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AMOS PERLMUTTER PRIZE ESSAY

Stalking the Secure Second Strike: Intelligence, Counterforce, and Nuclear Strategy

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ABSTRACT Secure second strike nuclear forces are frequently held to be easy to procure. Analysts have long argued that targeting intelligence against relocatable targets like submarine launched and land mobile ballistic missiles is difficult to obtain. However, the scholarly consensus on intelligence for counterforce operations is seriously overdrawn. Both during and after the Cold War, the United States developed substantial intelligence capabilities to track and target submarines and mobile missiles. These efforts achieved important and under-appreciated success. Second strike forces have been far more vulnerable than most analysts are willing to credit.

KEY WORDS: Nuclear Strategy, Intelligence, Counterforce, Mobile Targets, Secure Second Strike

One of the central concepts in nuclear analysis is the 'secure second strike:' the ability of a nuclear force to absorb a preemptive attack and nonetheless retaliate with enough weapons to cause unacceptable damage. While there is often disagreement about how effective a second strike needs to be or what 'unacceptable damage' looks like, the basic concept is ubiquitous in both nuclear theory and nuclear policy discussions, before and after the Cold War.[1]

[1]For examples of Cold War and post Cold War arguments hinging on secure second strike arguments see Richard K. Betts, *Nuclear Blackmail and Nuclear Balance* (Washington DC: Brookings Institution 1987) and Thomas Christensen, 'The Meaning of the Nuclear Evolution: China's Strategic Modernization and US-China Security Relations,' *Journal of Strategic Studies* 35/4 (Aug. 2012), 447–87.

Many nuclear theorists hold that secure second strike forces revolutionize military and political affairs. Previously dominant military factors – like the balance of power or clever strategies for force employment – cease to be politically relevant, since 'winning' a military exchange cannot save states from utter destruction. Competition becomes a test of nerves rather than strength, with each state attempting to demonstrate its resolve rather than its power. Instead of intentional escalation to win a military victory, states compete by taking risks that might cause inadvertent escalation, threatening a nuclear Armageddon that neither side intends. Most deterrence theorists contend that competitions in risk taking favor the defender of the status-quo, ameliorating the security dilemma and stabilizing world politics.[2]

Likewise, obtaining and preserving a secure second strike force has long been a primary goal for nuclear policymakers. Historically, many policy analysts have claimed that generating a secure second strike force was by no means simple. Most famously, Albert Wohlstetter argued that effective retaliation depended on building a multi-step system that integrated planes, weapons, refueling, bases, communication, and effective attack routes. 'Prizes,' he observed, 'are not distributed for getting over any one of these jumps. A system must get over all six.'[3] Ensuring the survival of both nuclear weapons and the ability to exercise command and control over them has thus been a source of significant study for decades.

However, analysts have also emphasized the difficulties of an effective counterforce attack – the disarming blow targeting a state's nuclear forces that a secure second strike force aims to prevent. Chief among these obstacles is the problem of intelligence: if states cannot find each other's weapons, even a large nuclear first strike will be of little utility in destroying them. As Wohlstetter's colleague William Kauffman cautioned, 'Intelligence about a prospective enemy, especially one as secretive as the Soviet Union, is almost always imperfect.'[4]

As the missile age developed, nuclear theorists and policy analysts alike came to see the intelligence problem as more salient than the

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[2]Two of the most influential works on these second strike dynamics are Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca, NY: Cornell UP 1989) and Thomas Schelling, *Arms and Influence* (New Haven, CT: Yale UP 1967).

[3]Albert J. Wohlstetter, 'The Delicate Balance of Terror [RAND Paper P-1472],' in Marc Trachtenberg (ed.), *The Development of American Strategic Thought, 1945–1969*, Vl. 3, Part III (New York: Garland 1987), 15. See also Albert J. Wohlstetter and Fred S. Hoffman, 'Protecting US Power to Strike Back in the 1950s and 1960s', in Marc Trachtenberg (ed.), *The Development of American Strategic Thought, 1945–1969*, Vl. 3, Part III (New York: Garland 1987); Albert J. Wohlstetter *et al., Selection and Use of Strategic Air Bases* (Santa Monica, CA: RAND Corporation 1954).

[4]William W. Kaufmann, 'The Crisis in Military Affairs,' *World Politics* 10/4 (1 July 1958), 589.

problem of ensuring retaliation. In particular, mobile nuclear weapons – 'relocatable targets' in the common parlance – are now generally viewed as untargetable in a first strike. A secure second strike has therefore become almost synonymous with a state possessing significant numbers of submarine launched ballistic missiles (SLBMs) and/or mobile intercontinental ballistic missiles (ICBMs).

