writes that the DRDO has evaluated five countermeasure technologies to defeat BMD systems:

> (1) MIRVs, with each missile delivering several warheads at the same, or even different, targets; (2) decoy warheads, which will be fired alongside the genuine ones, so that the enemy's defensive missiles are wasted in attacking decoys; (3) maneuvering warheads, which will weave through the atmosphere, dodging enemy missiles; (4) stealth technologies to make warheads hard to detect on enemy radars; and (5) changing warheads' thermal signatures to confuse the enemy's infrared seekers.[5]

There is not much publicly accessible information on China's research and development on anti-ballistic missile defenses, the goals of these efforts, the technological status of these systems, or what sort of missile defense architectures Beijing may be considering. Flight tests are still at an early stage. Over a period of four years, China has conducted three declared missile defense tests, with the last one occurring in July 2014.[6] The Chinese have referred to these tests as involving "ground-based midcourse missile interception technology."[7] Some US analysts have, however, asserted that some of these tests are anti-satellite tests.[8] Most, if not all, of these tests seem to have been carried out in idealized circumstances. In the January 2010 test, for example, the interceptor SC-19 missile was launched almost simultaneously with the target CSS-X-11 missile.[9] In reality, there would be a more substantial time lag between when the target missile is launched and when an interceptor can be released to destroy it. In this time lag, the anti-ballistic missile (ABM) system must identify the launch, track the missile, separate the target warhead from a cloud of countermeasures, and

Without clear insight into how China intends to operationalize a prospective BMD system, India has to hedge without overreaching.

then isolate the actual warhead with sufficient precision in order to guide an interceptor missile to its quarry. However, China has not deployed any of the supporting elements of an ABM system, including space-based early warning satellites, forward-deployed early warning radars, or high-resolution tracking radars, to be able to successfully guide interceptors to a target missile.

These various BMD-supporting elements and their technical configurations will, in fact, substantially influence the composition of any countermeasures package, including MIRVs, that India might consider. The stories of the US Polaris PX-1 and PX-2 countermeasure systems illustrate this point. Both PX-1 and PX-2 were developed in the 1960s to counter a hypothetical short-range exo-atmospheric Soviet ABM system. However, the Kremlin eventually deployed a different and longer-range ABM system. This forced the Pentagon to undertake a lengthy and costly redesign. Apparently, the deployed Russian BMD radar used a longer wavelength than was originally estimated by the Pentagon. The PX-1 and PX-2 chaff countermeasure designs based on the original estimates of the radar wavelength would not work against the different wavelength radars actually deployed. While in theory fixing this would have been as straightforward as resizing the chaff to the correct length, the reality was more complicated. It required a redesign of the warhead, decoys, decoy-dispensing mechanism, and a new tooling process, to manufacture the new chaff to correct the systems that were already in production.[10]

Indian attempts to develop MIRVs as part of a countermeasure package risk similar problems. While it may make sense to study and experiment with a range of countermeasures, deploying any of them prematurely might not provide any cost-effective tactical utility. Without clear insight into how China intends to operationalize a prospective BMD system, India has to hedge without overreaching. This reasoning also applies to MIRVs. If Beijing opts for a regional ballistic missile defense, or a more limited defense of one or more cities, it is conceivable that India could use non-independently targetable multiple re-entry vehicles (MRVs) as opposed to MIRVs as a cost-effective way to penetrate Chinese defenses. Although India might be able to eventually master MIRV technologies given its demonstrated ability to launch and dispense multiple satellites from a single launch platform, obtaining MIRV footprints that include targets with significant distances requires mastering new engineering technologies and probably the advent of new missiles as well.[11] For example, given distances between Indian and Chinese targets, MIRVs might have to be released using buses with much more fuel to generate the lateral velocities needed to reach the separate targets from the same missile. Even if this were technically accomplished, spreading MIRVs across distant targets would separate warheads from buses early in their flight path and would undo the advantages of presenting multiple potential targets to a BMD system. Simpler MRVs, on the other hand, would be directed to a single location, thereby posing the defense with the problem of saturation.

Similarly, while China is currently experimenting with a hit-to-kill ABM or anti-satellite (ASAT) missiles like the United States, its final kill mechanism might turn out be completely different. The United States, by virtue of the Stevens-Feinstein amendment, does not study or develop nuclear interceptors for its missile defense system — reflecting the general aversion of the American public in the early years of the Cold War to being "protected" by nuclear detonations over US soil.[12] In contrast, the Kremlin has opted for nuclear warheads as the kill mechanism on the ABM interceptors deployed to protect Moscow.[13] It remains likely that Russia still retains nuclear warheads on its Moscow system.[14] China may choose to go the Russian path, rendering any reliance on MIRVing for penetration to be flawed. ABM interceptors that use nuclear warheads have kill mechanisms that are very distinct from kinetic hit-to-kill interceptors.

Explosions from a nuclear detonation could theoretically dismantle live missile warheads for tens of miles. Simply using MIRVs does nothing to mitigate this. The appropriate countermeasure against nuclear-armed ABM interceptors might be to significantly harden the warhead. One study points out that dissipating the effects outlined previously would require "… a low atomic number material so that the radiation passed through and was absorbed in depth… or the material was so tough that it could survive strong shocks."[15] If China chooses to use nuclear-armed interceptors, then India might have to use MIRVs that are also hardened to withstand nuclear detonations. Given this, India might have to wait until China deploys a substantial portion of its BMD infrastructure before deciding what sort of MIRVs are a part of the necessary countermeasures package. However, this does not necessarily preclude a degree of preliminary research toward effective MIRV warheads.

External Drivers

The China Factor

The foremost external factor encouraging interest in MIRVing is the perceived threat emanating from a rising China. The history of the India-China relationship carries many of the features of a nuclear rivalry. This includes a border dispute that stretches over 4,000 kilometers (km), a major war (1962), periodic military confrontations over the years (1967, 1986-87, and 2013), and continual friction over a so-called line of actual control (LAC), reflecting the absence of an agreed-upon border demarcation. In September 2015, the Indian Army announced that during that year, there had been more than 100 "face-offs" on the Ladakh sector of the LAC alone.[16] On the positive side, trade between the two countries grew from $133.5 million in 1988 to $72 billion in 2014.[17] Yet, rising economic cooperation has been accompanied by mounting tensions. A pattern of low-level containment and counter-containment has become entrenched, with China expanding its influence in South Asia through an enhanced presence in Pakistan, Bangladesh, and Sri Lanka, to which India has responded by expanding defense cooperation with the United States, Japan, Singapore, and Vietnam. China's naval presence in the Indian Ocean has grown; likewise, the Indian Navy has raised its profile in the South China Sea.

Indian security concerns are underscored by the economic gap between the two countries. In terms of purchasing power parity, India's gross domestic product is only 40 percent of China's.[18] In this context, China's nuclear modernization has become a major galvanizing influence on Indian thinking about nuclear capabilities. China's apparent lead over India is visible in a number of areas, including nuclear-powered submarines and submarine-launched ballistic missiles (SLBMs), land-attack cruise missiles (LACMs), and ballistic missile development. Some Chinese missiles are already MIRVed.[19] China is also testing ASAT weapons, BMD, and hypersonic missiles.[20]

Assessments of China's motivations for nuclear modernization are relevant here. Chinese leaders worry about American containment and the need to bolster "assured retaliation" at a relatively low cost in an environment where they perceive US first-strike capabilities and that growing BMD capabilities might stem a counter-strike.[21] A recent development — the revival of a US program to counter MIRV warheads with multi-object kill vehicles — would be further cause for Chinese anxiety.[22] Conversations with Indian strategic experts brought similar reactions with respect to growing Chinese power. Given the looming Chinese threat, one former general observed, India needs to be sure it has the capacity to "devastate China" in a retaliatory strike.[23] A former member of the National Security Advisory Board similarly noted that, lacking reliable thermonuclear weapons, India needs alternative methods to carry out a "devastating city-busting strike," to which end it must develop MIRVed missiles, especially in light of China's emerging capabilities in MIRVing and hypersonic delivery vehicles.[24] Not all of those interviewed agreed. A former service chief and a former vice chief were of the view that India need not opt for MIRVing and that enhanced Chinese capabilities were not a major cause for anxiety. But most Indian expert opinion agrees that a rise in China's nuclear strength, regardless of the specific development of MIRV capability, requires a response from India.

A key point is the nature of threat perceptions. Chinese policymakers are responding to what they see as an aggravated threat from the United States and see little need to worry about India. But Indian policymakers view Chinese capability enhancements as directly threatening. This is a trilateral variation on the classic security dilemma, which causes spiraling competition in a bilateral relationship. Indeed, a fourth party is also involved here since Pakistan views India's response to China as threatening.[25] This cascading effect makes stabilization complicated and difficult, a point to which we will return later.

The Technological Imperative and Security Concerns

It is sometimes argued that technology drives military planning and acquisitions, and that military doctrines are no more than post hoc justifications for technologies produced by the engineers. Thus, technical determinism may occur when research and development on a weapon system is driven by "scientific curiosity, serendipity, or energetic engineering (science for science's sake) rather than a response to defined military requirements."[26] As Robert Oppenheimer put it, "When you see something that is technically sweet, you go ahead and do it and you argue about what to do about it only after you have had your technical success."[27] Once a technical device with a potential application has been found, there is a good chance that it will be supported by those whose business it is to think about it. More to the point, it is difficult for decisionmakers who are not sure about a new weapon system to oppose it, for fear of being left behind.[28] After the initial investment is made, it is hard to walk away. As former British Prime Minister James Callaghan said during an interview about a BMD countermeasure program in 1987:

> It's awfully difficult, unless you have the virtue of hindsight, when something is going on, has been going on for three or four years, and you're told, "Oh, it's going to be pretty soon now, can we have another hundred million or fifty million" to say "no, put it all on one side," to be

MIRVing has not required political approval because it is viewed as an extension of an existing (missile) technology.

certain you're right it's not going to succeed… And every time they called for a new tranche, I used to write "agree" on the minute or whatever it was, because one always thought it was just around the corner.[29]

Technical momentum often comes from within the creative process itself as scientists try to improve a product. The US experience is instructive. The Vernier engine, which is at the core of MIRV technology, was initially developed in order to overcome the problem of missile inaccuracy (relating to single-warhead missiles) that stemmed from an older, heavier engine.[30] In this way, MIRVing was viewed as a "normal" development aimed at better accuracy and greater certainty of hitting targets, which in turn made for more effective deterrence. Furthermore, MIRVing was considered an extension of the existing missile program, which meant it did not require fresh authorization as a new program.[31] The same could be said of the Indian MIRV program. As far as we could gauge, MIRVing has not required political approval precisely because it is not viewed as a new weapon system, but one that is an extension of an existing (missile) technology.

There has been regular criticism about the predominant role of India's missile-producing engineers (discussed in more detail later). The military, it is said, has no say in the planning of weapons systems. The process of weapons development in India is usually a fairly long and slow one, which means the country risks being seriously outpaced by rivals if a decision to pursue a particular weapon system is not taken expeditiously.[32] If weapons scientists and engineers are the predominant actors in the emergence of new systems, this is a fact intrinsic to the technology. It is hardly likely that military officers or civilian officials will be pondering future weapons systems a decade or more before they become feasible. Chinese interest in the development of MIRV technology, meanwhile, is said to date back to an early 1970s proposal, while actual work on the technology began in the early 1980s.[33] The time frame of US MIRV development was shorter, but still relatively long. In the US case, the idea of MIRVing dates back to at least 1959; development began in 1962; and the first MIRV deployment occurred in 1970.[34] The long time frames for development tell us something about the difficulty states have in avoiding the so-called technological imperative, even if they do not pursue these technologies aggressively. The pursuit of MIRV technology is less encumbered than during the Cold War because all of the major powers — and several of the smaller ones — have begun to modernize their nuclear arsenals as the initial post-Cold War thrust for disarmament has petered out.

Just because a weapon system has no predetermined military justification does not necessarily mean that it is of little or no value. Indeed, the more some technologies (such as cruise missiles) are pursued, the more a military justification can follow. The more important point is whether there is a rationale for the military technology in question under existing circumstances.

Military and civilian expert opinion in India has produced a variety of justifications for the adoption of MIRV technology, and these are more or less similar to the thinking in other countries. The strategic rationale for MIRVing encompasses: 1) penetration of Chinese BMD systems with the use of genuine or decoy warheads; 2) the cost-effectiveness associated with MIRVing since one missile can carry several warheads; and 3) wider targeting options — both strategic and tactical. All three aspects were widely cited during numerous interviews with senior officials (mostly retired) from both military and civilian backgrounds.[35] To be sure, a minority view rejects the notion that MIRVs bring deterrence benefits.[36] One expert, for example, pointed out that MIRVing is not required as a counter to adversaries' BMD capabilities because missile defense is inherently weak.[37] But for the most part those interviewed for this project were supportive of the thrust to integrate MIRV technology into the Indian arsenal.

Prestige and Status

There is a tendency to decry prestige motives as somehow irrational and counterproductive. One major critic of Indian nuclear strategy (or the absence of it) observes:

> For India's strategic force capabilities to improve, a clearer distinction needs to be made between the objectives of prestige (both internal and external) and deterrence. Not only do the two objectives now call for diverging force development paths, but the prestige path has reached a dead end.[38]

There is merit in the view that prestige is a suboptimal driver of policy, especially if it is tethered to narrow bureaucratic interests. There is also, however, a widely held realist understanding of international politics that prestige is an "everyday currency of international relations," one that lowers the cost of getting things done by obviating the use of force.[39] Prestige, in other words, provides "reputation for strength."[40]

In the context of nuclear weapons, the picture is more complex. On one hand, states may be motivated by the quest for national prestige.[41] On the other, if the reigning norm is against the acquisition of nuclear weapons, prestige may be obtained by not acquiring them.[42] Much depends on the prevailing norms among states at any given point of time. This is important because prestige comes not simply from the perceptions of individual states, but from the perceptions of individual states about what other states believe — i.e., prestige is a higher or second-order belief.[43] In the current world order, there is clearly a tension between two international norms: the nonproliferation norm, which regards possession of the Bomb as unacceptable, and the realist norm, which treats the possession of instruments of power as central to the international system. Both are inherently weak: the first does not properly apply to the states that possessed nuclear weapons in 1968, when the Non-Proliferation Treaty (NPT) was opened for signature, while the second is undercut by the prevalence, over 70 years, of a norm of non-use. But the nonproliferation norm is in some ways weaker, for two reasons. First, military power remains a ubiquitous currency of international politics. And second, not only do several powerful states retain and continue to enhance their nuclear weapons capacities, but a number of others continue to depend on extended nuclear deterrence for their security.

Nuclear weapons do not necessarily engender national prestige by themselves. For example, North Korea has not been able to gain prestige from its nuclear capability. Clearly, then, prestige is something that may need to be accompanied by other aspects of behavior more acceptable to the member states of the international system. Thus India's claim to be a "responsible" power, widely accepted by other states, facilitated its bypassing many of the rules and conventions of civil-nuclear commerce, when India's exemption by the Nuclear Suppliers Group was granted in 2008.[44] Pakistan's claims to a similar concession have not yet been treated as acceptable, while North Korea does not seriously make such a claim. But it is important to separate a state's original motivation for acquiring nuclear weapons from the bestowing of prestige. One of the co-authors of this paper surveyed elite perceptions shortly after India's 1998 tests and found marginal interest in the potential of the tests to attain prestige.[45] By and large, the overwhelming concern was security, the more so from the pressures imposed by the nonproliferation regime.[46] However, it is arguable that the prestige India has actually garnered after 1998 has become more of a driving factor than originally anticipated.

Economic liberalization and growth prior to 1998 benefited India, prompting many to recognize it as an emerging power. But it was by no means considered a major strategic player in the international system. On the contrary, it was under much pressure from the United States and others to roll back its covert nuclear weapons program. After 1998, sanctions were imposed but soon withdrawn. The

George W. Bush administration, seeing India as a rising power and a potential partner with which to hedge against the rise of China, sought to build bridges, which resulted in unprecedented military cooperation and, of course, the 2008 civil nuclear deal. In short, India's motivation in going nuclear was not predominantly to seek prestige, but the result of the tests was that India did acquire prestige and quickly came to be treated as a key player in contemporary strategic politics.

Given American concerns about the rise of China, it is hard to imagine that the Bush administration would have made the kind of concessions it did and publicly declared its support for helping India had New Delhi not crossed the nuclear threshold and underlined its capacity to act as an emerging strategic player in Asia. The combination of India's economic revival and its nuclear tests gave India unprecedented leverage. It is equally hard to imagine that India's policymakers would not have drawn the conclusion that the symbols of power that nuclear weapons represent are central to the status it is accorded as a rising power. In addition, it is noticeable that China, which was long dismissive of India's nuclear capability, is now somewhat more inclined to take India's concerns more seriously. And New Delhi would surely have discerned that, in the context of the uneasiness associated with China's rising power, India's acquisition of nuclear capabilities has not aroused significant opposition among most states, especially in East Asia.

This being the case, the MIRVing of missiles would at the very least be relatively unproblematic for Indian policymakers since it would, in addition to other expected benefits, further enhance India's prestige in possessing advanced military capability, particularly since China has already begun to MIRV. Prestige also brings the added benefit of strengthening a state's case to acquire a seat at the table. Even if India's technological capability is limited, it can, with each weapon system being developed, stake a claim to a place in future arms control negotiations. As Lora Saalman suggests with respect to Chinese interest in missile defenses, development may be aimed at least partly at gaining diplomatic currency: "By integrating China into a system of relations from which it was once excluded and threatened, it will be in a much stronger position to engage and to be engaged."[47] For India, too, the prestige motive may involve the thinking that more sophisticated weapons will gain diplomatic currency and leverage among the major military powers so as to enable it to better safeguard its strategic interests.