For instance, nuclear theorists like Daryl Press have argued that the end of American nuclear superiority in the early 1960s was caused in substantial part by 'the rapid growth of the Soviet submarine fleet.'[5] Later in the Cold War, Charles Glaser noted that while 'Soviet fixed ICBMs will become much more vulnerable' after American nuclear modernization, 'the Soviet Union is now deploying mobile missiles that will likely increase the survivability of its land based forces.'[6] Policy analysts agreed with these views: Karl Lautenschlager argued that submarines provided a robust 'capability for assured destruction that has remained intact in spite of many technological developments.'[7] Michael Brower similarly concluded at the end of the Cold War that 'Strategic experts have long assumed that mobility is an effective solution to ICBM vulnerability, and it appears this view … is justified.'[8]

In the contemporary era, analysts continue to emphasize the intelligence challenge for counterforce doctrines, especially against mobile ICBMs. Jan Lodal argues that 'The challenge in modern warfare is not hitting a target at a known and fixed location; the challenge is to know the target's location,' and asks rhetorically whether it is believable that 'the United States could destroy [Chinese] mobile systems.'[9] James Acton similarly asserts that 'it is still fiendishly difficult to locate mobile missiles hidden by a well prepared enemy' and notes that 'China, Iran, and North Korea are all focusing on the development of road-mobile missiles' in lieu of hardened silos.[10] Michael Gerson claims that 'a successful first strike would require near-perfect intelligence, surveillance, and reconnaissance,' a problem made 'more challenging as current and potential adversaries develop and deploy mobile and relocatable ballistic missiles.'[11] Chinese

[5]Daryl G. Press, *Calculating Credibility: How Leaders Assess Military Threats* (Ithaca, NY: Cornell UP 2005), 89.

[6]Charles Glaser, 'Why Do Strategists Disagree about the Requirements of Deterrence?,' in Lynn Eden and Steven E. Miller (eds), *Nuclear Arguments: Understanding the Strategic Nuclear Arms and Arms Control Debates* (Ithaca, NY: Cornell UP 1989), 140.

[7]Karl Lautenschläger, 'The Submarine in Naval Warfare, 1901–2001,' *International Security* 11/3 (Winter 1986), 131.

[8]Michael Brower, 'Targeting Soviet Mobile Missiles: Prospects and Implications,' *Survival* 31/5 (1989), 433–4.

[9]Jan Lodal, 'The Counterforce Fallacy,' *Foreign Affairs* 89/2 (2010), 146.

[10]James M. Acton, 'Managing Vulnerability,' *Foreign Affairs* 89/2 (2010), 147.

[11]Michael S. Gerson, 'No First Use: The Next Step for US Nuclear Policy,' *International Security* 35/2 (2010), 26–7.

analyst Li Bin likewise concludes that US efforts to track Chinese mobile missiles with space based radar are uncertain at best.[12]

Unfortunately, this consensus seriously overstates the difficulty of the intelligence problem in nuclear operations, even against relocatable targets. The United States has invested massive resources into intelligence capabilities for a first strike, including successful innovation in tracking submarines and mobile missiles. We argue that these efforts have achieved significant successes that are not widely appreciated.

We proceed in five sections. We begin our analysis by placing targeting intelligence for counterforce in military and political context. In addition to highlighting useful background information, this section aims to clarify the nature and limits of our argument. Next, we briefly recount early debates about US intelligence for counterforce against Soviet fixed targets. This second section, though already generally understood, demonstrates that intelligence capabilities that are now taken for granted were once considered difficult if not impossible even by knowledgeable observers – a relevant parallel for the present consensus on intelligence for counterforce.

We then proceed with the heart of our analysis. A third section describes US intelligence capabilities to track Soviet ballistic missile submarines and mobile ICBMs during the Cold War. Fourth, we discuss post-Cold War advances in US intelligence capabilities that are likely to greatly improve future efforts to track mobile systems. The fifth and final section concludes with brief observations about the implications of these US intelligence capabilities for theories of nuclear weapons and contemporary American security policy.

Intelligence in Context: The Military Requirements and Political Consequences of Counterforce

Appreciating our arguments about American nuclear intelligence capabilities requires an understanding of the military requirements of counterforce strategies, as well as their potential political consequences. We argue that revisions to our picture of American targeting intelligence are of considerable importance for military, theoretical, historical, and policy analysis. But our claims should not be confused with stronger arguments we do not make.

Counterforce nuclear strategies seek to destroy as much of the opposing nuclear force as possible, while making the enemy unwilling or unable to retaliate effectively with what remains.[13] Counterforce strategies can aim

[12]Li Bin, 'Tracking Chinese Strategic Mobile Missiles,' *Science and Global Security* 15/1 (2007), 1–30.

[13]We leave aside 'second strike' counterforce strategies, which have different aims.

at totally disarming attacks, or at mostly disarming attacks that are combined with efforts to incapacitate or successfully absorb whatever enemy weapons remain. Militarily, the success of a counterforce strategy depends on a number of inter-linked factors. In this essay, we examine a central determinant of a successful first strike: gaining the intelligence to find and prosecute nuclear targets. Any analysis of the nuclear balance, past or present, should take note of our principal claim: American intelligence for counterforce operations has been far better than most knowledgeable experts have believed.

However, intelligence is by no means the only hurdle that counterforce strategies must be able to clear. For instance, during the 1960s, the Soviet nuclear arsenal experienced a step-level increase in its ability to survive a first strike. An increasing number of fixed ICBM launchers, which were fitted with multiple warheads, led to a rise in both the retaliatory damage expected from surviving launchers and the probability that launchers would survive. Hardened missile silos reduced the probability that a warhead of a given yield and accuracy would land close enough to destroy its target. Soviet alert procedures moved from a multi-hour response time under the best of circumstances to an ability to launch within minutes during a crisis.[14] Because a full analysis of these and other factors is beyond the scope of a short essay, we take no position here on the effectiveness of an American counterforce strike at any particular point in history.

Politically, the consequences of counterforce strategies depend on how militarily effective they are likely to be. In the conclusion of our argument, we note that robust intelligence capabilities for counterforce have several important implications, though they will vary depending on the military context. Even if one believes counterforce was not likely to be militarily effective in limiting Soviet retaliation in the late Cold War, the same may not be true against smaller arsenals.[15] Improvements in intelligence thus provide both a crucial lens for interpreting nuclear history and for interpreting current nuclear policy, given that potential American nuclear adversaries today are far less capable than the Soviet Union.

Still, the political consequences of nuclear weapons are ultimately a matter for systematic empirical investigation. The present essay raises several interesting questions that we are pursuing in other work.[16] Among them: how did civilian policy-makers perceive the intricacies of

[14]Changes in Soviet nuclear forces get detailed coverage in Pavel L. Podvig (ed.), *Russian Strategic Nuclear Forces* (Cambridge, MA: MIT Press 2004).

[15]Charles L. Glaser and Steve Fetter, 'Counterforce Revisited: Assessing the Nuclear Posture Review's New Missions,' *International Security* 30/2 (Fall 2005), 84–126.

[16]Including, *inter alia*, Austin G. Long and Brendan Rittenhouse Green, '"The Least Miserable Option": The Political Economy of US Nuclear Counterforce Doctrine, 1949–1989,' unpublished MS.

counterforce intelligence? Did they understand and approve of American capabilities, or are intelligence improvements to be understood in terms of bureaucratic and organizational incentives? What was the impact of counterforce intelligence on world politics? Did American leaders believe they held a nuclear advantage and pursue a correspondingly tough diplomatic line? Or did they remain extremely cautious in political terms, constrained by the large consequences of small military errors? We encourage others to join us in these important areas of nuclear research.

Intelligence for Fixed Targets in the Early Cold War

During the early Cold War, it was widely assumed that the United States lacked the intelligence necessary to target Soviet nuclear forces. The Soviet Union was a vast and closed society, it was thought, making it impossible to find Soviet bases. Furthermore, the Soviet Union was assumed to be an extraordinarily capable adversary, not prone to the errors that analysts such as Wohlstetter believed made US forces vulnerable.

One of the foremost early nuclear theorists, Bernard Brodie, noted that 'Russian secretiveness and our comparative openness is bound to give them an intelligence advantage.'[17] He and colleagues at the RAND Corporation, the central location for much early thought on nuclear war, argued that 'the US knew little about the important parts of the USSR' and that Moscow would gain operational advantages stemming from 'a closed society, [and] a dictatorial government.'[18] Wohlstetter worried that 'we have a disadvantage not suffered by the Russians, in that we have incomplete (and increasingly incomplete) information as to the location and function of their various airports.'[19]

These assessments were typical of the broader analytic community at the RAND Corporation. As historian Andrew David May recounts, 'periodically, one strategist or another would propose [counterforce], only to be shouted down by a "chorus of protest" from others who found the strategy untenable.'[20] Intelligence was the central problem: 'the prevailing assumption at RAND seems to have been that while the United States suffered from a highly vulnerable striking force … the Soviets had placed their air bases with the problem of vulnerability and

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[17] Bernard Brodie, 'Unlimited Weapons and Limited War,' *The Reporter* 11 (18 Nov. 1954), 17, 18.

[18] Bernard Brodie, Charles J. Hitch, and Andrew W. Marshall, 'The Next Ten Years,' in Marc Trachtenberg (ed.), *The Development of American Strategic Thought, 1945–1969*, Vol. 3, Part II, 6 vols. (New York: Garland 1987).

[19] Wohlstetter *et al., Selection and Use of Strategic Air Bases*, xxxix, xl.

[20] Andrew David May, 'The RAND Corporation and the Dynamics of American Strategic Thought, 1946–1962', PhD Dissertation, Emory Univ. 1998, 235, 291.

secrecy uppermost in their minds.'[21] Well into the 1950s, 'counterforce would continue to be regarded by most RAND strategists as simply too far beyond existing capabilities to be worth pursuing.'[22]

The reality of US intelligence, as RAND analysts Joseph Loftus and Andrew Marshall were aware, was radically different from what other analysts believed.[23] Marshall was so frustrated by other RAND analysts that he noted in 1960:

> One cannot stand up in front of Air Force audiences, who know better, and make statements about how we cannot do this or cannot do that, or the Soviet Union has such and such an advantage over us, because we do not know where their strategic air bases are and expect that the audience will believe that one is an expert on war. RAND has on a number of occasions appeared to be a set of babes in the woods in just this way.[24]

Finding Fixed Targets

As Marshall and Loftus knew, even before the end of the atomic monopoly, US intelligence collection was almost feverishly focused on Soviet military targets and was quickly producing useable targeting intelligence. The most important source of early targeting intelligence was project 'Wringer', a massive effort to debrief individuals repatriated from the Soviet Union after World War II. These included prisoners of war and eminent German scientists who had been exposed to the locations of Soviet military facilities. Collectively, these reports produced detailed information on Soviet industrial and military targets, including 'area descriptions .... detailed maps of specific installations, technical drawings of weapons and machinery, copies of official Russian documents, photographs, material samples, and machine parts.'[25] 'Wringer' ultimately debriefed over 300,000 people, and when combined with German wartime photography and other sources of intelligence, played a major role in Strategic Air Command (SAC) targeting.[26]