Deterrence Thinking: Borrowed Discourse

All thinking about deterrence may be divided into two components: the operational-conventional and the political-revolutionary. The former tends to

> There has been no systematic effort to come to grips with what is meant by minimum deterrence.

look upon nuclear weapons as in some sense "usable," (i.e., as an extension of conventional weapons), although with great restraints attached. The latter conceives of nuclear weapons as essentially unusable (i.e., to be possessed solely for threatening retaliation in the unlikely event of first use by others). The operational-conventional approach, which tends largely to draw upon conventional thinking about the balance of power, is predominantly the province of military personnel and many strategic experts. The political-revolutionary approach, which rejects the notion that power balances between nuclear-armed states are meaningful, is espoused by decisionmakers confronted by the prospect of nuclear war and by a minority of strategic analysts who hold that minimal nuclear capabilities will suffice to deter nuclear attacks. The two overlap in the sense that, if nuclear weapons were completely "unusable," they would not deter. In practice, the operational-conventional approach to deterrence has dominated American and Russian understanding of how nuclear weapons and deterrence function.

The US- and Russian-dominated discourse draws heavily upon conventional experience. There are two reasons for this. First, the Bomb appeared toward the concluding stage of the Second World War amidst conventional mass destruction with city targeting. For quite some time, therefore, nuclear weapons were thought of as an extension (no doubt with a qualitative advantage) of conventional weapons of war. Second, over the years the conventional lexicon emerging from the post-war era was not altered because there was simply no alternative war experience from which to draw. Thus the balance-of-power language from the era of worldwide conventional war remained in place. During crises, this mode of thinking receded: when faced with the looming prospect of nuclear conflict, political decisionmakers were concerned only with finding ways to avoid war. The putative balance-of-power advantages or disadvantages of their weapons systems did not hold sway for leaders faced with a crossing of the nuclear threshold. Once the fear of a full-scale nuclear war had receded, however, the thinking of decisionmakers reverted to the conventional, and doctrines and arsenals continued to be shaped as of old.

One of the chief architects of deterrence orthodoxy was Albert Wohlstetter, from whose writings came the central tenets of American doctrine: the fear of a surprise attack (as at Pearl Harbor) and the need for an assured retaliatory response that would wreak severe damage upon the adversary.[48] This meant that the American arsenal had to be credible as well as survivable. The Soviet Union had to be fully aware that painful retribution was inevitable. The United States would need the capacity to absorb a first strike, bear considerable damage, and attack on a massive scale. Its arsenal would have to be dispersed to be made as survivable as possible in order to possess an assured second-strike capacity. It would then have the ability to penetrate any Soviet defenses and be fast, accurate, and destructive in order to maximize damage. All of this placed a premium on the notion of a balance of power because a first strike might destroy a significant portion of American forces. What it amounted to was an exhortation to possess more numerous and more sophisticated strategic forces than the enemy in order to correct a potentially adverse balance arising from a surprise attack.

This perspective is reflected in the language of deterrence espoused by most Indian strategic experts. We do not cite specific works here since borrowed discourse is the rule rather than the exception. The terms "credibility," "survivability," and "second-strike capability" are used by those expounding on nuclear strategy. As one active senior military officer noted, given the lack of experience with nuclear conflict, military thinking naturally falls back on the conventional understanding of conflict.[49] Another observed that there is "a good amount of Western bias" because available writings on the subject are mostly from the West, a factor reinforced by their easy availability via the Internet.[50] It is striking that virtually none of the writings, interviews, and discussions that are encompassed in this essay reflect upon the anomaly of using a discourse that lends itself to more, rather than fewer, requirements for minimum deterrence.

The use of the term "credible" to describe the Indian approach — "minimum credible deterrence" — is an indication of the difficulty: no one has been able to define what it means (conceptually, that is, not in terms of the quantity or quality of weapons). The term "assured retaliation" is not very different, since it still involves the same logic as Wohlstetter's, except that the level of damage required to deter may be lower. What this boils down to is that the way Indians (and many others) think about nuclear weapons keeps the door wide open to the quest for the improvement of capabilities such as MIRVing.

If there is an ambiguous understanding of Indian nuclear doctrine, it is at least partly because there has been no systematic effort to come to grips with what is meant by minimum deterrence. The older generation of senior officials (i.e., those who served the better part of their professional lives before 1998) received sporadic exposure, if any, to nuclear weapons issues. One observed that he had acquired a bare minimum of understanding while attending a staff college course in the United Kingdom. He noted that some, but not extensive, attention is given to nuclear weapons by the current crop of officers during higher command courses. A top (now retired) officer who was in service at the time of India's 1998 tests and for some years thereafter was frank enough to admit that he began to grapple with nuclear-strategic issues — by means of occasional discussions and sporadic reading — well after the tests. Today, there still appears to be no systematic effort to incorporate nuclear weapons into professional military education in India.

The common refrain about India's "credible" doctrine of minimum deterrence leaves little doubt that there are no serious constraints on the development of new weapons systems. As long as this remains true, it is unlikely that there will be an intellectual basis for putting a brake on weapons development. As a former member of the National Security Advisory Board put it, Indian decisionmaking on nuclear weapons tends to be reactive; no one will think about the matter unless a problem occurs.[51] Barring such complications, MIRVing and similar developments are therefore very likely to remain under consideration regardless of their place in deterrence strategy.

Domestic Drivers

Strategic Culture and Restraint

India is sometimes described as a reluctant nuclear power.[52] Its long and incremental development of nuclear capability was the result not only of external constraints, but also of powerful moral inhibitions imposed by its early leaders, M. K. Gandhi and Jawaharlal Nehru. Despite reservations, Nehru never closed the door on nuclear weapons completely, and China's 1964 nuclear test, which followed soon after India's humiliating defeat in the Sino-Indian war of 1962, marked the beginnings of its nuclear weapons program. The process remained hesitant and slow: even after a successful test in 1974, India did not begin to weaponize until about 1989 — after Pakistan had already done so.[53]

This diffidence gave the Indian nuclear weapons program after the 1998 tests a number of minimalistic characteristics that dovetailed nicely with the political-revolutionary aspect of nuclear weapons.[54] First, the Indian perspective emphasized the priority given to no first use (NFU), though this was modified later by allowing for nuclear retaliation against chemical and biological weapons. Second, it rejected the concept of nuclear warfighting and opted for a simple doctrine of massive retaliation so that there would be no sliding scale between non-use and use of nuclear weapons. Third, immediately after the 1998 tests, the government declared that there was no need for more tests and announced an indefinite moratorium on testing in keeping with the norms of the Comprehensive Nuclear-Test-Ban Treaty (CTBT). Fourth, India refrained — and still does — from active deployment of its arsenal, which created a margin of stability and safety that was particularly valuable during the post-test crises of 1999 and 2001-02. And finally, India's commitment to arms control and disarmament was reaffirmed.

The overall picture of restraint after the 1998 tests has not changed significantly despite the expectation that a new "Hindu nationalist" Bharatiya Janata Party (BJP) government would take bold measures (like the previous BJP-led government of Prime Minister A. B. Vajpayee, which crossed the nuclear threshold). There was no major shift in India's doctrine or posture under the Congress Party coalition government led by Prime Minister Manmohan Singh. The advent of a new BJP regime in 2014 brought renewed expectations of a rightward turn. The BJP's manifesto for the 2014 general elections said the party would "study in detail India's nuclear doctrine, and revise and update it, to make it relevant to challenges of current times."[55] Some expected a shift away from India's NFU posture.[56] Yet nothing of the kind happened. In October 2014, the National Security Advisor (NSA), Ajit Doval, is reported to have said that "India is shifting its posture from credible minimum deterrence to credible deterrence," which appeared to augur the abandonment of India's commitment to minimalism.[57] A year later, there was no formal change.

Nonetheless, signs of pressures against the minimalist approach to deterrence were growing. A decade after the 1998 tests, scientists in the nuclear establishment called for more testing.[58] In a widely read paper, retired Lieutenant General B. S. Nagal, who had served as the chief of the Strategic Forces Command (SFC),[59] called for a shift away from NFU and toward a posture of strategic ambiguity that would encompass counterforce capability.[60] Quite a few other major figures in the nuclear strategy circuit have similarly spoken in favor of dropping NFU, moving from massive retaliation to multilevel deterrence or flexible response, and keeping preemption options open.[61]

Interviews conducted in the summer of 2015 reveal considerable support for dropping massive retaliation, primarily on the grounds that a massive response to a small attack lacks credibility. The point was made that a similar problem arose in the case of US strategy during the Eisenhower administration, and that flexible response makes more practical sense.[62] One argument made in favor of more discriminate responses was that India lacks a demonstrated thermonuclear capability, without which the threat of a major countervalue strike lacks substance.[63] The need for strategic ambiguity on the precise nature of India's response also found favor. Although the preponderance of Indian thinking prefers continuity in strategy, post-1998 there is discernible pressure to move strategy away from its political and minimalist foundations.[64]

Will this lead to a shift in the basics of deterrence that will encourage the adoption of MIRVing, which is widely viewed as designed for counterforce targeting? The Indian civilian leadership's somewhat ambiguous understanding of nuclear doctrine (discussed further in the next section) seems quite tolerant of differences between the projected utility of nuclear weapons and a fairly static nuclear posture based on NFU, non-deployment, and non-testing. As a result of the long, slow, and covert process of weapons development, the focus has always been on building a wide array of capabilities without high readiness for using them. This tends to downplay the risks associated with any specific system. The short-range Prithvi surface-to-surface ballistic missile is a potentially destabilizing system that is already operational, but its risk propensity has been underplayed because it has not been actively deployed. The risk associated with deploying conventional cruise missiles near the border has also been underestimated. So long as the non-deployment preference holds, the risks attached to MIRVed missiles will be seen as minimal. This makes it likely that the pressure emanating from those who seek more credible deterrence will continue to back the effort to MIRV ballistic missiles without serious pushback.

Decisionmaking

The structure and impacts of decisionmaking on nuclear capability and strategy are somewhat unclear. Part of the difficulty is the existence of a civil-military "balance" in which the dominance of civilians is asserted without actually being fully established. Political and bureaucratic decisionmakers lack a thorough understanding of military affairs and are therefore unable to ask penetrating questions about weapons systems and their strategic roles. In a formal sense, there is no question that the civil writ rules. At the top, decisions on nuclear issues are taken by the prime minister through the Cabinet Committee on Security, which leans on the Prime Minister's Office (PMO) and the NSA for advice. The military, it is generally said, is not in the loop during the process of making decisions that pertain to the introduction of new weapon systems. Thus, one former chairman of the Joint Chiefs of Staff Committee has drawn attention to "the complete exclusion of the armed forces from all aspects of planning and structuring of strategic programmes."[65] The problem is that civilians harbor a fundamental distrust of the military, which is structurally sidelined in the decisionmaking process.[66] In part, this may reflect the organizational interests of the civilian bureaucracy, which would like to keep the armed forces off its turf.[67] The fact remains that the government's reluctance to follow up a long-standing recommendation by its own reform committee to appoint a chief of defense staff is an additional barrier against the armed forces taking a formal role in apex nuclear weapons decisionmaking.

This is not to say that the military has no role in nuclear strategizing. Military and other critics recognize that the services have inputs into policy, primarily via the Strategic Policy Staff (SPS) of the NSA, where retired high-level officers advise the NSA on nuclear issues. At least one recent chief of the SFC has later headed the SPS, while another has a doctoral degree in nuclear-strategic issues. Serving and retired military officers interviewed for this essay have pointed out that this is not good enough, and that there needs to be a structured and direct involvement of the armed forces in nuclear decisionmaking. That criticism is appropriate where operational readiness is concerned.[68] Whether it applies as well to the conceptualization of the requirements of deterrence is another matter. As we have shown, there is no significant variation in civilian and military thinking (most of which is borrowed) on basic doctrinal questions. So, on this count at least, there would probably be no significant change in policy in the event of greater military involvement.

The nuclear/technical establishment has a prominent role in determining the direction of research and development. Initially, the Department of Atomic Energy (DAE), which the prime minister oversees, played a leading part as the focus was on acquiring the capacity to produce the Bomb. Since 1998, the DAE's role has been less prominent in nuclear-strategic affairs, partly owing to India's public commitment to adhere to a moratorium on nuclear testing. Nonetheless, it maintains an active presence in nuclear decisionmaking through its privileged access to the upper echelons of policy formulation. The DAE's influence is particularly felt through the Office of the Principal Scientific Advisor to the Government of India, which has direct access to the prime minister. Currently, the principal scientific advisor (PSA), R. Chidambaram, a former chairman of the DAE, and his deputy, S. K. Sikka, are both nuclear scientists.

The producer of missiles, the DRDO, is most prominent in the advocacy of missile systems. Though under fire for the late delivery of conventional weapons systems such as combat aircraft and tanks, the DRDO has claimed greater success with respect to missiles, especially considering the severe constraints it has had to face with respect to collaborations and imports. The organization's influence is substantial. Officially, it reports to the Ministry of Defence, but in practice the latter can be bypassed through the close informal links between the DRDO and the DAE, as well as the Department of Space. The scientists and engineers of these three organizations have access to the apex decisionmaking structure and the PMO through its informal connections with the DAE and hence the PSA. The result is that the DRDO is able not only to push through its programs, especially in the nuclear area, without great difficulty, but also to act, as it were, as the chief official source for the strategic rationale for the various systems.

A number of factors place the DRDO in the driver's seat with regard to the development of MIRVed missiles. First, the DRDO does not require separate approval for research and development on MIRVing since it is a technology that is regarded as an appropriate extension or technical refinement of existing missile systems. Development does not require political approval and remains within the financial purview of the DRDO itself, which has a generous budget. Subsequent demands for funds that might require approval will occur at a juncture when the momentum for further development will already have accelerated thanks to the overall preferences of the strategic community.

Second, the civilian authorities' peculiar understanding of the civil-military bargain has actually facilitated the higher public profile of the DRDO. This bargain is generally understood to place all final decisionmaking on questions of political, organizational, and financial authority with the political leadership, while professional matters "internal" to the military reside with the services. The latter includes preferences with regard to weapons systems, which generally originate with the armed forces while being subject to final approval.

Third, and consequently, civilian leaders do not seem to have fully understood that nuclear weapons, being essentially political weapons in their own right, require greater political attention — unlike in the case of conventional weapons. By not taking on this responsibility, civilians have facilitated the ascent of an alternate source of authority to justify research and development on nuclear weapons — the same source that produces them. Inevitably, there is no organizational basis for ensuring the optimality of weapons systems like MIRVed missiles by asking hard questions about how they fit into a doctrine of minimum deterrence. The military may appear to have been sidelined, but, in practice, the operational conceptions it espouses (while not unique to it) are driving the MIRVing process.

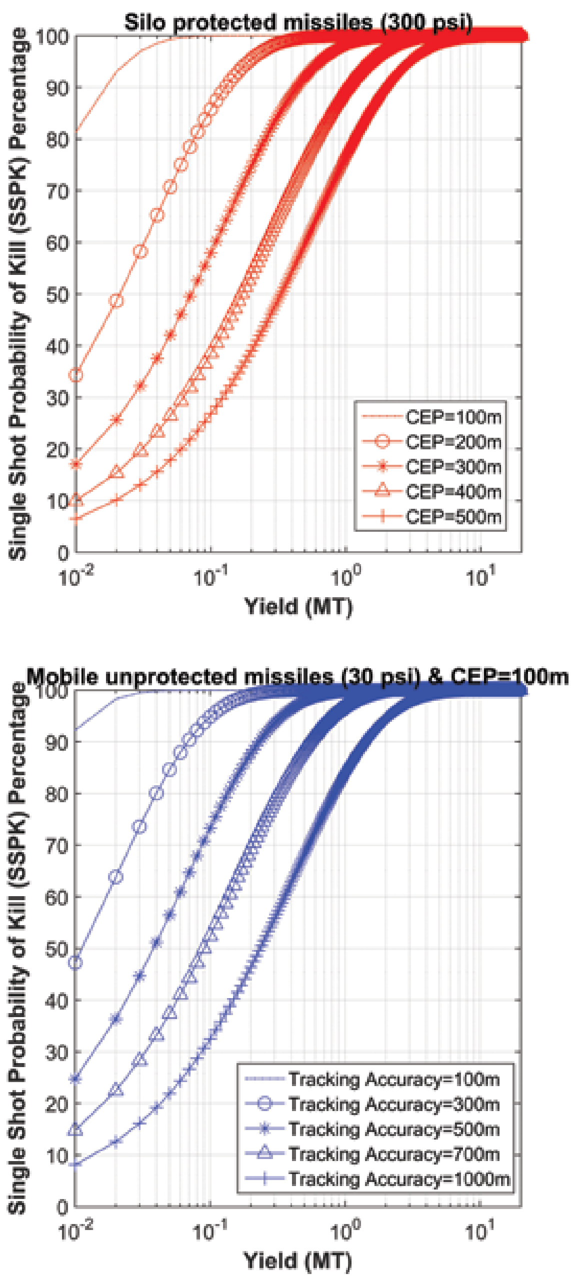
Potential Impact of MIRVing

India's quest for MIRV technology has produced considerable criticism from outside the country. Much of it draws from historical experience elsewhere. The Cold War debate on MIRV development and the improvement in missile-targeting accuracies raised some very real concerns about first-strike stability and arms racing. For instance, the 1969 debate among Albert Wohlstetter, George Rathjens, and John S. Foster, Jr. on ABMs and MIRVs centered on how quickly, under what circumstances, and how effectively the follow-on to the Soviet SS-6 intercontinental ballistic missile (ICBM) force (with MIRVs and improved accuracies) could destroy a major portion of US Minuteman missiles.[69] In the 1970s, the combination of MIRVs and improved missile-guidance accuracies led to concerns about the possibility of a first strike. Against fixed silos, the effect of improving guidance accuracy measured in circular error probable (CEP) is much more lethal than increasing nuclear yield. The 1969 edition of *Strategic Survey* points out that "doubling the accuracy thus has about the same effect as multiplying the yield by ten."[70]

To illustrate, the first graph at the top of Figure 1 shows the single shot probability of kill (SSPK) of one nuclear warhead for various CEPs against a hardened silo that would require a blast overpressure of at least 300 psi to be destroyed. Assuming a single warhead missile with a yield of one megaton (Mt) and a CEP of 400 meters, an SSPK of 90 percent is achieved. Now, if the same missile were armed with three MIRV warheads, each with a reduced yield of 0.1 Mt (or 100 kt) but a higher CEP of 200 meters, each MIRV warhead would still have an SSPK of almost 90 percent. In essence, a single missile can then be used to produce the kill-blast overpressure on three different targets.