[21]Ibid., 257.
[22]Ibid., 260.
[23]Loftus and Marshall had security clearances that made them privy to intelligence most RAND analysts were not able to see.
[24]Andrew Marshall, *Some Aspects of Central War Important to Future RAND Studies* (Santa Monica, CA: RAND 1960), 43.
[25]James M. Erdmann, 'The WRINGER in Postwar Germany: Its Impact of United States-German Relations and Defense Policies,' in Clifford L. Egan and Alexander W. Knott (eds), *Essays in Twentieth Century American Diplomatic History Dedicated to Professor Daniel M. Smith* (Washington DC: UP of America 1982), 178.
[26]For more on the all source intelligence that developed out of 'Wringer' and its impact on targeting, see David Alan Rosenberg, 'The Origins of Overkill: Nuclear Weapons

A number of other intelligence sources were used to produce targeting data about Soviet military installations during the early Cold War, with varying degrees of success. Espionage and signals intelligence (SIGINT) contributed to the effort to some degree. The Air Force and Navy also conducted aerial reconnaissance of the Soviet military installations using 'slant photography' from planes flying alongside Soviet borders.[27] Clandestine overflights of the USSR began under Truman and continued under Eisenhower, providing valuable imagery of Soviet airbases.[28] These programs culminated in the development of the U-2 spy plane, which improved US intelligence on Soviet nuclear installations significantly. Like 'Wringer' before it, overflights were integrated into targeting plans and often came at the request of planners.[29] Finally, the development of satellite reconnaissance ended uncertainty about fixed targets. Beginning in the summer of 1960, the 'Corona' program satellites were able to photograph the entire Soviet Union in great detail.

Intelligence innovations made a real difference. The U-2 led the 'bomber gap' controversy to evaporate and confirmed that the development of Soviet ICBMs was not proceeding on a crash basis.[30] 'Corona' imagery ended the subsequent 'missile gap' debate, and provided intelligence on low readiness among Soviet strategic forces during the Cuban missile crisis.[31] More generally, a range of sources revealed serious operational deficiencies among Soviet nuclear forces. As Andrew Marshall concluded in 1960, the 'irrationality' of Soviet basing was 'fantastic.' The Soviets

and American Strategy, 1945–1960,' *International Security* 7/4 (Spring 1983), 20–1; Fred M. Kaplan, *The Wizards of Armageddon* (New York: Simon and Schuster 1983), 211; Ernest R. May, John D. Steinbruner, and Thomas M. Wolfe, *History of the Strategic Arms Competition 1945–1972*, Vol. 1 (Washington DC: Government Printing Office 1981), 180–1.

[27] R. Cargill Hall, 'Postwar Strategic Reconnaissance and the Genesis of Corona,' in Dwayne A. Day, John M. Logsdon, and Brian Latell (eds), *Eye in the Sky: The Story of the Corona Spy Satellites* (Washington DC: Smithsonian Books 1999), 93–4.

[28] Ibid., 96–7.

[29] R. Cargill Hall, 'Denied Territory: Eisenhower's Policy of Peacetime Aerial Overflight,' *Air Power History* 56/4 (Winter 2009), 4–9.

[30] Gregory W. Pedlow and Donald E. Welzenback, *The CIA and the U-2 Program, 1954–1974* (Washington, DC: Center for the Study of Intelligence 1998), 104–12, 122–8, 135–9, 159–69, 315–18. See also Hall, 'Postwar Strategic Reconnaissance and the Genesis of Corona,' 101–5; John Prados, *The Soviet Estimate: US Intelligence Analysis and Russian Military Strength* (New York: Dial Press 1982), 30–5.

[31] Ernest R. May, 'Strategic Intelligence and US Security: The Contributions of Corona,' in Dwayne A. Day, John M. Logsdon and Brian Latell (eds), *Eye in the Sky: The Story of the Corona Spy Satellites* (Washington DC: Smithsonian Books 1999), 24–6. On 'Corona' and its impact see also May, Steinbruner, and Wolfe, *History of the Strategic Arms Competition*, vol. 1, 417–20; Hall, 'Postwar Strategic Reconnaissance and the Genesis of Corona.'

had 'no ground alert; it takes six to eight hours just to load the planes. In these circumstances, they are just sitting ducks.'[32]

Together, these sources of intelligence provided the United States with the capability to target Soviet nuclear forces. This capability was robust and improved over time. As Daryl Press points out, even though there was a fierce debate within the US government about projecting future Soviet nuclear forces, current day estimates displayed both consensus and amazing accuracy.[33]

Relocatable Targets During the Cold War

US intelligence might be able find fixed targets, critics eventually admitted, but 'relocatable' targets were another problem entirely. No matter how precise US imagery became, it would be useless if the target moved. In this vein, submarines and mobile ballistic missiles were routinely assumed to be untargetable for counterforce purposes. The result of these beliefs about the difficulty of finding mobile targets led many analysts to be extremely skeptical of counterforce capabilities.

Submarine technology has often been seen as checkmate for counterforce operations. For Henry Kissinger, the submarine's elusiveness would, 'for the first time in military history,' bring about a strategic 'stalemate despite an absolute [US] superiority in number of weapons and technology.'[34] Analyst Karl Launtenschlager has argued SSBNs 'emerged at just the right time to solve [the] emerging strategic problem' of 'how to maintain a secure deterrent force,' and that 'developments in ASW [anti-submarine warfare] technology do not appear to threaten the survivability of ballistic missile submarines in the foreseeable future.'[35] Richard Garwin agreed, arguing that SSBNs were invulnerable: 'it is inconceivable that a fleet-wide covert trailing operation could be long maintained.' Even if submarines could be found, 'the inevitability and effectiveness' of countermeasures 'keeps both the US and the Soviet Union from building a fleet' of trailing submarines.[36]

Likewise, during the Cold War, mobile ICBMs were also perceived as beyond the reach of US intelligence. Mobile missiles, Michael Brower

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[32] Marc Trachtenberg, *A Constructed Peace: The Making of the European Settlement, 1945–1963* (Princeton UP 1999), 182; May, 'The RAND Corporation and the Dynamics of American Strategic Thought,' 344.

[33] Press, *Calculating Credibility*, 92.

[34] Henry A. Kissinger, 'Military Policy and Defense of the Grey Areas,' *Foreign Affairs* 33 (April 1955), 418.

[35] Lautenschläger, 'The Submarine in Naval Warfare,' 130, 131, 132.

[36] Richard L. Garwin, 'Will Strategic Submarines be Vulnerable?' *International Security* 8/2 (1983), 55, 56. Note that Garwin is attacking passive and active sonar trailing, respectively.

concludes, 'could disperse widely over rail and road networks' beyond the capacity of imagery to follow. They 'would emit radio signals rarely, if at all, and consequently finding them would be much more difficult.' In short, 'efforts to threaten Soviet [mobiles] … face a number of challenges which appear to be overwhelming.'[37] Finally, a very sophisticated civilian analysis carried out in the late Cold War noted that improvements in US counterforce capability posed a grave risk to Soviet silo-based forces '… but do not threaten the Soviets' sizable SLBM, mobile ICBM, or bomber forces.' The Soviets could therefore mitigate any US ability to significantly limit damage by expanding SLBM or mobile ICBM forces.[38]

Once again, the government took a different view. Large investments in acoustics and SIGINT technology allowed US forces to trail and target Soviet submarines with high confidence. Similarly, the US invested heavily in SIGINT and other capabilities to track Soviet mobile missiles. In this section we demonstrate that the intelligence challenge for mobile targets, like fixed targets before them, was far more soluble than most analysts believe. However, unlike fixed target intelligence, most of these capabilities are still not widely appreciated despite declassification. The result has been unwarranted assumptions about the security of certain systems for second strike during the Cold War.

Submarines and Intelligence

American anti-submarine warfare (ASW) during the Cold War relied on intensive innovation in both ocean surveillance technology and SIGINT. In the early Cold War, the United States held a geographic advantage derived from the fact that the vast bulk of Soviet naval forces, and particularly nuclear submarines, were initially based in the western Soviet Union. Transiting from these bases to the Atlantic Ocean, which was required to target the United States due to the limited range of early submarine launched ballistic missiles (SLBMs), meant passing through the region between Greenland, Iceland, and the United Kingdom. This created a natural chokepoint, known as the GIUK gap, around which to focus ASW efforts.

The key to exploiting favorable geography was advances in acoustic detection. These were principally embodied in the Sound Surveillance System (SOSUS), a network of undersea hydrophones that exploited a quirk of sound propagation in the ocean. Near the surface of the ocean

[37]Brower, 'Targeting Soviet Mobile Missiles: Prospects and Implications,' 433–4, 438, 439, 441.

[38]Michael Salman, Kevin Sullivan, and Stephen Van Evera, 'Analysis or Propaganda? Measuring American Strategic Nuclear Capability, 1969–1988,' in Lynn Eden and Steven Miller, *Nuclear Arguments: The Major Debates On Strategic Nuclear Weapons And Arms Control* (Ithaca, NY: Cornell UP 1989), 237.

sound moves very quickly through water, slowing as depth increases and the water temperature cools. However, at a certain depth the increasing water pressure causes sound waves to begin speeding up again. As the sound waves slow, they bend down and, conversely, they bend up as they speed up. This phenomenon produces a region where underwater sound bounces back and forth with little loss of clarity for extremely long distances. Known as the 'deep sound channel,' it allowed SOSUS hydrophones, combined with extensive signal processing to eliminate noise, to detect submarines across distances of hundreds of miles.[39]

The resolution of SOSUS was not enough to pinpoint Soviet submarines on its own, but it could direct other assets roughly where to search. These assets included quiet US nuclear submarines (SSNs) equipped with large passive sonar arrays, as well as airborne ASW aircraft (VPs). Together these platforms were highly effective against Soviet ballistic missile submarines. As Owen Coté notes of the late 1960s–70s:

> The submarine community was also prepared for strategic ASW against forward deployed Soviet SSBNs because of its capability to track them covertly in their deployment areas. Because Soviet SSBNs of the Hotel and Yankee classes had to pass through Allied barriers before getting within range of their targets, American SSNs could be vectored by SOSUS to intercept them as they passed through those barriers. The SSN would then maintain continuous contact with its quarry, in some cases for the entire duration of the SSBN's forward patrol. Also, a powerful synergy existed between SSN tracking operations and the SOSUS/VP team. In those cases, when the former lost contact with its target, the latter was often able to quickly reacquire it and hand it back off to the SSN, which could then resume tracking.[40]