Alternatively, if each of the MIRVs were guided to the same target, the overall probability of kill would significantly improve. SSPK is a metric that speaks only to the efficiency of creating a predetermined blast overpressure after a single warhead detonation; a number of other prior factors matter for a successful first strike. These factors are captured in the overall probability, which accounts for the fact that there are numerous potential failures between the order to fire a missile and the detonation of its warhead. The overall probability is the "product of the individual probabilities that the system will not malfunction during each stage of countdown and launch (launch reliability) and during each stage of flight — the boost phase, the separation of the re-entry vehicle, the penetration of the atmosphere, and the detonation of the warhead (flight reliability)."[71] In sum, if each warhead were to have an overall probability of 90 percent, then directing all three warheads to the same target increases the cumulative kill probability to 99.9 percent.[72] When all warheads are directed to one target, they act more like unguided MRVs rather than MIRVs.

Figure 1: Variation of Single Shot Probability of Kill (SSPK) with Circular Error Probable (CEP) and Tracking Accuracy



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This discussion clearly illustrates the military efficacy of MIRVs against static targets. Technologically, Indian missiles already seem to have very high guidance accuracy. While the 3,500-5,000-km Agni-III is reported to have achieved a CEP of 100 meters, the DRDO has been trying to achieve an accuracy of 100 meters on its 5,000-plus-kilometer-range, road-mobile Agni-V missile.[73] A combination of highly accurate Agni missiles with a future MIRV configuration could raise concerns of first-strike stability, which Pakistani researchers have already noted.[74] Conceivably, if MIRVs become a staple in India's arsenal, China might also react by modifying and increasing the number of warheads directed at India. However, China, India, and Pakistan, unlike the United States and the Soviet Union during the 1970s discussion of MIRVs and strategic stability, do not have most of their land-based missiles in fixed silos. Instead their missiles are road- and rail-mobile. The mobility of missiles considerably complicates tracking and targeting. For example, as indicated on the second graph at the bottom of Figure 1, a CEP of 100 meters with a 100-kt warhead would have an SSPK of approximately 70 percent if mobile missiles can only be tracked to an accuracy of 500 meters. An SSPK of 70 percent is a very low value for a mission that requires a high probability of success. In theory, as the ability to track the location of a mobile missile increases, so, too, does the SSPK.

Even with the advent of MIRVs, concerns over preemptive strikes could be mitigated because India (or China and Pakistan) might not possess the technological means for real-time targeting to track hundreds or even tens of mobile missile launchers with high accuracy over a large area.[75] Real-time, persistent, 24/7 tracking and targeting either requires the establishment of air superiority or the utilization of significantly sized satellite constellations. For example, a single satellite placed at an optimized inclination angle to maximize coverage over the Chinese missile launch base at Delingha in the norther Qinghai province (located at 37 degrees 38 minutes north latitude and 97 degrees 38 minutes east longitude) would have an average coverage of approximately 4.5 minutes per day.[76] Therefore, to create 24/7 coverage would require approximately 320 satellites. This number is a low-end estimate. It was calculated based on a 600-km operating altitude and a 30-degree off-nadir satellite field of regard (FOR). In reality, the best-resolution commercial satellite imagery that might be used for military applications — such as GoeEye, Ikonos, WorldView, and Quickbird — have a FOR of less than 30 degrees, which reduces the area covered by the satellites and consequently increases the number of satellites required for 24/7 coverage.[77]

Designing and manufacturing high-resolution military satellites with sufficient reliability is an extremely costly proposition, usually running into the range of hundreds of millions of dollars per satellite.[78] Even assuming that some future technology would dramatically reduce costs, satellite constellations will remain expensive. For example, the operationally responsive space (ORS) projects studied by the United States have touted satellites costing around $20 million.[79] At $20 million, the 320 satellites required for 24/7 coverage over the Delingha missile base would total around $6.4 billion. It is highly improbable that India would be able to spend such large amounts. Even at such exorbitant costs, the optimized satellite constellations provide 24/7 coverage only at a particular latitude. If China, for example, relocates its transporter erector launchers (TELs) to more northern or southern regions, the constellation will have significant gaps in coverage.

Given India's limited tracking and geolocating potential, it is highly improbable that India can possess the situational awareness to conduct a first-strike operation that destroys all of China or Pakistan's strategic deterrents. However, India might still need to deal with the real-world implication of Pakistan presuming that India might seek strategic advantages through targeting acquisition and MIRVs. In this context, MIRVs could increase prospects of arms racing, crisis proneness, and shifts toward counterforce doctrine.[80] The complications inherent in MIRVing land-based missiles are compounded, as William Potter has observed, with the advent of sea-based strategic deterrents.[81]

In the past, increased nuclear capabilities through MIRVing resulted in an accelerated arms competition rather than increased confidence in deterrence. Whether this remains true for India (or for China and Pakistan) is likely to depend on the pace and scale of MIRVing. More generally speaking, the fear of nuclear war can induce caution, regardless of imbalances in nuclear firepower.[82] In this regard, Benjamin Lambeth decries the "superiority fallacy" that sees advantage in a favorable balance of capabilities, and dismisses it as "an almost mystical fixation in American strategic folklore."[83] India prides itself on not being fixated by western constructs relating to nuclear weapons. This confidence will be tested by the advent of MIRVing.

Conclusion

Among the Indian strategic community, some believe MIRVing will bring stability by bolstering India's deterrence capability, especially in view of China's interest in MIRVs and BMD, while others acknowledge that it may result in strategic instability. Among the latter, few are sufficiently concerned to have given much thought to what might be done about it.

The thrust of this essay has been to show that the quest for MIRVing in India, while slow, is likely to proceed largely unheeded. There are two main reasons for this. First, all of the external and internal drivers examined previously — from the China threat to domestic organizational and political pressures — point toward movement in the direction of MIRVing. China's pursuit of BMD and MIRVing is in itself sufficient cause to push the process along. The cascading effects of competitive MIRVing, flowing from the United States to China to India and finally Pakistan, have created a multi-dimensional security dilemma that appears to be leading inexorably to a new and complex problem in Asian security.

Second, while there is awareness of the risks associated with MIRVing, there is no sense of rising alarm among the main players in the region (as opposed to the sentiments of external observers). This is primarily because widespread MIRVing is far into the future, and there are other, stronger, nearer-term drivers of strategic instability, such as cruise missiles and the ever-widening array of ballistic missiles that China, India, and Pakistan, among others, are pursuing. If India MIRVs along with China, mutual threat perceptions would be likely to grow, bringing incentives for arms racing, possible shifts toward counterforce targeting and alert postures, and an increased propensity for crises, all of which could have a negative impact on regional stability. Down-side risks could be moderated, however, if MIRV programs are inherently limited in scope and if difficulties in real-time target acquisition, especially against mobile missiles, continue.

As with many aspects of human affairs, not much is likely to be done to forestall the pressures for MIRVing unless there is a major shift in the strategic temperature. Operational and technical matters will be unlikely to invite adverse attention unless the regional or international environment deteriorates. For instance, if there is a move toward active deployment of currently-recessed nuclear missiles, the strategic community in India and elsewhere will suddenly come to attention and think about the consequences of possessing certain types of weapons capabilities, such as MIRVed missiles. Alternatively, an economic crunch might lead to the discovery that the costs of MIRVing have outweighed the putative benefits. Until then, it is likely to be business as usual.

Finally, what might be done to think about mitigating the effects of MIRVing? Once deployed, MIRV warheads are likely to resist arms control since ascertaining whether states are keeping to their commitments would be likely to require intrusive verification.[84] Might it be possible to forestall deployment? This is not yet a serious problem since China, India, and Pakistan do not, so far as we know, deploy their missiles in an active mode. But pressure for active deployment will follow closely behind submarine-based warheads if they are brought into the picture. The general momentum toward research and development on MIRVing makes it unlikely that testing can be stopped, especially since China has already begun to MIRV.

The United States, from whence the cascading process of competitive deployment originated, continues to deploy MIRVs at sea even though it has de-MIRVed its land-based missiles.[85] If the United States were to de-MIRV all its missiles, others just might be persuaded to hold off on testing, but this scenario is highly unlikely on all counts. It has been suggested that sea-based MIRVs are preferable to land-based systems, in that they signal a retaliatory rather than first-strike capability.[86] However, nuclear intent lies in the eye of the beholder, and besides, the targeted state might well consider this even more dangerous since hard-to-track, MIRVed missiles at sea could still be used for a first strike. Now that MIRVs are resurgent, political negotiations, not weapons systems, are the best hope for strategic stability.

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PAKISTAN

Feroz H. Khan and Mansoor Ahmed

Pakistan, MIRVs, and Counterforce Targeting

Strategic competition between Pakistan and India is intensifying. Both countries have now entered into a phase of modernization and expansion of their respective strategic forces, reflecting significant investments in strategic programs. Their fissile material production capacities have grown substantially and they have inducted a plethora of new delivery systems. Both are in the process of fielding nuclear triads. Technological advancements are underway in: modern combat aircraft and air defense capabilities; cruise and ballistic missiles; sea-based deterrents; tactical nuclear weapons (TNWs); ballistic missile defense (BMD); and multiple independently targetable re-entry vehicles (MIRVs). India and Pakistan now possess more new types of nuclear weapon delivery vehicles than the United States.[1] To complement these developments, there are advancements in: intelligence, surveillance, and reconnaissance (ISR) technologies; communications and navigation; precision-strike weapons; anti-satellite (ASAT) technology; and cyberwarfare capabilities. These technological innovations have the potential to erode strategic stability on the subcontinent.[2]

While all of these technologies are of crucial interest to Pakistan, India's twin pursuits of MIRVs and BMD challenge the effectiveness of Pakistani strategic deterrent and force Pakistan to make choices either to cede ground or engage in a continuing strategic arms competition.[3] If history is a reliable guide, in the event that India places MIRVs atop its missiles, Pakistan is likely to do so as well.[4]

As Joshua T. White and Kyle Deming have concluded, the immediate consequence of India's MIRVing is a possible "acceleration of the arms race between India and Pakistan."[5] One reason for such a course would be that the MIRV-BMD combination swings the pendulum in favor of the attacker.[6] If New Delhi chooses to deploy BMD to defend vital areas and protect command centers, its threshold for launching conventional military strikes could be lowered. MIRVed missiles could expand India's targeting capabilities. The synergy of these two technologies significantly increases India's ability to engage Pakistani nuclear hard targets in a first strike and degrade Pakistani retaliatory capacity. As former Indian strategic force commander Lieutenant General B. S. Nagal has written, "the [BMD] system will provide security to important command and control centers besides protecting value centers. The BMD increases the credibility of the command and control mechanisms by protection as well as denial to the adversary."[7]

Pakistan will face tough choices in the not-too-distant future as India's modernization programs proceed. Pakistani strategic anxieties are influenced by India's continued pressure on its eastern front, at a time when its military commitments on the Afghan borderlands and internal security contingencies are sapping its security resources. While the Pakistani military continues to balance these contingencies, the role of its nuclear weapons is limited to deterring Indian military adventures. It is within this context that Pakistan introduced short-range, nuclear-capable weapons systems, which are designed to complicate Indian conventional attack plans at the tactical/operational level. Given conventional force imbalances and the growing technological gap vis-à-vis India, Pakistan has adopted what South Asian nuclear scholar Vipin Narang has described as a nuclear posture of "asymmetric escalation."[8]

This essay examines this competition and analyzes Pakistan's options and responses should India decide to follow China's lead in MIRVing, thereby increasing its counterforce targeting options. We consider three Pakistani responses to Indian MIRVs and BMD: not to respond (the "ignore" option); responding, but in a measured way (the "tortoise" option); or responding quickly (the "hare" option). We conclude that Islamabad will most definitely respond with MIRVs, as and when resources permit. Nonetheless, despite the enduring history of the strategic competition on the subcontinent, the "tortoise" option is most likely, given the weak state of the economy and the potential negative impact of the allocation of resources for research and development on such high-cost technologies.

The first section of this essay briefly explores the impact of Indian strategic modernization programs on Pakistan's deterrence posture. The second section undertakes a brief technological assessment of the current state of Pakistan's missile capability and assesses candidate missiles amenable for MIRVing and the pursuit of additional counterforce capabilities. The third section analyzes the external and internal factors that will inform Pakistan's choices. The fourth section analyses options that Pakistan has to respond to India's pursuit of MIRVs and counterforce targeting. The final section summarizes our key arguments.

India's Strategic Modernization and Pakistan's Deterrence Posture

Open-source assessments indicate that India might follow China in MIRVing medium- and long-range ballistic missiles along with developing and flight-testing missile defense interceptors.[9] Chinese developments may have been influenced in part by parallel Indian strategic modernization.[10] As India has the capability to improve the guidance and accuracy of its missiles, counterforce targeting using enlarged and upgraded missiles is clearly within its reach. Counterforce targeting for nuclear- or dual-capable delivery systems implies warfighting roles.[11]

Pakistan is carefully watching nuclear and technological developments in India. The natural impulse of Pakistan's decisionmakers, given the intense rivalry with India, is to match destabilizing offensive technological advancements where possible by resorting to available options. Since Pakistan will have great difficulty affording missile defense deployments, the instinct to respond by increasing warhead totals and enhancing the effectiveness of existing missile systems will be quite strong. This is already being demonstrated through flight tests of improved versions of ballistic and cruise missiles.[12] A limiting factor would be prioritization and spending for conventional force modernization. In sum, Pakistan's strategic planners have hard choices to allocate resources between deterrent force developments and conventional force investment in the near future.

India's MIRVing and Counterforce Targeting Capabilities

India's strategic ambitions are to compete with China and to modernize its strategic forces under an ambitious program that demonstrates its burgeoning power-projection capabilities. These ambitions increase power asymmetries with Pakistan. India's rationale for MIRV development is predicated, in part, on the expectation that China might deploy missile defenses. As Avinash Chander, former head of India's Defence Research and Development Organisation (DRDO), explained, "our future missiles should counter the threat of interceptions."[13] A second rationale for MIRVs would be as a force multiplier.[14] From Dr. Chander's statement, we infer that Pakistan is not in the focus of Indian strategic planners because Pakistan has shown no indication of acquiring missile defenses. However, the "force multiplier" effect of prospective Indian MIRVs is certainly a factor that would not go unnoticed in Pakistan.

In April 2012, India tested the Agni-V, with a stated range of 5,000 kilometers (km). This missile was ready for induction in 2015.[15] India could begin flight-testing the Agni-VI, with greater range and payload, in 2017.[16] Dr. Chander declared that "the Agni-VI will carry a massive 3-ton warhead, thrice the weight of the 1-ton warhead that Agni missiles have carried so far."[17] Chinese analysts assessed that this test was deliberately designed not to reveal the Agni-V's actual range of 8,000 km.[18] India's announcement indicated that the system was expected to be operational in 2015.[19] Although the Agni-VI is reportedly designed to be of the same length as the Agni-V, it will be two meters larger in diameter, which will increase payload capability,[20] and will facilitate payloads for multiple warheads, whether independently targeted or not.[21]

India's pursuit of MIRVing is not limited to land-based missiles. India is developing a 4,000-km-range K-4 submarine-launched ballistic missile (SLBM) for its Arihant-class nuclear-powered ballistic missile submarines (SSBNs).[22] MIRVing the K-4 SLBM missile might be technologically challenging, but is not beyond reach with technical assistance from any of India's strategic partners. The advent of such capability will provide India with counterforce capabilities on all three legs of its triad, thus meeting India's power-projection ambitions to match China's achievements.[23] The K-15 Sagarika SLBM — which has preceded the development of the K-4 — is reportedly designed to be launched from the Arihant-class SSBN and to carry a 1,000-kg nuclear warhead to a range of 700-1,500 km.[24] Each Arihant-class submarine would be able to carry 12 K-15 missiles that would later be replaced by K-4 variants with a range of 3,500-5,000 km.[25] Each Arihant SSBN can either carry four K-4 or 12 K-15 SLBMs.[26] Three Arihant-class SSBNs are currently under construction — one at Visakhapatnam and two in Vadodara, India.[27] The first Arihant-class boat has successfully completed user trials and is ready to enter the Indian submarine fleet for operations — which signals the completion of the country's nuclear triad.[28] The build-out of India's sea-based leg of the triad is ostensibly to counter China, but it provides the capability to target Pakistan from standoff distances as well.[29]

India's emerging heavy-lift satellite launch capabilities also suggest that it has developed the basis for intercontinental ballistic missiles (ICBMs) and MIRV technology.[30] This capability was demonstrated when the Indian polar satellite launch vehicle (PSLV) in its 23rd flight successfully placed seven satellites into sub-synchronous orbit in early 2013.[31] The DRDO is believed to have made progress in developing multiple warhead technology,[32] and is geared toward equipping advanced versions of the Agni-V and Agni-VI with different MIRV configurations.[33] Presumably the number of MIRVs carried by the Agni-V and the Agni-VI and its SLBMs would, as with land-based missiles, depend on missile payloads, success in warhead miniaturization, and range.