As one history of US operations notes of this period '[t]railing Soviet missile subs was fast becoming the Navy's most critical mission…' Trailing was so frequent that on at least three occasions in 1970 alone US submarines collided with the Soviet submarines they were trailing.[41] The dominance of US ASW against the 'Hotel'- and 'Yankee'-class Soviet SSBNs was so great that the late 1960s and

[39]Owen Coté, *The Third Battle: Innovation in the US Navy's Silent Cold War Struggle with Soviet Submarines* (Newport, RI: Naval War College 2003), 16–17.
[40]Coté, *The Third Battle,* 52.
[41]Sherry Sontag and Christopher Drew, *'Blind Man's Bluff:' The Untold Story of American Submarine Espionage* (New York: Public Affairs 1998), 140–1, quotation on 140.

early 1970s have been called 'the happy time' of the US submarine force, echoing the U-boat commanders in the early days of the Battle Atlantic.[42]

However, the Soviets launched several new classes of submarines in the 1970s, each of which posed a challenge to US ASW dominance. Perhaps the most important was the 'Delta'- class SSBN, which carried much longer range SLBMs than its predecessors. This allowed 'Delta' SSBNs to threaten the US homeland while remaining close to the Soviet Union, avoiding the need to transit the GIUK gap. Moreover, the 'Deltas', operating near their home ports, could be protected by Soviet naval forces, making the US ASW effort against them much more difficult.[43]

This so-called Soviet 'bastion' strategy of protecting SSBNs close to home would require significant changes in how the US targeted SSBNs. Rather than trailing SSBNs as they crossed into the Atlantic, US submarines would have to surge into Soviet waters to search for SSBNs. Unfortunately, these waters were too shallow to exploit the deep sound channel so even the relatively loud 'Delta' SSBNs could not be detected at very long range with passive sonar.[44]

Civilian analysts were therefore extraordinarily skeptical of the US Navy's proclaimed 'Maritime Strategy' in the 1980s, as it emphasized the US Navy's capability to hunt Soviet SSBNs in these bastions.[45] Yet as Owen Coté notes, Soviet behavior, informed by a spy ring inside the US Navy, seems to indicate that Moscow considered the threat significant. Coté then describes ways in which the US Navy could still track Soviet SSBNs acoustically. For example, the US Navy's SSNs could still conduct trails of the 'Delta' if they picked the 'Delta' up as it left its home port.[46]

The Navy also continued to invest in additional resources for tracking Soviet SSBNs. Another major contribution was the creation of ships that trailed very long and sensitive passive sonar known as the Surveillance Towed Array Sensor System (SURTASS). SURTASS ships provided very powerful sonar much closer to Soviet 'bastions' than the existing SOSUS sites. Another major contribution was the deployment

[42]Coté, *The Third Battle*, Chapter 4 is titled 'ASW and the Happy Time, 1960–1980.'
[43]Ibid., 63–7.
[44]Ibid., 66. Coté does note the Barents Sea, though shallow, is overall a good sonar environment. See ibid., 73.
[45]Civilian analysts opposed the maritime strategy for a number of reasons, among them the difficulty of hunting submarines. See for example, John Mearsheimer, 'A Strategic Misstep: The Maritime Strategy and Deterrence in Europe,' *International Security* 11/2 (Fall 1986), 3–57.
[46]Coté, *The Third Battle*, 73.

of Rapidly Deployable Surveillance System (RDSS) units, which could be quickly deployed in and around the 'bastions.' These units were networked to create temporary 'mini-SOSUS beds' on short notice.[47]

Innovation in acoustic detection worked in synergy with SIGINT. The Navy maintained close ties to US national SIGINT, as demonstrated by the opening in 1957 of the Navy Field Operational Intelligence Office (NFOIO) at Fort Meade, home of the National Security Agency (NSA).[48] Unfortunately, the vast majority of the SIGINT contribution to efforts to track Soviet ballistic missile submarines remains classified.

However, what is known is the extent to which the NSA and the Navy's submarine force were mutually supportive, with Navy submarines providing highly effective platforms for a variety of sensitive SIGINT missions while the NSA provided substantial support to the submarine force. Former senior intelligence official Richard Haver, who was involved in many of these efforts, noted of the 1980s 'how pleased the Navy, and in particular the Navy Submarine Force, was with the production coming out of the National Security Agency and out of the intelligence community.'[49] An unclassified history written by two Navy reserve intelligence officers based on a classified symposium similarly notes the importance of SIGINT to the Navy's ocean surveillance capability.[50] NFOIO maintained a Special Projects Detachment that after 1976 provided 'unique support' on ASW efforts.[51]

While the exact details of SIGINT support to ASW remains classified, two alleged 'special projects' have been revealed that would have contributed substantially to the effort. These two projects are the tapping of Soviet undersea naval communications lines in the Barents Sea and the Sea of Okhotsk, both of which yielded an enormous amount of information about Soviet patrols' tactics and timing, logistics and maintenance challenges, and a host of other issues.[52] This intelligence bonanza surely contributed substantially to US ability to track Soviet SSBNs.

All of these diverse sources of intelligence, along with others such as overhead imagery, were combined at intelligence fusion centers to

[47]Christopher Ford and David Rosenberg, *The Admirals' Advantage: US Navy Operational Intelligence in World War II and the Cold War* (Annapolis, MD: Naval Institute Press 2005), 103.

[48]Ibid., 33.