India enjoys a head start over Pakistan in ISR and space-based capabilities, and is rapidly expanding and improving these capabilities, which have counterforce targeting ramifications.[34] This was exemplified with the launch of a dedicated military communications satellite by India in 2015.[35] In contrast, Pakistan lacks such a dedicated satellite.[36] Existing and projected asymmetries in ISR, cyber, and space capabilities[37] are likely to raise Pakistan's concerns about the viability of its strategic deterrent. Nonetheless, it will remain quite difficult for India to gain real-time targeting information on all of Pakistan's mobile missiles in order to conduct counterforce targeting.

Therefore, to achieve credible counterforce capabilities, both countries must improve targeting accuracy against hard targets and mobile targets/launchers through real-time ISR capabilities and better access to space-based assets. India is clearly ahead in this field, but still a long way from having constant, real-time surveillance of all possible mobile missile deployment areas. Pakistan lags well behind India in ISR capabilities, which makes precision-targeting ability during crisis or wartime inconceivable. To lower this gap, Pakistan might seek assistance from China, as explained below.[38]

Threat Perceptions

From a Pakistani perspective, India's evolving force posture is indicative of a palpable shift toward more counterforce targeting along with countervalue targeting.[39] Pakistan's threat perceptions will drive countervailing responses, which will also be influenced by: the modernization of the Indian Air Force; integration of the Brahmos and Nirbhay land-attack cruise missiles (LACMs) to its SU-30 and Mig-29K fleet; development of the hypersonic Brahmos-II cruise missiles; and their integration into India's nuclear submarine fleet along with SLBMs.[40]

New Delhi's advances, not just in strategic capabilities, but also as a result of access to Western technologies and arms sales, could provide the impetus for revisions to India's nuclear doctrine or a differentiated doctrine for Pakistan and for China. A number of Indian strategic analysts have expressed dissatisfaction with India's declared doctrine, including retired Rear Admiral Raja Menon, who proposes doctrinal revisions based on India's growing capabilities. In his opinion, "against China where our capabilities are undeveloped, a certain amount of ambiguity is sensible, but against a country which is openly wedded to first use, and is introducing battlefield weapons, an untended 10-year-old piece of paper is inadequate… Nuclear signaling from the Indian government is hugely overdue."[41]

India's counterforce targeting would seek to disrupt, degrade, and destroy Pakistan's ability to mobilize and deploy its strategic forces during a crisis or during warfare. The degree of intent might be measured by the extent to which New Delhi chooses to place MIRVs on its missiles, as well as by quantitative increases and qualitative upgrades in the Indian Air Force. Essentially, India's land-based and sea-based capabilities and its MIRVing options could raise concerns in Pakistan about the credibility, if not the survivability, of its deterrent.

This worst-case scenario of an all-out preemptive attack would be unlikely to succeed completely, but the correlation of surviving forces could be in India's favor, thereby deterring a Pakistani second strike. Thus, Pakistan's decisionmakers cannot be oblivious to the growth of India's MIRV and counterforce capabilities.

Those who believe this scenario to be far-fetched might recall how big a role such concerns played during the Cold War competition between the United States and the Soviet Union. While the strategic competition on the subcontinent is at a far lesser scale, the pursuit of MIRVs and added counterforce capabilities can still be destabilizing, as the state leading the competition might be perceived as having strategic and operational advantages, while the state that has fallen behind might perceive itself as being disadvantaged. MIRVed missiles also can be destabilizing if they become more attractive and time-urgent targets, prompting preemptive strikes and preventive war in a deep crisis.[42] Pakistan would carefully calibrate its responses based on assessments of India's developments.

A serious pursuit of MIRVs and counterforce capabilities requires the availability of large stocks of fissile material and the engineering potential to weaponize these stockpiles for a variety of warheads of different yields and designs. It is also possible that more than one design might be earmarked for different delivery vehicles. In our assessment, India enjoys the advantage in fissile material stockpiles, production capacities, and new fissile material production capacities.[43] Pakistan's calculus of India's existing stocks and potential for future fissile material production will be an important factor in determining its requirements for force structure, warhead totals, and fissile material production.[44]

Pakistan's Potential to MIRV: A Technical Assessment

MIRVing poses many challenges and a broad degree of technical sophistication. Should Pakistan choose to develop MIRV technology, it will face engineering and technical challenges, some of which might require assistance from external sources. Pakistan would need to design guidance mechanisms, compact warheads, and a "bus" that could carry and release multiple warheads. The miniaturization of warheads seems achievable, as is evident by the nuclear-capable, 60-km-range Nasr ballistic missile. Counterforce targeting for MIRVs would necessitate dependence on satellites and advanced ISR capabilities. Pakistani choices will be influenced by many factors, beginning with India's choices, but also Pakistan's internal situation, economic strength, and strategic partnerships.

Missile-Centric Deterrence

Pakistani engineers and scientists have had a quarter-century of experience in developing and producing ballistic missiles and cruise missiles. Pakistan's initial experience with space and missile technology began in the 1960s when the Space and Upper Atmospheric Research Commission (SUPARCO) blossomed under the guidance and stewardship of Abdus Salam and I. H. Usmani. Collaboration between the US National Aeronautics and Space Agency (NASA) and SUPARCO resulted in the Rehbar series of sounding rockets. But this series remained very basic, at best. The wars of 1965 and 1971 took a toll on both the Pakistan Atomic Energy Commission (PAEC) and SUPARCO — two premier organizations — when nearly half of their work forces, consisting of Bengali talent, left when Pakistan was dismembered and Bangladesh was created. In the 1970s and 1980s, Pakistan's focus was on development of the nuclear fuel cycle, fissile material production, and the development of nuclear weapons in the face of obstacles from the nonproliferation regime. Lack of funding compounded these problems. In the 1990s, Pakistan's focus shifted toward acquiring ballistic missiles, especially after receiving a shock when its then-principal delivery means — F-16 aircraft — was withheld by the United States as a consequence of the Pressler amendment, while India's missile programs were proceeding apace.

Over the past quarter-century, Pakistan's strategic thinking has been based on three key premises. The first is that the reliance on Western technology and arms sales is a risky strategy. The demise of the Soviet Union reduced Pakistan's strategic significance, while Pakistan's pursuit of nuclear deterrent capabilities ran counter to Western nonproliferation objectives. The second premise is that Pakistan must become self-reliant in matching India's missile threat. But achieving self-reliance takes time, and the window began to close for Pakistan. Technology transfer deals could only be struck with China and North Korea. China joined the Non-Proliferation Treaty (NPT) in 1992, and soon thereafter joined the Missile Technology Control Regime (MTCR). The third premise is that ballistic missiles would become the premier delivery means of Pakistan's strategic arsenal. Pakistan's deterrence strategy involved buying technology off the shelf to fulfill immediate requirements; the transfer of technology from China and North Korea were necessary steps toward long-term self-reliance.

Pakistan's missile quest began with the development and testing of the 80-km-range Hatf-I in 1989. In the 1990s, the focus shifted to intermediate-range ballistic missiles (IRBMs) with the acquisition of the Ghauri (Hatf-V) from North Korea by Khan Research Laboratories, and the development of the Ghaznavi (Hatf-III) and Shaheen-I (Hatf-IV) by a subsidiary of the PAEC — the National Development Complex (NDC). These missiles were earmarked for countervalue strikes inside India[45] in response to India's development and deployment of the Pakistan-specific 150-km-range Prithvi-I, the 250-km-range Prithvi-II, and the 350-km-range Prithvi-III (Dhanush), along with 700-km-range Agni-I ballistic missiles.

Pakistan's acquisition of solid fuel technology eventually led to solid propellant baselines and the foundation of future missiles. The first flight test of the Ghauri, conducted on April 6, 1998, was a failure, with the missile burning up on re-entry. Another Ghauri test a year later also ended in failure, resulting in the immediate need for a redesign of the missile's navigation and guidance system by the NDC, which merged into the National Engineering and Scientific Commission (NESCOM) — a new organization distinct from the NDC — in 2001.[46]

Pakistan's missile arsenal currently includes 11 different types of ballistic and cruise missiles:

1. Hatf-1A — 100-km range
2. Abdale — 180-km range
3. Ghaznavi — 290-km range
4. Shaheen-I — 750-900-km range
5. Shaheen-1A — 1,100-km range
6. Ghauri — 1,150-1,300-km range
7. Shaheen-II — 1,500-2,500-km range
8. Shaheen-III — 2,750-km range
9. Nasr — 60-km range

Two types of cruise missiles have been tested and deployed:

10. Subsonic Babur LACM — 500-700-km range
11. Subsonic Raad air-launched cruise missile (ALCM) — 350-km range[47]

A version of the Babur (Hatf-X) is believed to be under development and might have been tested by the Pakistan Navy from naval platforms along with other LACMs following the creation of the Naval Strategic Force Command in May 2012.[48] Among ballistic missiles, the Ghauri is Pakistan's only liquid-fueled system; all others use solid propellants. Several flight tests of each of these systems have been conducted over the past 15 years to achieve improved performance, targeting, and accuracy parameters.[49]

As ballistic missiles became the mainstay of Pakistan's deterrent strategy, fissile material production requirements gradually shifted from highly enriched uranium (HEU) to lighter and more compact plutonium-based warheads. With the advent of cruise missiles and warheads for short-range delivery systems, Pakistan's shift to plutonium production became more pronounced. The LACMs and ALCMs are now part of Pakistani strategic forces. In a few years, Pakistan is expected to field a sea-based deterrent on ships and submarines, completing the triad. In addition, Pakistan has introduced short-range, nuclear-capable missiles to respond to India's conventional force advantages with "full-spectrum deterrence."[50]

Candidates for MIRVing

Pakistan's experience in developing missiles in the past quarter-century indicates the versatility and design capabilities of its missile engineers. Assessing Pakistan's technological prowess is still difficult because all missile production information is classified. Press releases issued by the Inter-Services Public Relations (ISPR) Directorate are the primary source of information regarding the technical evolution of Pakistani missiles and improvements in their operational effectiveness in response to evolving threats. Supplementary information comes from sporadic interviews of retired scientists and research reports comprising photo-interpretation and analysis of various missile tests.[51] Our assessment is based on information in the public record.

Of the nine ballistic missile systems in Pakistan's arsenal, five are short-range — the Hatf-1A, Abdali, Ghaznavi, Shaheen-I, and Nasr. The three cruise missile systems — the Babur, Raad, and the prospective naval variant of the Babur — are also only suitable for short-range counterforce targeting. Only four ballistic missile types in the entire inventory appear to have been tested with enhanced guidance and penetration capabilities. These four are intermediate-range systems — the Shaheen-1A, Ghauri, Shaheen-II, and Shaheen-III — which possess ranges suitable for deep strikes inside India. These missiles could be utilized for countervalue or counterforce targeting. Given their payload capacity, at least two of these — the Shaheen-II and Shaheen III — are likely to have the potential to carry MIRVs.

The Shaheen series of solid-fueled ballistic missiles constitutes the mainstay of Pakistan's road-mobile, deterrent capability. The Shaheen-I was first flight-tested in April 1999, followed by newer versions — the Shaheen-1A, the Shaheen-II, and the Shaheen-III.[52] Since the 1998 tests, Pakistan has conducted more flight tests of shorter-range ballistic and cruise missiles than longer- or intermediate-range systems.[53] These tests were carried out to validate improved guidance, propulsion, and control features, along with enhanced penetration and reduced circular error probabilities. Such tests are part of the research and development process required before the army's Strategic Force Command — the repository of Pakistan's land-based missile systems — accepts new missiles for induction and deployment.

Since Indian officials announced an interest in BMD, Pakistan's declarations following some ballistic missile flight tests indicated the incorporation of advanced technologies possibly designed to defeat missile defenses. On April 25, 2012, for example, the ISPR issued a statement indicating that the 900-1,100-km-range Shaheen-1A was tested with "improved range and technical parameters."[54] Of particular note was the testing of the 180-km-range Abdali and 60-km-range Nasr short-range ballistic missiles. Following the testing of the Abdali, the ISPR declared that the missile had "varied maneuverability options," providing an "operational level capability."[55] Other ballistic missiles, such as the Shaheen-II, are reportedly equipped with a terminal guidance system, which allows for evasive in-flight maneuvers to penetrate BMD systems.[56] It is likely that these technologies will be incorporated into the Shaheen series of missiles.

Ballistic missiles can also be flown on depressed trajectories that are designed to confuse and defeat missile defense systems and achieve assured destruction of high-value targets. Depressed trajectory missiles can also be fitted with penetration aids and other countermeasures. They are also compatible with the introduction of maneuverable re-entry vehicles (MaRVs) on single-warhead ballistic missiles. However, nuclear-weapon states typically view MIRVs as the most effective method of achieving assured destruction of high-value targets.[57]

Pakistan's cruise missile programs offer better counterforce targeting options over ballistic missiles because of their ability to achieve precision strikes. Cruise missiles are difficult to detect and intercept and less expensive to build and maintain; moreover, they can carry any type of warhead with greater precision and can be quickly deployed. Launched from standoff ranges, LACMs provide greater targeting flexibility and possess "high maneuverability" to penetrate anti-missile systems while striking targets with "pin-point accuracy."[58] Pakistan views its cruise missiles as central to "counterforce precision strike capability, with or without conventional warheads."[59]

Pakistan's flight-testing of air and land cruise missiles, as well as the Nasr, implies the capability to field miniaturized nuclear warheads. The diameter of the Nasr's warhead — about 11.8 inches — suggests that Pakistan has developed an implosion-type miniaturized warhead. Given that Pakistan has maintained a nuclear test moratorium since 1998, the technical parameters of warhead designs would presumably have been validated by means of computer simulations and hydrodynamic testing — based on data accumulated from previous hot tests.

Pakistan has also advanced its in-flight maneuvering techniques for the 60-km-range Nasr.[60] According to an ISPR press release, a salvo-launch test-firing of the Nasr was conducted on February 11, 2013, in which the missile was stated to have been "specially designed to defeat all known anti-tactical missile defense systems."[61] This was an obvious reference to India's possible acquisition of anti-tactical ballistic missile systems, such as the Israeli Iron Dome that can intercept short-range incoming rockets and ballistic missiles with ranges up to 70 km. This also implies that Pakistan is determined to find countervailing responses to India's air defense systems even at short ranges.

Should Pakistan decide to MIRV, the Shaheen-II and Shaheen-III are its best candidates for MIRVing. This might entail redesigning existing warheads of these medium-range missiles, significantly improving terminal guidance systems, and ensuring the robustness of the re-entry vehicles that must rely upon heat-shielding metallurgies. After several experiments and failures, Pakistan has improved its re-entry shielding, guidance, and accuracy for its ballistic missiles. The most likely candidate for MIRVing might be the Shaheen-III ballistic missile, with a declared range of 2,750 km. Pakistani officials have explained that the range is pegged to target the farthest of India's strategic safe-havens — implying India's tri-service base at the Andaman and Nicobar Islands.[62] In our assessment, Shaheen-III is in the same league as the Agni-V. If DRDO's interest in developing a MIRVed Agni-V is realized, it is possible that Pakistan's NESCOM may be tempted to match India's achievements. The Shaheen-III's bus, however, might carry fewer warheads than the Agni-V. However, MIRVing of the Shaheen-III would require a comprehensive and extensive re-configuration of its overall design and performance parameters, which would in effect make it an altogether new version of the missile.

Pakistan's ISR Capacity and Net-Centric Warfare: An Assessment

Effective counterforce targeting, either through ballistic or cruise missiles, largely depends on reliable navigation and guidance with in-built redundancies. Emerging force-multiplier technologies in ISR, communications, and navigation may make the difference in the event of a future conflict between India and Pakistan. Technological asymmetries in favor of India have grown in net-centric warfare — gaps where Pakistan's capabilities are lacking. Pakistan is, however, working to close these gaps. On May 31, 2012, following the flight test of the Raad ALCM, the ISPR declared:

> A major additional feature of today's test was the effective employment of the National Command Authority's fully automated Strategic Command and Control Support System (SCCSS). It has enabled robust

> Command and Control capability of all strategic assets with round-the-clock situation awareness in a digitized network centric environment to decision makers at National Command Centre (NCC). The system has the added capability of real time remote monitoring of missile flight path.[63]

A similar statement was released on November 28, 2012, following the Ghauri test.[64]

Missiles typically rely on satellite-based global positioning systems (GPS) and/or inertial guidance for achieving accurate targeting. Pakistan's Shaheen-II ballistic missile (2,000-km range) uses GPS for minimizing circular error probability. Pakistani cruise missiles use inertial guidance and terrain contour mapping.[65] In the absence of an indigenous GPS system, Pakistan possibly uses commercial GPS, which means the GPS provider can switch off or deny access at any point during a crisis. In such an eventuality, Pakistan would be left with no choice but to employ inertial navigation that is built into every missile system in its inventory.

A reliable ISR architecture is considered to be an essential prerequisite for a credible delivery capability of Pakistan's operational deterrent. Open sources indicate that Pakistan has adopted China's Beidou-II satellite (BDS-II) navigation system, but it is not clear if access will be guaranteed in all situations.[66] Beidou is believed to provide more accurate navigation than available commercial systems, and can help Pakistan augment its precision-strike and counterforce targeting capabilities. This system is already providing commercial navigation services to Pakistan along with several other Asian countries, and military navigation services to Pakistan and Thailand.[67] At present, the BDS-II system is operating 23 satellites; by 2020, it is expected to double that number, improving precision by up to two meters.[68] Several of Pakistan's missile-delivery vehicles would likely switch from GPS to Beidou in due course, if this has not already occurred.

Beidou would be particularly effective for Pakistan's sea-launched cruise missiles (SLCMs). SLCMs are expected to be deployed on board Pakistan's air independent propulsion–equipped conventional attack submarines. As Mansoor Ahmed has noted, "Beidou's value will mainly be through the accurate positioning of the launch submarine rather than the guidance of the missile itself, because inertial navigation should still be sufficient for a submarine-launched weapon as long as the submarine's position is accurately determined."[69] The naval Babur is dubbed as the "custodian of the country's second-strike capability." Its utilization of the Beidou satellite network will, therefore, be of immense strategic value during a crisis.[70] Presumably, as reported in the *Kanwa Defense Review,* Pakistan

> … applies BDS-II technologies to all of its strategic assets and submarine fleet whereas the country's surface fleet will soon be able to integrate

> these technologies. The BDS-II system will therefore enable precision positioning of Pakistani cruise missiles launched from conventional submarines in mid-course of flight, which will significantly improve their overall strike accuracy.[71]

It is believed that both China and Pakistan have incorporated data from Beidou satellites in their respective military exercises. Most of the GPS-guided weaponry on the Sino-Pakistan JF-17 Thunder fighter-bombers is also supported by the BDS-II satellite system. In terms of overall targeting, the BDS-II offers coverage of all of India, which will greatly improve the accuracy of Pakistan's existing missiles and help assist in precision targeting through MaRVed and MIRVed ballistic missiles — should Pakistan choose to go down this route.[72]

Pakistan is also likely to reduce existing asymmetries in its ISR and satellite navigation capabilities under its 2040 space program, and is expected to launch its own independent satellites in orbit in the near future.[73] The development of space-based navigational and communications capability is vital to maintaining effective command and control over deployed strategic forces during a crisis and counterforce targeting involving ballistic and cruise missiles.

Internal and External Factors Informing Pakistani Strategic Choices

This section analyzes various factors that affect Pakistan's deterrence posture, including external and internal dynamics that would inform Pakistan's choices. Pakistan's assessment that India's emerging technological capability upsets the strategic balance contributes foremost to decisionmaking. Islamabad lacks sympathetic support from Western countries for technological purchases to counter the Indian threat. Consequently, for hardware purchases and technological transfers, Islamabad relies mostly on non-Western powers, primarily China. Further, oil-rich Muslim states have historically supported Pakistan's strategic weapons program. Uncertainties about whether they will be forthcoming in the future might also affect Pakistan's choices. Four intertwined factors are considered below: domestic politics and decisionmaking; diplomatic and external factors; economic and technical challenges; and perceived national security imperatives.

Domestic Politics and Decisionmaking

Since the mid-1970s, when Prime Minister Zulfiqar Ali Bhutto elaborated on how nuclear weapons would serve as Pakistan's ultimate security, preserving nuclear deterrence has been an indelible narrative in Pakistan's domestic political discourse.

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Nuclear issues are politically charged, and frank discussions on nuclear-related issues are considered sensitive. The nuclear bureaucracy tightly controls this narrative, and dissenting views are generally discouraged. Consequently, despite the emergence of a vibrant civil society and bright young scholars in recent years, debates on strategic modernization programs and alternative requirements for deterrence are matters still considered to be too technical or sensitive to be publicly debated. Pakistan's political elite would not risk their political capital by questioning the course preferred by the Pakistani strategic enclave.

The demonstration of new technology and the formal induction of tested missile systems are essentially the purview of the Strategic Plans Division (SPD) at the Joint Services Headquarters (JSHQ), which has been functional since 1999. The most important committee in Pakistan's Nuclear Command Authority (NCA) in peacetime is the Development Control Committee, which is a military-scientific body headed by the chairman of the Joint Chiefs of Staff Committee (CJCSC). The daily functioning of the Secretariat of the NCA, staffed by the SPD, is directly under the CJCSC. The CJCSC also allocates the budget of the tri-services. The locus of strategic planning and budgetary decisions, therefore, lies in the JSHQ where various strategic programs and projects are carefully prioritized. It is believed that various programs are subject to periodic reviews, given the changing strategic environment that affects force goals. The nuclear bureaucracy — the SPD and scientific organizations — work closely with the civil bureaucracy (the Ministries of Foreign Affairs, Defense, and Finance) on strategic projects. Conventional military plans rest with respective service headquarters and are coordinated at the JSHQ.

The peaceful transfer of power from the military to a civilian-led government in 2008, and between one civilian government to the next for the first time in Pakistan's history in 2013, reflects a modus vivendi between the political rulers and the military leadership on national security issues. Successive political leaders have deferred three areas to the military: foreign relations with the United States and China; regional security policy, most notably in India and Afghanistan; and strategic weapons policy and military affairs. In return, the civilian leaders have created space to pursue domestic policies and politics, complete their terms in office, and conduct regular elections. The direction of the strategic program remains the preserve of the military. Military prerogatives are perceived to be reinforced by the presumption that civilian and political leaders lack the capacity and understanding of the complex nexus of technology and nuclear deterrence. Political leaders who have *de jure* authority do not question the preference and direction of the strategic program determined by the military. Across the political spectrum there is an informal consensus that nuclear issues are best left to the most robust institution in the country. There is scant public questioning of nuclear force goals and requirements, budgetary costs, and tradeoffs with other strategic programs or other areas of national power. If debates occur, they are held *in camera*.

Diplomacy and External Factors

The lack of sufficient resources, the existence of technological barriers, and the export control restrictions of supplier states affect Pakistan's technological progression. Political friction with the West has been a constant shadow over Pakistan's nuclear ambitions, exacerbated by the legacy of the A. Q. Khan proliferation network. Consequently, Pakistanis perceive China to be their only reliable and steadfast ally. Despite internal security predicaments, economic challenges, and external handicaps, Pakistan has shown resilience in meeting its strategic needs. Taken together, ongoing geostrategic shifts, technological challenges, and the absence of any strategic restraint arrangements with India have resulted in continued increases in Pakistan's strategic capabilities.

Pakistan's predicament is accentuated by the limited options available to acquire state-of-the-art conventional weapons from supplier states. India's strategic partnership with the United States, its large market, and fast-growing economy place Pakistan at a growing disadvantage. India has the purchasing power to choose from Russian, French, Israeli, and, more recently, US military equipment. India also has a booming domestic defense industry now buttressed by pledges of technology transfers in high-tech areas. Pakistan does not have the market or the economy to match India's growing conventional counterforce capabilities that relieve pressures to employ battlefield nuclear weapons.

US arms sales to Pakistan continue, but are diminishing and subject to congressional opposition. Russia has lately shown interest in commercial arms sales, but China is increasingly the only major power upon which Pakistan can rely. India's strategic development provides common ground to determine countervailing responses. Oil-rich Muslim states in the Persian Gulf and the Middle East have been traditionally sympathetic to Pakistan's quest for a nuclear deterrent after India conducted its first nuclear test in 1974, when Islamabad faced sanctions and a Western-led nonproliferation regime. The Islamic world

Pakistan's inclination is to match or compensate for every military-technological development in India.

has changed greatly since then, and Pakistan is unlikely to receive the same kind of "Islamic brotherhood" support as in the past.

Economic and Technical Considerations

Pakistan's economy, while improving, suffers from many deficiencies, including a poor tax base. Nonetheless, defense programs will continue to be a high priority. Sunk costs will not diminish prospective costs to maintain and upgrade Pakistan's strategic forces. If Pakistan decides to MIRV some of its ballistic missiles, added costs will be incurred. The weakest technological link, as indicated above, is in the realm of ISR, which suggests dependence on external sources. As observed by Toby Dalton and Michael Krepon, "India's conventional military capabilities are forecast to grow relative to Pakistan's, whereas Pakistan's nuclear capabilities are forecast to grow relative to India's."[74] The United States' silent encouragement of India's strategic ambitions to challenge China further incentivizes China to deepen strategic relations with India's neighbors, especially archrival Pakistan.

National Security Imperatives

India and Pakistan have been embroiled for decades in mutual rivalry and distrust. Their competition has not diminished over time and has evolved with geostrategic shifts resulting from the rise of China and the US decision to rebalance its posture to the Asia-Pacific region. The latter has catapulted India into a lynchpin role in the emerging geopolitical balancing game in Asia. The drawdown of US forces from Afghanistan, the reduced threat of al Qaeda, and the relaxation of US tensions with Iran also point toward a gradual fading of Pakistan's significance to US national security policies.

Pakistan's sense of vulnerability is growing along with the reduced US footprint in Afghanistan and its strategic engagement with India. India is investing in the modernization of its military far more than Pakistan. Pakistan's security managers are convinced that India will find Pakistan vulnerable as it struggles to balance multiple security contingencies from within and lacks resources to compete with India's growing conventional capabilities. Left with few choices, Islamabad thus relies on nuclear weapons to offset conventional force imbalances and on China to secure external balancing as a source for political and strategic succor. Pakistan's nuclear history is awash with defiance of the West, dependency on China, and financial support from Saudi Arabia and, at times, other Muslim countries. Given Pakistan's history, security considerations will likely trump all other considerations.

Pakistan's Choices

The past five decades have shown that India and Pakistan have been locked in an action-reaction syndrome. India and Pakistan have operationalized their respective deterrents and are building triads. Even as both countries profess a doctrinal posture of credible minimum deterrence, they continue to develop capabilities that demonstrate an emphasis on maintaining and enhancing credibility rather than on minimalism. In Pakistan, this is characterized as a full-spectrum deterrence posture. In the event that India pursues MIRVs and BMD, Pakistan has three options, described below.

The "Ignore" Option

To ignore India's MIRV and BMD developments would be a major departure from Pakistan's traditional approach toward national security. Pakistan's inclination is to match or compensate for every military-technological development in India. What factors might result in such uncommon restraint — other than a significant shift in the civil-military balance, which is not likely in the near term?

First, Pakistan would need to have sufficient confidence in the survivability of its strategic deterrent and its sufficiency to dissuade India from undertaking risky initiatives. Second, economic resources would need to be deemed insufficient for a costly undertaking to MIRV ballistic missiles and add significantly to counterforce targeting. As an alternative, Islamabad could simply decide to rely on existing capabilities that would provide a mix of countervalue and counterforce targeting. Third, Pakistan could decide to rely increasingly on China for assurance in the event of a war with India. Fourth, Pakistan could decide to respond to Indian MIRVs and BMD with the accelerated production of single-warhead ballistic and cruise missiles, while taking additional steps to increase the survivability of its deterrent, such as the multiplication of missile storage sites. Mixing real with dummy sites would complicate India's targeting ability. Fifth, Pakistan could add to its stockpiles of TNWs and short-range systems to complicate India's military plans. With Pakistan retaining capacity to devastate major cities with countervalue targeting, its deterrence posture would deny India a war-winning capability or advantages in a limited war scenario. In terms of nuclear diplomacy, Islamabad could offer yet another strategic restraint regime proposal to India to include the mutual prohibition of targeting military nuclear facilities.

The ignore option might or might not allow Pakistan to escape the trap of an arms race with India. As noted above, Pakistan could decide to ignore MIRVing, but still engage in an increased competition by other means. Nor is it clear that Pakistan would gain diplomatic benefits, such as entry into the Nuclear Suppliers Group (NSG), by opting not to MIRV some of its ballistic missiles. Pakistan's insecurities would persist as long as India continues to proceed with major conventional force deployments on its western border, increasing its capacity to launch a surprise attack and modernizing weapons that are clearly more Pakistan- than China-specific.

Given the domination of the military-bureaucratic-scientific enclave in Pakistan, and Pakistan's history of competing with India in nuclear capabilities, the ignore option is unlikely. If India is perceived as gaining advantages from MIRVing, Pakistan is likely to MIRV as well if resources permit.

The "Tortoise" Option

This option presumes that, given the history of strategic competition, Pakistan will likely match India if it flight-tests and inducts missiles carrying multiple warheads, but at a measured pace. Rather than sprinting to acquire technologies, which would require dependency on external sources, greater budgetary outlays, and increased international pressure, Pakistan might choose to take a long view of the emerging Indian threat. By choosing this option, Pakistan would be cognizant of India's significant advantages in resources, indigenous technological base, and access to Western technological cooperation. In contrast, Pakistan is dependent on only one reliable defense supplier — China — and lacks comparable purchasing power. In this option, Pakistan would decide on a middle course of slow, but steady, technological acquisition and indigenous development.

The choice of a middle course would be dictated by resource constraints, including available stockpiles and production rates of fissile material. With 11 different nuclear-capable means of missile delivery, Pakistan has to make tough choices in distributing its fissile material resources. According to a Princeton University study, Pakistan might face natural uranium constraints in the absence of foreign supplies and fresh discoveries at home. This study estimates that by 2020, Pakistan will have accumulated about 450 kg of weapons-grade plutonium from the four production reactors at the Khushab Complex.[75] This would be sufficient for perhaps 90 warheads,[76] which would have to be distributed on a priority basis among delivery vehicles. MIRVing would multiply the number of warheads. In the absence of additional fissile material production, constraints on warhead allocation would grow. Advanced compact warheads for MIRVs would necessarily compete with warheads for short-range ballistic and cruise missiles — particularly the Nasr, Babur, Raad, and Abdali. If a projected Pakistani nuclear arsenal includes perhaps 200 miniaturized warheads, this might require at least 800 kg of weapons-grade plutonium.[77] Pakistan, unlike India, is disadvantaged with respect to existing stocks of weapons-grade plutonium.[78] This factor, among others, suggests the tortoise option.

By choosing the tortoise option, Pakistan could still employ countervailing strategies to defeat the twin threat of Indian MIRVs and missile defenses.[79] Pakistan's strategic deterrent would still pose a threat to India if, first, it were to employ increased dispersal and a higher state of readiness. Second, Pakistan could increase production of missiles carrying single warheads. Third, Pakistan could undertake less costly countermeasures to assure penetration and destruction of Indian targets. For example, Pakistan's strategic forces could: employ depressed trajectories for ballistic missiles; rely increasingly on cruise missiles; resort to simultaneous launches; develop maneuvering re-entry vehicles that are not MIRVs; increase electronic warfare capabilities; and acquire rudimentary stealth technologies. Pakistan will most certainly undertake countermeasures such as decoys and chaff. All of these steps could be taken while the technological maturation of MIRVs occurs at a measured pace.

An increased reliance on cruise missiles seems likely, whatever option Pakistan chooses. In this respect, the Babur and the Raad are likely candidates for technological upgrades, and strategic planners might choose to also add supersonic capabilities to match India's Brahmos missiles. Cruise missiles are less vulnerable to missile defenses and can strike with greater precision and accuracy.[80] If Pakistan chooses this option, it can deploy cruise missiles in greater numbers than ballistic missiles on a variety of platforms, thus making it more difficult for India to degrade or decimate Pakistan's strategic forces or its command and control system.

The "Hare" Option

Pakistan could also opt for the hare option, but this would necessarily entail the increased production of fissile material. Under this option, Islamabad would spend and do what it takes to deploy MIRVs as quickly as possible. In responding to India's capability in MIRVs and to counter prospective Indian BMD deployments, a number of steps included in the tortoise option could also be pursued in the hare option. The hare option is most likely if security managers conclude that the strategic balance would tilt in India's favor, making New Delhi more inclined toward risk-taking. Strategic planners would then, as discussed

> If Pakistan places multiple warheads atop some of its ballistic missiles, they will likely be deployed in limited numbers as a result of fissile material and financial constraints.

earlier, be likely to task scientific organizations — NESCOM and SUPARCO — to develop an adequate response to the DRDO in four key areas. First would be Pakistan's satellites and ISR capabilities. Second would be improved missile guidance capabilities. Third would be further development of compact nuclear warheads. Fourth would be developing a missile bus that could carry the independent miniaturized warheads for multiple targeting — and to develop synergies in all the identified areas.

History also informs us that Pakistan's scientific organizations are always ready to be challenged. Scientific pride and Pakistani strategic culture, coupled with the urgency to neutralize a perceived existential threat, prompt competition with India. Resources have not been a constraining factor. In the early 1990s, Pakistan quickly matched India's quest for ballistic missiles, initially with help from China and North Korea, before being able to attain indigenous capabilities. Pakistan also demonstrated to the world its resolve to produce fissile material, particularly by significantly increasing its plutonium production capacity. Characterized by some as the "fastest-growing" nuclear arsenal in the world — a label Islamabad resents and contests — Pakistan has shown a dogged resolve in the face of opposition to pursue full-spectrum deterrence.