[49]Richard Haver, 'Naval Intelligence and the Submarine Force,' Proceedings of the Submarine Development Group TWO & Submarine Development Squadron Symposium, Mystic, CT 20–22 May 1999. For deeper discussion of submarine based intelligence collection see Sontag and Drew, *'Blind Man's Bluff'*.

[50]Ford and Rosenberg, *The Admirals' Advantage*, 43, 53, 130.

[51]Ibid., 99 and 101, quotation from 99.

[52]Sontag and Drew, *'Blind Man's Bluff'*, 158–83 and 210–20.

produce a daily report on the location and status of Soviet submarines, including SSBNs.[53] The result was that many in the US Navy felt confident in their ability to target a substantial portion of the Soviet SSBN force. Admiral David Jeremiah, who commanded the US Pacific Fleet in the mid-1980s, remarked on the US ability:

> …to identify by hull number the identity of Soviet subs, and therefore we could do a body count and know exactly where they were. In port or at sea. If they were at sea, N3 [Director for Operations] had an SSN … [on them], so I felt very comfortable that we had the ability to do something quite serious to the Soviet SSBN force on very short notice in almost any set of circumstances.[54]

Mobile Missiles and Intelligence

Mobile missiles challenged American reliance on overhead imagery, since these targets could move after they were photographed. The US response was to carefully map Russian missile deployment patterns, using two techniques: satellite based SIGINT and unmanned aerial vehicle (UAV) development.

The Soviet Union began developing two mobile ICBMs near the end of the Cold War: the rail mobile SS-24 and the road mobile SS-25. The SS-25 was deployed in 1985 and perhaps not coincidentally National Security Decision Directive (NSDD) 178 was issued in July of that year. The focus of NSDD 178 was strategic modernization and one of the key tasks was '[o]n an urgent basis, develop a program to provide a capability to attack relocatable targets with US strategic forces.'[55] A declassified official NSA history further clarifies that the standard required was robust, requiring '… the ability to destroy at least 50–75 percent of the [Soviet] force.'[56]

NSDD 178 led to the creation of the Mobile Missile Task Force, an intelligence community and Department of Defense organization focused on generating the intelligence needed to target Soviet mobile

[53]Ford and Rosenberg, *The Admirals' Advantage*, 99.

[54]Ibid., 105–6. Jeremiah also notes his intelligence officer at the time was future Vice Admiral Mike McConnell, who would later head NSA and eventually become Director of National Intelligence, further indication of the ties between the operational Navy, the NSA, and the broader intelligence community.

[55]National Security Decision Directive 179, 'Strategic Force Modernization,' 10 July 1985 (declassified in 2011 – available at the National Archives and Records Administration).

[56]Thomas Johnson, *American Cryptology during the Cold War 1945–1989*, Vol. 4 (Ft. Meade, MD: Center for Cryptologic History 1999: declassified 2007), 339.

ICBMs.[57] The task force was well funded and very high priority, but at present much of what the task force did and any possible successes remain classified. However, some suggestive information is available about two different but complementary efforts to track Soviet mobile missiles.

The first effort used SIGINT to track mobile missiles. Contrary to assertions that mobile missiles would be unlikely to emit detectable signals, there is good reason to believe that mobile ICBMs communicated with their higher headquarters with some frequency. In addition, mobile ICBMs are not typically operated as single transporter-erector-launchers (TELs). There is a mobile command center, a support vehicle carrying supplies and a field kitchen for the crew, a massive fuel tanker, and at least one security vehicle. Communications between these vehicles can also potentially be intercepted and used to locate the vehicles.

There are two possible ways in which SIGINT could have been effective in tracking Soviet mobile ICBMs. The first is geolocation of transmissions originating from the mobile missile complex. This technique uses multiple observations of the same signal to determine the area where the signal originated. It can be employed relatively rapidly if different receivers that are geographically and geometrically dispersed but linked by communications systems observe the signal simultaneously.[58] The US Navy is reported to operate a set of satellites in low earth orbit to locate ships using this technique.[59]

However, this technique has limits when intercepting signals using only satellite systems. Reports on the Navy system noted above indicate that the emitter location can only be narrowed down to an area several kilometers in size.[60] It is therefore unlikely that this technique alone was useful in tracking Soviet mobile ICBMs, although it could have contributed to mapping deployment patterns, discussed below.

The second SIGINT technique is difficult but potentially more effective. It requires listening to Soviet communications and extracting data

[57]Ibid. and Desmond Ball and Robert Toth, 'Revising the SIOP: Taking War-fighting to Dangerous Extremes,' *International Security* 14/4 (Spring 1990), 77–81.

[58]See Richard A. Poisel, *Electronic Warfare Target Location Methods*, 2nd ed. (Boston: Artech House 2012) for an overview of various methods of locating emitters.

[59]A. Andronov, 'Kosmicheskaya Sistema Radiotekhnicheskoy Razvedki VMS SShA 'Uayt Klaud' [The US Navy's 'White Cloud' Spaceborne ELINT System], *Zarubezhnoye Voyennoye Obozreniye* [*Foreign Military Review*], No. 7 (1993), trans. Allen Thomson. See also Norman Friedman, *Seapower and Space: From the Dawn of the Missile Age to Net-centric Warfare* (Annapolis, MD: Naval Institute Press 2000).