The hare option would mimic the US choice of expanding its arsenal without greatly expanding the number of its delivery vehicles. In addition to MIRVing, Pakistan is likely to marginally, but not significantly, increase the number of its delivery vehicles and transporter-erector launchers.[81] Pakistan might raise no more than a few additional batteries to enhance survivability and redundancy. Since India's primary purpose of fielding the Agni-V and Agni-VI with MIRVs would be oriented toward China, Pakistan would hope that this would incentivize Beijing to bolster its ally. China could offer its ISR and satellites to assist Pakistan where necessary. Beijing could send this signal to New Delhi in indirect ways, especially if the United States chooses to share missile defense technology with

India. For Pakistan to become self-reliant in ISR and complimentary technologies, China is the most likely and only source on which it can rely.

If Islamabad decides on the hare option, it will encounter resource and technological challenges. Pakistan will have to divert resources from other priority projects and also face criticism from the international community. Pakistan's acquisition of MIRVs and hard-target-kill capabilities on a rapid course is likely to draw far more attention than India's strategic modernization programs. Islamabad would have to brace for such criticism.

The hare option is fraught with obstacles and risks for Pakistan at a time when it wants to be recognized as a legitimate, normal, *de facto* nuclear power like India. Islamabad is struggling to counter India's efforts to prevent Pakistan's entry into the NSG. It is trying to project an image as a responsible nuclear power, making significant efforts on nuclear security and safety while tightening export and custodial controls. Pakistan's utmost desire is to be treated on par with India. Islamabad would rather avoid spending additional sums for Pakistan's nuclear program in addition to avoiding additional challenges to its nuclear legitimacy. Further, this option requires significant help from China that is not assured — especially during periods of crisis — given China's evolving strategic outlook and priorities in the world.

Conversely, if Pakistan seems unlikely to gain legitimacy via NSG membership, and if it is unlikely to secure equal treatment to India as a "mainstreamed" nuclear state, then there would be no incentive for self-restraint if India were to embrace MIRVs and BMD. Pakistan's strategy would also be contingent on other variables, such as budget constraints, technological challenges, and the willingness of friends to extend financial or technical cooperation.

Conclusion

A constant feature of Pakistan's evolving nuclear posture is to cope with — and match — India's strategic modernization programs. Pakistan is convinced that India will endeavor to be able to checkmate Pakistan's strategic deterrent and punish Pakistan in a short, decisive conventional war. Pakistan's defense posture is designed to negate New Delhi's options. Nuclear weapons play an essential role in negating Indian conventional and nuclear military options. Islamabad has consequently shifted its nuclear posture from minimum credible deterrence to credible minimum deterrence to full-spectrum deterrence.

If India proceeds with MIRVs and BMD, Pakistan would feel compelled to diversify its delivery methods and develop penetration aids. Pakistan is also likely to flight-test the release of multiple warheads on some of its ballistic missiles.

These warheads could be unguided, maneuverable, or independently targetable. It is also likely to expand its inventories of cruise missiles. If Pakistan develops capabilities to place multiple warheads atop some of its ballistic missiles, they will likely be deployed in limited numbers as a result of fissile material constraints in addition to other inhibiting factors, including financial resources.

Pakistan's most likely strategic trajectory will be geared toward completing its triad and maintaining the effectiveness and robustness of existing capabilities. MIRVs could be a cost-effective way to achieve these objectives, without trying to match Indian ballistic-missile-carrying submarines or aircraft carriers. If pressed by India, Pakistan is likely to move toward multiple-warhead missiles — but not before it is able to achieve the best bang for the buck through improvements in its existing missile capabilities, especially its cruise missile program. This is not likely to be for power projection, but to deny India strategic advantages that it might seek to exploit, and to maintain the credibility of Pakistan's deterrent in the face of evolving threats.

Under these circumstances, it is inconceivable that Pakistan will ignore India's pursuit of MIRVs and BMD. If India flight-tests MIRVs or deploys limited BMD, the only question is whether Pakistan will choose the tortoise or hare option. Pakistan's dilemma is to contest India's strategic modernization programs and yet avoid engaging in a debilitating arms race. But given the choice of negating India's options or avoiding an arms race, Pakistan will choose the former. In our assessment, Pakistan will continue to factor in the evolving nature of technological asymmetries with India, and is likely to respond to the extent that it can in terms of available resources. We conclude that, based on past experience, and keeping in view the emerging imbalance in resources and access to technology, Pakistan's most likely choice when faced with the prospect of Indian MIRVs and limited BMD will be the tortoise option.

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Commission (NESCOM) under whose wings other organizations were also brought in, such as the Air Weapons Complex (AWC), the Project Management Organization (PMO), and the Maritime Technology Organization (MTO). Therefore, in 2001, about several hundred employees of the NDC were shifted from PAEC to NESCOM, and Dr. Samar Mubarakmand, who served as director and then director-general of NDC from 1990-2001, was appointed as the founding chairman of NESCOM in 2001, and continued there until 2007. Ibid.; Usman Ansari, "Pakistan Ballistic Missile Test Failed," *Defense News*, December 3, 2012, http://archive.defensenews.com/article/20121203/DEFREG03/312030008/Pakistani-Ballistic-Missile-Test-Failed; and "North's Missiles Tied to Musharraf's Blunder," *Japan Times News*, January 28, 2013, http://www.japantimes.co.jp/news/2013/01/28/asia-pacific/norths-missiles-tied-to-musharraf-blunder/#.Vd4aw3h4mDp.

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LOOKING AHEAD

Michael Krepon

Summing Up and Looking Ahead

The triangular nuclear competition among China, India, and Pakistan has been marked by increased numbers of ballistic and cruise missiles, the building out of nuclear triads, and — for India and Pakistan — the growth of fissile material production capacity. This competition will accelerate with the advent of multiple warheads atop some of China's missiles. India and Pakistan are likely to emulate China, but unlikely to match its warhead increases. Stockpile growth is likely to be a small fraction — perhaps 200 warheads or less over the next 10-15 years — rather than thousands, as was the case during the first nuclear age. Even so, the introduction of multiple-warhead missiles will complicate and accelerate nuclear competition in Asia and raise the salience of nuclear weapons during the second nuclear age.

The extent of these negative ramifications will depend on the motivations behind placing multiple re-entry vehicles (MRVs) or multiple independently targetable re-entry vehicles (MIRVs) atop missiles based on land and, in the case of China and India, at sea. The extent of MIRVing in the first nuclear age reflected the intensity of the superpower competition. In contrast, China's decision to place multiple warheads on missiles has lacked a sense of urgency, arriving at least two decades after Beijing's ability to do so. India's leaders have acted in a similar relaxed manner, reflecting a healthy degree of skepticism about the military utility of nuclear weapons.

An important question raised by the essays in this book is whether the second coming of multiple-warhead missiles will alter the views of Chinese and Indian leaders toward nuclear weapons. So far, Beijing and New Delhi have appeared disinterested in expanding counterforce targeting options. They will, however, be able to supplement countervalue with counterforce targeting as their warhead totals rise and their missile accuracies increase. If added nuclear capabilities result in a steady progression toward counterforce targeting, then the negative ramifications resulting from the advent of multiple-warhead missiles in Asia will be open ended. If Beijing and New Delhi continue to resist the lure and pitfalls of MIRVs and counterforce targeting, then dampening effects are possible — more so if the decisions to incorporate multiple-warhead missiles into arsenals are made with clarity regarding downside risks, and if the deployments proceed slowly.

This chapter contrasts the powerful motivations behind decisions to flight-test and deploy MIRVs on a large scale during the first nuclear age with the considerations facing national leaders in China, India, and Pakistan over how extensively to invest in multiple-warhead missiles in the decades ahead.

US Motivations for MIRVing in the First Nuclear Age

In the United States, governmental and public debates over MIRVs (and ballistic missile defenses, which were being readied for deployment at the same time) were intense and well informed.[1] The founding fathers of strategic arms control — including Hans Bethe, McGeorge Bundy, William C. Foster, Carl Kaysen, John J. McCloy, George Rathjens, Gerard Smith, Jerome Wiesner, and Herbert York — took issue with Donald Brennan, John S. Foster, Jr., Henry Kissinger, Melvin Laird, Paul Nitze, and Albert Wohlstetter, among others. Key officials in the Nixon administration faced off against their predecessors in the Kennedy and Johnson administrations. Powerful senators — Edward Brooke (R-MA), William Fulbright (D-AR), Al Gore, Sr. (D-TN), Henry M. "Scoop" Jackson (D-WA), Edmund Muskie (D-ME), John Stennis (D-MS), and Stuart Symington (D-MO), to name a few — built cases pro and con through exhaustive hearings and floor debates. The American public was paying attention. The debaters were worthy of the stakes involved. No arms control debates before or since were so well informed and so consequential.

US debates did not provide crystal-clear answers about the motivations behind MIRVs because advocates offered up many reasons in order to see which ones would have maximal effect. These arguments shifted and some of the debaters contradicted themselves. Reflections offered after MIRVs were left unconstrained by the Strategic Arms Limitation Talks (SALT I) Interim Agreement in 1972 were in some cases too convenient to fit the facts.

One argument for MIRVs was not offered in public hearings or floor debate, but was ever-present in the Nixon White House's calculations. President Nixon and National Security Advisor Kissinger complained bitterly about harassment from doves, but they were even more bothered by the prospect of harsh critiques from hawks. They knew that to forgo MIRVs would result in firestorms in the Pentagon and on Capitol Hill.[2]

In addition to private political considerations, there were five main public arguments for letting MIRVs run free in SALT I. The first was negotiating leverage. In testimony before the US House Armed Services Committee on US military posture in 1969, the Pentagon's director of defense research and engineering, John Foster, argued: "If we find through arms control talks or by following Soviet deployments over an extended period, that they are not trying to protect their cities against us, then our hedge, the MIRV, could become the subject of proper negotiations."[3] Foster, who was the Pentagon's point person in these debates, also made the argument in congressional testimony that the effect of MIRVs would be "to help the US position in the SALT talks."[4]

Kissinger also strained to make an arms-control rationale for MIRVs while testifying on behalf of the SALT accords on June 15, 1972:

> By setting a limit to ABM [anti-ballistic missile] defenses the treaty not only eliminated one area of potentially dangerous defensive competition, but it reduces the incentive for continuing deployment of offensive systems… Beyond a certain level of sufficiency, differences in numbers are therefore not conclusive… Therefore, too, if we can move into the second phase of SALT, into an explicit recognition that both sides will stay away from counterforce strategies… then perhaps the premium on MIRVs will be reduced because… MIRVs were developed at first as a hedge against ABM.[5]

This rationale was strongly contested. The US chief negotiator during SALT I, Gerard Smith, did not find MIRVs helpful to the negotiating process. Instead, his memoir recounts a complicated, well-choreographed dance to allow MIRVs to run free:

At Vienna, an ingenious and disingenuous MIRV mismatch was proposed by the two sides. The American approach would have banned deployments of MIRVs, but permitted the United States, with MIRVs fully tested before a treaty was signed, to continue to produce and stockpile them… The Soviet proposal called for an unverifiable ban on MIRV production and deployment but would allow them to test MIRVs. Cynics might suspect *sub rosa* cooperation between two parties unwilling to give up MIRVs but anxious to appear to be in favor of outlawing them.[6]

A second rationale for MIRVs was penetrating Soviet missile defenses. As Foster testified before the House Armed Services Committee in 1969, "We have to hedge against the installation of a Galosh or improved ABM around a number of cities. Also, we are still concerned about the capabilities of the Tallinn system. That system employs a number of interceptors which would be converted to an ABM capability in addition to their anti-aircraft role."[7]

Secretary of Defense James Schlesinger testified before the Senate Foreign Relations Committee on March 4, 1974, that the entire rationale for MIRVs hinged on Soviet ABMs:

> Senator Stuart Symington: Why do we need MIRV in the absence of ABM deployment on the part of the Soviet Union?
>
> Secretary Schlesinger: We do not.
>
> Senator Symington: We do not need it?

> Secretary Schlesinger: We do not. We would not deploy it in the absence of ABM. The reason for doing R&D on MIRV is to prepare against the contingency that they might decide to break the treaty. We would then have the means of penetrating ABM defenses. It is our belief that, if they know we can penetrate such defenses, any desire they may have to upset the treaty will be further reduced.[8]

Schlesinger's testimony is at odds with the thinking of most advocates for MIRVs. The standard case in favor of flight-testing and deployment was partially, but not entirely, based on penetrating Soviet ABMs and hedging against their possible appearance.

A third argument in favor of MIRV flight-testing and deployments had to do with verification difficulties in monitoring a MIRV ban. Advocates of MIRVing argued that the United States could not know for sure whether the heaviest Soviet missile, the SS-9, might have already been flight-tested with MIRVs instead of with three unguided MRVs. And even if the Soviet tests were forerunners of MIRVs but not actual MIRVs (which was, indeed, the case), proponents argued that this Rubicon had already been crossed. As Foster testified before the House Foreign Affairs Committee, "We must consider the possibility that the SS-9 triplet might be deployed on the basis of further extensive ground tests and without further flight tests."[9] Secretary of Defense Melvin Laird added to this obfuscation in his testimony during the SALT I hearings in 1972 by saying, "I have never gotten into the semantics of whether the MRV they have tested had an independent capability. I don't think there is any sense in getting into that discussion."[10]

A fourth motivation for MIRVing was the challenge posed by Soviet strategic modernization programs. When asked about the choice of a MIRVed or an un-MIRVed world in Senate Foreign Relations Committee hearings, Deputy Secretary of Defense David Packard argued, "I do not see that it would make any significant difference."[11] This answer makes sense only under the presumption that the Soviet challenge was immutable.

The Senate's Permanent Investigating Subcommittee, whose most influential member was the formidable Senator Henry M. "Scoop" Jackson, advanced a similar argument in a 1968 report: "If this [MIRVs] is within our technological capability and our resources, then prudence surely dictates that we assume that it is also within the technological capability and resources of the Soviets."[12]

Senator Jackson was the strongest opponent of floor amendments that tried to close the door on MIRVs before and after the SALT I accords were negotiated. In his view, Soviet advantages in land-based missiles could place the United States at a significant disadvantage with MIRVing. For Jackson and other hawks, this was not an argument to ban MIRVs, but for the United States to get a head start: "The Soviets start out with 50 percent more launchers and 400 percent more throw weight, so if they proceed with an aggressive MIRV program … they can gain a lead that we could not diminish because we have a much, much smaller base."[13]

A fifth motivation for MIRVs in the United States, related to the fourth, was shoring up a deterrence strategy based on persuasive nuclear warfighting requirements. The advent of MIRVs and increased accuracy would allow the Pentagon to place a wide variety of Soviet targets at risk. If, as a result, US nuclear capabilities failed to deter the Kremlin, they could then limit damage to the United States in the event of nuclear exchanges.

Secretary of Defense Robert McNamara removed the veil of secrecy from MIRVs in an interview published in *Life* magazine in September 1967. He offered several rationales, including cost-effectiveness and the ability to "overcome the most powerful defenses the Soviet could build." He added:

> More important, we're capitalizing on a major new technological advance. We can now equip our boosters with many warheads, each of which can be aimed at a separate target… We believe that we have a substantial lead over the Soviets in this important technology. Through the use of MIRVs, we will redesign our strategic force to increase the total number of warheads. This will do two things: exhaust their defenses and at the same time better match the size of weapons to the targets to be destroyed. The net result will be an increase in military effectiveness with some reduction in the total megatons of our force.[14]

Albert Wohlstetter stressed this rationale in his testimony before the Senate Armed Services Committee in 1969, saying, "Contrary to the popular belief, MIRVs are not a reaction to ABM. MRVs… not independently aimed are a counter to ABM. MIRVs are a reaction to dispersed, vulnerable targets… It has to do with cases where a dispersed target system presented excessively tempting targets, if you could divide your payload."[15] Ron Tammen's contemporaneous account, *MIRV and the Arms Race*, reaches a similar conclusion: "The MIRV concept for Minuteman was formulated in 1962-3 as an economical means of increasing target coverage of the ballistic missile force."[16]

Which of these rationales most influenced the Nixon White House? Why did the Nixon administration open the floodgates to MIRVs when it was clear that the Kremlin would follow suit, effectively ruining prospects for serious strategic arms limitation for almost two decades?

Domestic politics had something to do with this result, because Nixon and Kissinger could not oppose the Pentagon and its allies on Capitol Hill on both MIRVs and national ballistic missile defenses. Missile defenses had only "lukewarm" support in the Pentagon, whereas MIRVs had "passionate" defenders.[17] To ban MIRVs while strictly limiting national missile defense, as doves wanted, would have created serious difficulties for Nixon and Kissinger. But Nixon and Kissinger crossed hawks on other issues, such as opening diplomatic relations with "Red" China and giving up on nationwide ballistic missile defenses. Domestic politics mattered in the MIRV decision, but politics was not the overriding reason why the Nixon administration chose to MIRV or to MIRV to such an extent.

Verification concerns also played a part in the decision to let MIRVs run free, but they were hardly decisive. A ban on further flight-testing of multiple reentry vehicles would have been politically taxing, but feasible from a monitoring perspective without requiring on-site inspections. The Arms Control and Disarmament Agency's blue ribbon General Advisory Committee, chaired by the formidable John J. McCloy, advised the Nixon administration to this effect.[18] Verification difficulties were not the driver here; freedom of action was. Hard-liners in Washington (and Moscow) debated the pros and cons of MIRVs quite seriously. It would have taken a strong-willed partnership to ban them, and Washington was unwilling to take the lead. The dance of the veils that Washington and Moscow choreographed in the SALT I negotiations was purposefully designed to avoid a ban on MIRVs.

A halfhearted reason for letting MIRVs run free was to secure bargaining leverage for subsequent negotiations, but this was a risible excuse. The worrisome ramifications of MIRVs could be easily foreseen and, besides, Washington and Moscow were not about to cash in bargaining chips during the Strategic Arms Limitation Talks. Bargaining chips only became expendable 15 years after SALT I allowed MIRVs, when Ronald Reagan and Mikhail Gorbachev were willing to trash orthodoxy in nuclear deterrence and escalation control.

Technological drivers explain the timing of MIRVs, and competing laboratories — domestic as well as foreign — help explain the procession of warhead designs that followed. But technological determinism and vested domestic interests are not persuasive in explaining the resulting profusion of warhead totals, propelled by MIRVs, which boosted superpower arsenals past the 10,000-weapon mark.

Of the many motivations behind MIRVing in the United States, two had the most propulsive effect: responding to challenging Soviet strategic modernization programs and embracing counterforce targeting. The latter served three interlocking purposes: bolstering deterrence, responding to executive nuclear warfighting plans, and limiting damage to the United

States in the event of a failure of deterrence. These drivers shifted the superpower competition into overdrive. Robert McNamara and arms controllers opposed to ballistic missile defenses assumed that the "action-reaction" phenomena would be propelled by parallel offensive and defensive moves. But the propulsive effect of MIRVs was so great that the superpower arms race continued to accelerate even when national missile defenses were foreclosed by the Anti-Ballistic Missile Treaty.

Retrospective laments about MIRVs by those who enabled their proliferation were lacking in candor. The most memorable was voiced by Kissinger in a press background briefing after negotiating a tentative follow-on agreement to the SALT I Interim Agreement at Vladivostok in 1974: "I would say in retrospect that I wish I had thought through the implications of a MIRVed world more thoughtfully in 1969 and 1970 than I did."[19] Kissinger offered a variant of this retrospective judgment during hearings on the Vladivostok Treaty.[20] The best Kissinger could do in the two-year interval after SALT I was to top off MIRVing at 1,320 land- and sea-based strategic nuclear delivery vehicles. Even this was deemed to be unacceptable by hawks in the Ford administration and on Capitol Hill.

In truth, Kissinger and every other key participant in the fateful decision not to seek a ban on MIRVs in SALT I knew full well what the consequences would be: a large increase in warhead numbers, concerns about land-based missile vulnerability, and an acceleration of the strategic arms race. The 1974 Vladivostok Accord (which set limits of 1,320 MIRVed land- and sea-based ballistic missiles) clarified the predictable ballooning of warhead totals resulting from the failure to ban MIRVs.

Nixon and Kissinger factored in the risks of letting MIRVs run free and found these risks to be acceptable — or at least more acceptable than not proceeding with MIRVs. As Nixon's secretary of defense, Melvin Laird, later wrote in *International Security*:

> MIRVs were a relatively low-cost means for modernizing our strategic missiles in the near term. They would provide us with a larger number of surviving warheads in the event of a first strike and, in addition, a needed hedge against the ABM system the Soviets were deploying, without requiring us to embark on a costly expansion of our missile forces. In short, MIRVs were the only feasible option available for response to an expanding Soviet threat, given the hostile attitude of many members of Congress toward defense spending.[21]

MIRVs were not just cost-effective counters to BMD; they were also cost-effective counters to Soviet missile modernization programs. Removing the first rationale did not diminish requirements for the second. As Kissinger wrote in *The White House Years*, MIRVs were "crucial" and "our counterweight to the growing Soviet numbers."[22] New Soviet missiles were coming off production lines at a rate of 200-300 per year during the SALT I negotiations.[23] Without MIRVs, the Nixon White House believed that the United States would have been outcompeted by the Kremlin, badly undermining US security while damaging the country's international standing and alliance management.

The proliferation of MIRVs and the advent of prompt hard-target-kill (HTK) capabilities were inseparable drivers. Their combined effect significantly altered and undermined calculations of strategic stability. MIRVs meant that second-strike, retaliatory capabilities would grow significantly, but this was scant comfort because first-strike capabilities also would grow precipitously. The superpower competition rose to new heights with vastly expanded targeting lists.

MIRVs were a signature feature of the first nuclear age, figuring prominently in the death of the SALT process. As William Hyland, a close confidant of Kissinger, wrote in *Mortal Rivals*:

> Refusal to ban MIRVs was the key decision in the entire history of SALT I. Both Nixon and Kissinger thought it would be a weak move at the outset of a new administration and the opening of a long negotiation. And it would have provoked a bloody fight inside the administration and in the Congress. It was a truly fateful decision that changed strategic relations, and changed them to the detriment of American security. But I doubt that Nixon and Kissinger could have forced through the Pentagon both a ban on MIRVs and a sharp limit on ABMs, and then persuaded the Soviets to agree.[24]

Soviet Motivations

The Kremlin's motivations for pursuing MIRVs with a vigor that matched the Pentagon's are not well documented in the public domain. For this reason alone, we are beholden to Alexey Arbatov and General Vladimir Dvorkin for their essay in this book. Pavel Podvig characterizes internal debates over strategic modernization in the 1960s and 1970s as a "small civil war."[25] Both Podvig and Steven J. Zaloga,[26] as well as Arbatov and Dvorkin,[27] suggest that this "civil war" was mostly about what design bureaus would receive which pieces of the very large pie that the Kremlin authorized in order not to be disadvantaged by US technological advantages in both the offensive and defensive sides of the strategic equation. As these concerns were outsized — especially with respect to missile defenses — the Kremlin habitually overspent to keep pace.

The driving impulse behind Soviet MIRVing, described by Arbatov and Dvorkin, was to catch up and keep pace with the Pentagon's offensive strategic advances: "The USSR [Union of Soviet Socialist Republics] was largely following the lead of the United States in the development and deployment of major strategic weapon systems, trying to catch up with the opponent after each American 'jump' forward in the arms race and to negate its attempts to gain strategic advantages."[28]

In the United States, a system of checks and balances, including a closely divided Congress on these matters, resulted in costly strategic modernization programs with damaging consequences for arms control. The Soviet system could hardly decide otherwise, as there were no checks and balances relating to budgetary outlays and nuclear warfighting requirements. As Arbatov and Dvorkin write, decisionmakers "were the captives of the defense establishment."[29] This imperative was no doubt reinforced by deep concerns over prospective US ballistic missile defense deployments — anxieties that that have not diminished with the passage of time, despite enduring technical challenges. Chinese strategic analysts now share Soviet/Russian concerns about breakthroughs in US missile defense technologies.

There is scant evidence that the downside risks of MIRVing for the prospects of arms control were seriously debated in the Kremlin. If anyone had the temerity to offer such arguments, one can imagine a rejoinder much like that offered by Deputy Secretary of Defense David Packard who, as noted above, testified that restraint would not be reciprocated. It would have been as hard for the Kremlin as it was for the Nixon White House to ban MIRVs while strictly limiting national ballistic missile defenses in SALT I. Both superpowers were feeling their way in an entirely new and heavily freighted negotiation. There were insufficient grounds to gamble on bold steps to limit both strategic offenses and defenses.

Moreover, it was inconceivable for the Kremlin to take the lead in negotiations to forgo MIRVs. The Nixon administration shaped the contours of the SALT I negotiations; Moscow reacted to Washington's proposals. The Kremlin entertained radical proposals only when the financial consequences, the strategic arms race, and the weaknesses of the Soviet economy became painfully apparent. If the Kremlin was to be persuaded to stop MIRVs in the late 1960s and early 1970s, Washington would have needed to take the lead — and this, as we know from internal Nixon administration deliberations, was not going to happen. As Kissinger wrote in *The White House Years*, MIRVs had passionate defenders in the Pentagon and on Capitol Hill, whereas support for national ballistic missile defenses ranged from lukewarm in the Pentagon to hostile in Congress and in some of the metropolitan areas to be defended by nuclear-armed interceptors.[30]

The timing of MIRVs and the advent of SALT I negotiations were not right; MIRVs had too strong a constituency, and diplomacy was not up to the task.

The Nixon White House did succeed in persuading the Kremlin to forgo national ballistic missile defenses. This outcome was far from assured. When President Lyndon Johnson and Secretary McNamara first broached this idea at the 1967 Glassboro Summit, Soviet Premier Alexey Kosygin replied, "Defense is moral, offense is immoral!"[31] The Kremlin, fearful of US technological advantages, was therefore willing to change course. Missile defenses had far more of a head start than MIRVs, but they had less of a constituency in the United States, were costly, and were likely to be ineffective — especially against MIRVs. Thus the result of SALT I: no constraints on MIRVs and significant constraints on ballistic missile defenses.

This outcome was severely detrimental to strategic stability as well as to strategic arms limitation, as both superpowers rushed to build out force structure that lent credence to worst-case assumptions. The number of MIRVs could have been much lower had their growth been accompanied by more relaxed nuclear postures. Instead, the advent of MIRVs and growth of prompt HTK capabilities became pillars of superpower nuclear warfighting strategies of deterrence.

During the first nuclear age, the superpowers had the foresight to know where MIRVing would lead, but they were unwilling to take the risks to avoid this outcome. Technologies with obvious military utility were maturing, powerful domestic constituencies were supportive of their fruition, diplomacy lagged far behind technical advances, and, most of all, the intensity of the competition in the late 1960s and early 1970s was far more conducive to shifting gears upward than to deceleration. Moreover, decisionmakers in Washington were of the view that MIRVs and corresponding HTK capabilities would give the United States a decisive edge in the arena of international diplomacy. As Brendan Rittenhouse Green and Austin Long write elsewhere in this volume,

> The most important drivers of US HTK capabilities were the strategic incentives produced by the international system. Specifically, decisionmakers across administrations believed that HTK was a source of several political benefits: it would help deter the Soviet Union from initiating war; influence Moscow's broader diplomatic approach, especially with regard to détente and the SALT talks; and shape the foreign policy of America's allies and partners in favorable ways, particularly those in NATO.[32]

The strategic challenges posed by US technological advances and Soviet missile production lines were mutually reinforcing. The Soviet Ministry of Defense and General Staff relied upon brute force in the form of missile throw weight to counter US advances in accuracy and warhead miniaturization. MIRVing held out the promise that a single missile could destroy multiple targets — to the extent that missile accuracy and warhead yield allowed. The strongest advocates of MIRVing in the United States and the Soviet Union were the quickest to question the motives behind each other's programs: Why go to such lengths — and to the high launch-readiness associated with vulnerable and lucrative targets — if not to signal a commitment to nuclear warfighting in the event of a breakdown in deterrence?

During the first nuclear age, MIRVing proceeded on a scale befitting an ideological and geopolitical competition between superpowers. The pursuit of strategic advantage and the fear of being placed at a disadvantage were the two interlocking gears of superpower rivalry. The undeniable cost-effectiveness of MIRVs, which were far less expensive than building and deploying additional missiles, greased these gears.

The combination of increased accuracy and large warhead numbers enabled a vast expansion of targeting lists. Each warhead needed a destination to fulfill its deterrent purpose, and given the surfeit of warheads created in this manner, more than one warhead could be assigned to the same target so as to maximize kill probabilities. The growth of deliverable warheads and their diversified means of delivery, to include hard-to-detect cruise missiles, fed worst-case scenarios. The competition that unfolded was contrary to the concept of strategic stability propounded by Western deterrence strategists, who hypothesized that secure second-strike capabilities would ensure superpower caution and sobriety. These sage conceptualizers of deterrence theory failed to predict that the growth of destabilizing and prompt HTK capabilities would override the growth of reassuring second-strike capabilities.

Multiple-Warhead Missiles in the Second Nuclear Age

China, India, and Pakistan are in a position to learn from the mistakes of the United States and the Soviet Union during the first nuclear age. Beijing and New Delhi appear to have learned the lesson that a growing economy provides more power and status than rapidly growing nuclear capabilities do. Nonetheless, their nuclear capabilities are growing, with negative consequences that even modest MIRVing can compound. Rawalpindi has drawn different conclusions — that nuclear weapons are central to offset conventional force disparities, and that competing with an economically stronger foe is necessary to deter its adventurism.

As Jeffrey G. Lewis notes in his chapter of this volume, China has been in a position to MIRV for at least two decades, and is only now doing so.[33] According to the US intelligence community, China could possess more than 100 warheads on its longest-range missiles by the mid-2020s.[34] This equates to perhaps five new intercontinental ballistic missiles (ICBMs) annually. In contrast, Soviet production rates were between 200-300 ICBMs during the SALT I negotiations.

Throughout the first nuclear age, Beijing retained a relaxed nuclear posture when faced with not one, but two, antagonistic superpowers. By comparison, the threat posed by India in the second nuclear age is quite slight. As Lewis notes, Beijing prefers a slowly evolving nuclear posture that follows general lines established by leaders who do not attend to the detailed requirements of deterrence in the absence of a forcing function. Continued evolutionary development of nuclear doctrine and requirements is not assured, however. India's slow strategic evolution is not of primary concern; sharp advances in US conventional and missile defense capabilities are. As Lewis writes, the entanglement of forces operating in close proximity could lead to crises with the United States at sea, and competition is heating up in the global commons of space and cyberspace as well. External events could change the contours of US-Chinese relations and increase the extent of China's strategic modernization programs. The pace and scope of MIRVing would be one indicator of such shifts. However, in Lewis' view, significant doctrinal shifts and "sprinting" to achieve parity with the United States in nuclear capabilities appear remote.

New Delhi has also moved to operationalize its nuclear deterrent at a relaxed pace that is in marked contrast to US and Soviet/Russian behavior. A nuclear doctrine was only announced (but not released) in January 2003 — almost five years after testing a nuclear device — following the unusual prior step of having a national security advisory board (consisting of retired military officers, former diplomats, and a working journalist) suggest a draft nuclear doctrine in August 1999.[35] As recounted by Raj Chengappa in *Weapons of Peace*, India's first nuclear weapon did not fit into the bomb bay of the aircraft designated to carry it[36] — a symptom of the lack of communication and coordination among Indian military officers, their civilian masters, defense scientists, and powerful bureaucrats.

Integration remains hampered by a strategic and political culture predicated upon consensual decisionmaking. Absent consensus, decisions are usually postponed unless external events force decisions. Joint service operations remain problematic — especially the air force's close air support for army-centric warfare — and there is still no appointee as chief of defense staff, reflecting continued wrangling among the military services for hierarchical tri-service appointments. Indian defense procurement remains hampered by domestic bottlenecks, mandating significant growth in foreign military sales.

New Delhi is in a position to leverage these sales into co-production compacts and technology transfers in service of Prime Minister Narendra Modi's "Make in India" policy, so as not to be forever dependent on foreign military suppliers.

On the nuclear side, India continues to modernize its nuclear capabilities, most notably with a new class of ballistic-missile-carrying submarines and longer-range missiles. A panoply of nuclear-capable cruise missiles can be expected. Command and control arrangements have been upgraded. The growth of India's nuclear capabilities reflects the geographical reality of having two nuclear-armed neighbors with which it has fought wars and does not have settled borders. There is collusion between India's neighbors, with China helping out Pakistan to overcome bottlenecks in fielding a deterrent. By necessity, India's capacity to deliver nuclear weapons has been historically constrained by range limitations, and hence geared primarily toward Pakistan. India is only now mastering capabilities to target China.

India's leaders have not demonstrated a sense of urgency to operationalize their nuclear deterrent. Beijing's first nuclear test in 1964 provoked some alarm in New Delhi, but not enough to overcome the as-of-yet unassailable moral legacies of M. K. Gandhi and Jawaharlal Nehru.[37] 24 years lapsed between the testing of the first and subsequent nuclear devices. According to public estimates, India lags behind Pakistan — whose economy is nine times smaller — in the size of its nuclear stockpile and in annual warhead production.[38] India clearly has the production capacity to outcompete Pakistan in arsenal size and fissile material production dedicated to warheads, but this would require trading off electricity for stockpile size — a trade-off that three coalition Indian governments have so far been unwilling to accept.

As Rajesh Basrur and Jaganath Sankaran write in their chapter of this volume, Indian leaders view the Bomb as an instrument of political utility, as a defensive deterrent, and as a facilitator of New Delhi's access to the high table of international relations. India's political leaders have not, however, viewed the Bomb as a warfighting instrument. As Basrur and Sankaran argue, "India prides itself on not being fixated by Western constructs relating to nuclear weapons. This confidence will be tested by the advent of MIRVing."[39] Civilian leaders in India invite senior military officers into conversations about nuclear matters, but reserve decisionmaking for themselves.

Pakistan, too, views the Bomb as instrumental for national security and international standing. The Bomb is widely viewed as essential to prevent another major war with a foe that has previously used conventional military power to dismember Pakistan. For this reason, the talking point upon which

Pakistani interlocutors rely — that Pakistan reluctantly armed itself with nuclear weapons only because India rejected mutual nuclear restraint on the subcontinent — is not credible. Pakistan would have needed nuclear weapons even if India abstained because of an expected imbalance in conventional forces.

Consequently, Pakistan's dedicated pursuit of the Bomb began shortly after the disastrous 1971 war — two years before India first tested a nuclear device. In addition, Pakistani leaders, civilian as well as military, view the Bomb as having considerable political utility. The Bomb gives Pakistan an outsized role in international affairs.[40] It also ensures US and Chinese attentiveness to Pakistani needs, as well as Indian restraint in crises and respect for Pakistani red lines.

In the event that deterrence fails, the guardians of Pakistan's nuclear arsenal view the Bomb in warfighting terms, and perhaps even as a war-winning weapon, if New Delhi is derelict in ensuring retaliatory capabilities. All states with nuclear arsenals have targeting plans. US presidents, for example, are briefed on targeting plans and then resolve to do their best to avoid having to execute them. To the extent that Pakistan's civilian leaders have been read into these plans, they, too, would no doubt find them appalling. Indian leaders have signaled their deep distrust of such plans in many ways, including the exclusion of senior military officers from the inner sanctum of decisionmaking. In contrast, decisionmaking in Pakistan on nuclear-related issues is the province of senior military officers who, like their civilian counterparts elsewhere, would be hard-pressed to execute the plans they have drawn up. As would be expected, Pakistani military leaders give these plans more thought than Indian political leaders do.

Nuclear deterrence is a bluff that cannot be called without risking everything national leaders hold dear. To avoid a bluff being called, leaders seek "credible" instruments of nuclear deterrence. The requirements of credibility were extremely high in the first nuclear age for the United States and the Soviet Union. Not so for China's leaders, who in the second nuclear age have exercised great nuclear restraint on the assumption that the prospect of very few mushroom clouds on cities would suffice to deter New Delhi, as well as Washington and Moscow. Indian leaders seem to be operating from a similar assumption. India's declared nuclear doctrine is that of minimum credible deterrence. Pakistan's declared nuclear doctrine reverses the order of the words "credible" and "minimal." The imperative of credibility has, in turn, led to the evocation and requirements of "full-spectrum" deterrence.

This counterintuitive result is understandable in the context of military decisionmakers who take nuclear warfighting requirements more seriously than civilian decisionmakers who reject nuclear warfighting strategies of deterrence. Consequently, Pakistan has moved more quickly than India on key measures of nuclear warfighting capacity. It was the first country to flight-test solid-fueled ballistic missiles.[41] Pakistan appears to possess more nuclear warheads than India, as well as an annual production capacity to extend this lead in the short term — despite having an economy that is nine times smaller.[42]

While Pakistan has far less to spend for defense-related items, its military has first call on budget expenditures. The Indian military has a far larger budget, but more competition for it from civil society. India has the production capacity to outcompete Pakistan in arsenal size and fissile material production dedicated to warheads, but this would require trading off electricity for stockpile size — a trade-off that has been made in Pakistan, but which has been unacceptable to three coalition Indian governments so far. In the future, fissile material constraints will be lifted, as new Indian facilities are under construction.[43] The pace and extent of Rawalpindi's efforts to make its deterrent increasingly credible have succeeded in getting New Delhi's attention. Pakistan's nuclear enclave will not feel comfortable with the result.

The Importance of Nuclear Doctrine

Nuclear doctrine is likely to matter at least as much — if not more — than other factors upping requirements for multiple-warhead missiles or MIRVing in the second nuclear age. Economic and budgetary considerations certainly matter, as do impulses from defense research establishments, domestic politics, and regional security concerns. But, so far, these factors have not resulted in a significant competition over MIRVs. To date, the two Asian states most capable of MIRVing on a sizable scale — China and India — have demonstrated little interest in counterforce targeting, prompt HTK capabilities, and damage-limitation strategies of nuclear warfighting and deterrence. Pakistan is more inclined toward counterforce targeting, but it faces multiple constraints in operationalizing counterforce targeting.

An evolutionary shift by China and India in nuclear doctrine, abetted by MIRVs and increased missile accuracy, toward reliance on counterforce targeting would ratchet up the nuclear competition and warhead requirements. China and India certainly have the means to spend far more on nuclear-weapon-related capabilities, and their nuclear enclaves are not lacking in core technical competencies. So far, however, the would-be leaders in the action-reaction syndrome in southern Asia have decided to compete on other playing fields. Heretofore, their nuclear requirements have been contained by higher-priority political imperatives, especially sustained economic growth and applying balm to varied sources of public disaffection. Strategic modernization programs in China and India have taken decades to see the light of day. Basic requirements of deterrence are met and new technologies are demonstrated, but without great attentiveness to nuclear warfighting requirements. As yet, there is scant evidence that China and India are moving to embrace counterforce targeting in a serious way.

Pakistan's ambitions include counterforce targeting. This is the declared justification for extending the range of its longest-range missiles (deemed essential to strike Indian strategic and naval facilities in the Andaman and Nicobar Islands) and its shortest-range missiles designed to blunt an advance of Indian armor. Pakistan's declared commitment to counterforce targeting lends itself to open-ended nuclear requirements.

Implementation of counterforce targeting, however, requires surmounting considerable challenges, as Feroz H. Khan and Mansoor Ahmed argue in their chapter of this volume. Pakistan lags far behind China and India in space-based capabilities, real-time surveillance, and targeting information, all of which are necessary to track mobile missiles. Pakistan will lag farther behind India in these metrics with every passing year. Lacking these capabilities, serious counterforce targeting becomes problematic or dependent on the gross negligence of Indian authorities. Also problematic, Khan and Ahmed argue, will be fissile material production capacity. While Pakistan has so far competed with India in this regard, a significant expansion of counterforce targeting and acceleration of warhead production would require an even greater expansion of fissile material production.

So far, money has not constituted an observable constraint on the growth of Pakistan's nuclear stockpile. An accelerated rate of stockpile growth would, however, require improved national economic fortunes or far better revenue collection, from which additional military expenditures could be drawn. It would also require generous Chinese military assistance as the level of US military assistance declines. As Khan and Ahmed observe, China would also have to provide support for weaknesses in Pakistan's space, surveillance, and targeting capabilities.

Avoiding Nuclear Excess During the Second Nuclear Age

The second coming of multiple-warhead missiles has begun in Asia, with China taking the first step. Multiple-warhead missiles could steadily increase Chinese and Indian stockpile sizes, placing added pressure on Pakistan to keep pace with India and complicating deterrence requirements in the region. The chapter by Basrur and Sankaran predicts that India will likely follow China down this path, more because of the autonomy of India's defense technology sector than because of a conviction by India's leaders to pursue counterforce targeting. The chapter by Khan and Ahmed predicts that, if India flight-tests multiple re-entry vehicles, Pakistan is likely to follow suit. Pakistan's track record is one of presuming adversarial moves and taking precautionary actions to avoid being disadvantaged.

In the first nuclear age, the cards were stacked in favor of MIRVs and against restraint. Anxieties about an intensified nuclear competition were trumped by anxieties over not competing forcefully enough. Once MIRVing began, those invested in the competition grew stronger because MIRVs heightened threat perceptions. And once the action-reaction syndrome kicked into high gear, reversing course required unorthodox leaders who were willing to take exceptional risks.

So far, Beijing and New Delhi have consciously and wisely decided not to engage in nuclear arms racing. Their declaratory postures of no first use (NFU) of nuclear weapons have been emblematic of their restraint. The pace of Chinese strategic modernization programs is quite unusual. According to published estimates, China still only possesses 50-60 ICBMs[44] — 35 years after first deploying them. A second-generation Chinese ballistic-missile-carrying submarine took about three decades to appear after the first.[45] Indian leaders have been so disinterested in the operational aspects of having a nuclear deterrent that they have fallen behind Pakistan in certain aspects of the competition. There are indicators — not just China's belated move to place multiple warheads atop some of its missiles, but also India's steps to increase fissile material production and upgrade command and control arrangements[46] — to suggest that both are committing greater attentiveness and resources to nuclear deterrence.

If China and India's previous levels of relaxation concerning the requirements of minimal nuclear deterrence are now in the rearview mirror, their embrace of robust warfighting requirements still remains unlikely. Strategic culture rarely changes radically, especially when a procession of leaders in both countries have adhered to well-established guidelines. Important constraints remain in place against replicating the excesses of the first nuclear age. Leaders in China and India continue to have higher priorities than nuclear arms racing, and the requirements for robust counterforce targeting are very expensive.

With the advent of MIRVs and increased missile accuracy, counterforce options will certainly grow. But damage-limiting options will remain beyond reach because mobile missiles will increase in number alongside increases in counterforce targeting capabilities. Moreover, targeting information against mobile missiles in near real-time will be extremely challenging. And if some military targets can be destroyed with confidence, but many others cannot, Chinese and Indian leaders may well reach the conclusion that a shift to reliance on counterforce targeting is not worth the expense and bother against states that can be deterred from using nuclear weapons by countervalue targeting.

Increases in nuclear capabilities are likely to be pursued for other reasons. As Lewis argues, Beijing might take precautionary steps against US moves to upgrade missile defenses and pursue prompt global-strike capabilities. And as Basrur and Sankaran argue, India cannot remain passive as Chinese and Pakistani capabilities grow. This adds up to an intensification of the triangular nuclear competition, for Rawalpindi seems incapable of not competing with or compensating for decisions by New Delhi to grow its nuclear capabilities, as Khan and Ahmed conclude.

Once the threshold for MIRVing was crossed in the first nuclear age, the floodgates were opened. In the second nuclear age, crossing the threshold for multiple-warhead missiles, whether MIRVed or not, does not necessarily equate to opening the floodgates. The numbers of land-based missiles that could carry multiple-warhead missiles are limited, as are the number of Chinese and Indian ballistic-missile-carrying submarines likely to be built. The rate of growth in these strategic nuclear delivery vehicles will be incremental. Deployments have not been rushed. If Beijing and New Delhi can continue to manage their bilateral relationship without intense crisis, and if they seek improved relations, they might well be able to successfully manage the advent of multiple-warhead missiles.

More importantly, Beijing and New Delhi can avoid the lure and pitfalls of MIRVs by refraining from the embrace of counterforce strategies of deterrence. Shifting reliance from countervalue to counterforce targeting would presumably require leadership endorsements at some stage of this process — endorsements that would likely come at the expense of conventional military modernization programs and economic growth rates that have been given a higher priority. Pakistan's decisionmakers are most likely to pursue the progression from countervalue to counterforce targeting, but are least able to execute ambitious plans.

Conclusion

China and India, the two Asian countries most capable of engaging in nuclear arms racing by virtue of their financial and technical means, have so far chosen not to do so. Nor have they chosen to pursue nuclear deterrence strategies that emphasize counterforce targeting. Instead, they have moved deliberately to field and modernize their nuclear deterrents. Pakistan's decisionmakers have moved with a greater sense of urgency, reflecting a stronger belief in the efficacy of nuclear deterrence, declaring that their deterrence strategy requires counterforce as well as countervalue targeting.

The slow and gradual induction of multiple-warhead missiles seems to be the best option available in southern Asia, as there are no diplomatic strategies to prevent prospective increases in warhead numbers. As in the first nuclear age, a ban on the flight-testing and deployment of multiple-warhead missiles is most unlikely. It has barely been considered, and has not been proposed. Pakistan, the state most inclined to propose dramatic but implausible bans to capture the diplomatic high ground, has refrained from offering a ban on multiple-warhead missiles, presumably so as not to offend China. India has not proposed a ban on further flight-testing, perhaps so as not to appear overly concerned by China's strategic modernization programs. In any event, bans on the production and deployment of multiple warheads on top of missiles are not verifiable without intrusive inspections at sensitive military sites — something as inconceivable in Asia at this stage of the second nuclear age as they were when MIRVs were ready for deployment during the superpower competition.

Moreover, there is no strategic dialogue of any consequence between China and India. The composite dialogue between India and Pakistan on security and other topics was suspended in 2008 after violent extremists belonging to a group with ties to Pakistan's military and intelligence services carried out spectacular attacks in Mumbai. Eight years later, this dialogue has yet to resume. Decisionmakers in China, India, and Pakistan will therefore not be able to rely on diplomacy and formalized arms control arrangements to avoid or limit the advent of multiple-warhead missiles. The presence or absence of formal negotiations would not be decisive, in any event: Although the United States and Soviet Union negotiated strategic arms limitations, success proved elusive because they were unable to ban MIRVs. If China and India agree to limit multiple-warhead missiles for reasons of national interest, it will be by tacit understandings and not as the result of negotiations.

In the second nuclear age no less than the first, the motivations behind placing multiple warheads atop missiles will determine how extensive nuclear arsenals will grow and how pernicious the effects of stockpile growth will become. Success in dampening the negative repercussions of multiple-warhead missiles will rest on two foundations. The first is improved bilateral relations. One of the responsibilities of states that possess nuclear weapons is to pursue nuclear risk reduction measures (NRRMs) with nuclear-armed states, especially those with which they have previously fought wars. By this yardstick, China, India, and Pakistan can be found wanting.

A willingness to improve bilateral relations is measurable in many ways. It is affirmed by the absence of firing across and aggressively patrolling nearby unsettled borders; the avoidance of violent acts emanating from one country's soil that can lead to intense crises; failing that, the successful prosecution of higher-ups; engagement in meaningful strategic dialogue that produces NRRMs; and preventing increased trade or improved relations from being held hostage to issues that are not ripe for settlement.

The second foundation for dampening the negative consequences of multiple-warhead missiles in Asia is to resist a progression from countervalue to counterforce targeting strategies of nuclear deterrence. This metric, as with the willingness to improve bilateral relations, is measurable in several ways, including the retention by China and India of NFU doctrines; proceeding slowly with limited numbers of multiple-warhead missiles; and being more transparent about strategic modernization plans and programs.

China, India, and Pakistan are not doomed to repeat the mistakes of the United States and the Soviet Union. Unlike the first nuclear age, it is possible to dampen the extent of warhead increases attributable to MRVs or MIRVs. Potential limiting factors rest on a continuation of Beijing and New Delhi's demonstrated resistance to becoming enmeshed in a nuclear arms race. If the two rising powers in Asia wanted to project their power by advertising and accelerating their nuclear weapon capabilities, their arsenals would now be much larger and the pace of their strategic modernization programs much faster.

Other factors militate against large increases in warhead totals. The Comprehensive Nuclear-Test-Ban Treaty (CTBT) affirms the norm against nuclear testing. China — a signatory, but non-ratifying, state — and India, which has neither signed nor ratified the CTBT, appear unwilling to violate this norm.[47] In the absence of renewed nuclear testing, it would be difficult for China, India, and Pakistan to have high confidence in untested warheads of significantly reduced yield and size. And absent significant warhead miniaturization, very few warheads can be accommodated atop individual Chinese, Indian, and Pakistani missiles. Moreover, if one reason for China's deployment of multiple-warhead missiles is to penetrate US ballistic missile defenses, then MRVs rather than MIRVs might suffice. Beijing's requirements might also be restrained insofar as increments of prospective US national missile defense deployments appear to be limited and are likely to be poorly matched against China's countermeasures.

Granted, these calculations may be overly optimistic. The first nuclear age demonstrated that once warhead numbers rise, interactive competitions are hard to decelerate. The action-reaction syndrome does not apply solely to the superpower competition; it applies to the second nuclear age as well. China, India, and Pakistan will compete on a far smaller scale than the United States and the Soviet Union, but will nonetheless face challenges in avoiding the lure and pitfalls of engaging in a nuclear arms competition. China will set the tone for this competition. India will likely indulge in technological advances as well. And Pakistan, the country least equipped to engage in such a competition, is most susceptible to this dynamic as it seeks to keep pace with India.

Restraint with respect to multiple-warhead missiles in Asia will still result in an additional increment of perhaps 200 warheads over the next 10-15 years. They will constitute a new tributary to established flows of nuclear competition, which include the growth and diversification of ballistic and cruise missile inventories. If the addition of multiple-warhead missiles signals moves by Beijing and New Delhi toward warfighting strategies of deterrence, then the second nuclear age will become far more dangerous and the salience of nuclear weapons will grow alongside stockpiles. If decisionmakers in China, India, and Pakistan wish to avoid repeating the missteps of the United States and the Soviet Union during the first nuclear age, they will limit the extent to which multiple warheads are placed atop missiles, they will proceed at a slow pace, and, most important, they will reject the lure and the pitfalls of counterforce targeting strategies.

Endnotes

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47. Pakistan, another non-signatory, is unlikely to resume testing of nuclear weapons unless India does.

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THE LURE & PITFALLS OF MIRVs

In the second nuclear age, no less than the first, there are no realistic prospects for banning multiple-warhead missiles. China has started to deploy such missiles, and India and Pakistan are likely to cross this threshold as well. The motivations behind these steps will determine how extensively nuclear arsenals will grow and how pernicious the effects of stockpile growth will become.

Success in dampening the negative repercussions of multiple-warhead missiles will rest on two foundations. The first is improved bilateral relations among the contestants. The second foundation for dampening the negative consequences of multiple-warhead missiles in Asia is to resist a progression from countervalue to counterforce targeting strategies of nuclear deterrence. This metric, as with the willingness to improve bilateral relations, is measurable in several ways, including: the retention of no first use doctrines by China and India; proceeding slowly with limited numbers of multiple-warhead missiles; and being more transparent about strategic modernization plans and programs.

If the growth of warhead totals and missile accuracy presages moves by Beijing and New Delhi toward warfighting strategies of deterrence, then the second nuclear age will become far more dangerous, and prospects for reducing the salience of nuclear weapons on international affairs will be undermined. If decisionmakers in China, India, and Pakistan wish to avoid repeating the missteps of the United States and the Soviet Union during the first nuclear age, they will limit the extent to which multiple warheads are placed atop missiles, they will proceed at a slow pace, and, most important, they will reject the lure and pitfalls of counterforce targeting strategies.

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