[60]Such a system would also be limited against intermittent transmissions such as communications from a mobile missile rather than a persistent transmitter such as a radar system.

useful for locating mobile missiles, which would require decoding the communications if they are encrypted. It is likely that, at least periodically, the mobile missiles report their location to their higher headquarters – mobile missiles are potentially much more vulnerable to attack from even a small group of armed men (e.g. special operations forces or terrorists), while also having much less endurance than nuclear submarines. These updates can be intercepted and used to locate the missile very precisely if the missiles are monitored over time so that it becomes understood that when, for example, a mobile missile complex reports it is at 'Location XYZ' that corresponds to a certain field deployment launching site. This could provide extremely precise location once deployment sites are mapped.

Similarly, the vehicles that make up the mobile missile complex may communicate details about their location that could also be used to help locate the mobile missile complex. For example, if a security vehicle is scouting the route ahead of the TEL, it may call back to indicate that a certain road is clear. Likewise the fuel tanker may communicate with the TEL about a rendezvous point for refueling. Over time this information can also be used to build a pattern for deployment and patrol locations.

Making use of intercepted communications is relatively easy if they are not encrypted. However, encrypted signals can be challenging to break. It is not entirely clear at the unclassified level how successful the United States was at decrypting Soviet communications in this period. Yet there are a variety of strong suggestions that indicate substantial success in breaking Soviet codes in this period. The declassified NSA history of the Cold War mentioned earlier notes that by the late 1970s '… cryptology was yielding the best information that it had produced since World War II … By the end of the Cold War in 1989 the cryptologic system had lots of shiny new toys, and was using them to very telling effect.'[61] Matthew Aid also supports this contention, arguing that by the late 1970s NSA had succeeded in breaking several key Soviet codes.[62]

Exactly what NSA accomplished against mobile missiles is unknown, but there are several suggestive pieces of evidence in the public record. The NSA history, for example, spends two pages describing NSA's contribution to the anti-mobile effort that have been completely redacted during declassification. A Russian military officer, referencing Western media sources, implies SIGINT collection from geosynchronous and high orbit satellites was quite successful. This source notes:

[61]Johnson, *American Cryptology,* Vol. 3, vii–viii.

[62]Matthew Aid, *The Secret Sentry: The Untold History of the National Security Agency* (New York: Bloomsbury 2009), 164–5.

> The results of satellite reconnaissance over the past decades have been carefully concealed and only a few of them have been published in periodicals. One such result is the surveillance of Soviet rail-mobile missile complexes (the SS-24 ICBM). According to data in the Western press, the location of these complexes was revealed in the 1980s through intercepts of the exchange of encoded radio signals between the combat complexes and the missile forces' command centers.[63]

Intelligence historian Matthew Aid also argues NSA was successful in intercepting SS-24 communication and adds that it intercepted communications of the SS-20, a mobile theater missile, as well.[64] The same techniques would likely have been effective against the SS-25.

According to another source, US SIGINT had achieved such success against Soviet communications in this period that it had discovered a vulnerability, enabling the United States to prevent the Soviet Union from issuing '… orders from the high command to its strategic missile forces, submarine fleet, and air forces.' While the Soviets apparently fixed this vulnerability at some point, it led to a larger program intended to find and exploit other Soviet and Warsaw Pact communications vulnerabilities. One outcome of these efforts included interception and recording of the voice patterns of Soviet ground controllers for aircraft. In a war these voice prints could be used to send misleading instructions to Soviet military pilots. This evidence highlights the significant and far reaching successes US SIGINT had against Soviet communications in the 1980s, and these techniques could have been similarly effective if deployed against mobile ICBMs.[65]

The second major effort to track Soviet mobile ICBMs was an ambitious effort to create a stealthy high altitude unmanned aerial vehicle (UAV) that could penetrate Soviet airspace and monitor the mobile missiles.[66] This would allow precise location through continuous imagery and also potentially SIGINT, by supplementing satellite collection and helping solve some of the challenges for emitter location posed by using satellite systems alone.

[63] A. Andronov, transl. Allen Thomson, 'Amerikanskiye Sputniki Radioelektronnoy Razvedki na Geosynchronnykh Orbitakh' ['American Signals Intelligence Satellites in Geosynchronous Orbit'], *Zarubezhnoye Voyennoye Obozreniye* [*Foreign Military Review*] No. 12 (1993), 42.

[64] Aid, *The Secret Sentry*, 183.

[65] See Benjamin Fischer, 'CANOPY WING: The US War Plan that Gave the East Germans Goose Bumps,' *International Journal of Intelligence and Counterintelligence* 27/3 (2014), quotation on 439.

[66] This description is drawn from Thomas Ehrhard, *Air Force UAVs: The Secret History* (Washington DC: Mitchell Institute 2010), 13–17.

This project, known as the Advanced Airborne Reconnaissance System (AARS), was to provide real time tracking capability to target mobile missiles. AARS was extraordinarily ambitious in terms of technology and was enormously expensive as a result, but in the words of Thomas Ehrhard, 'The Soviet mobile missile threat loomed large and the Reagan Administration kept the black money [classified funding] flowing.'[67]

However, the Cold War ended before AARS could be fielded and as the Soviet mobile ICBM threat receded, so did the flow of resources. AARS was canceled but the technology developed for the program would be recycled into the smaller scale DarkStar UAV in the 1990s. DarkStar was in turn cancelled in 1998 but as with AARS the technology would provide a foundation for future efforts.[68]

SIGINT and UAVs can be combined with other sources of intelligence to map mobile missile deployments. The massive size of mobile ICBMs (the SS-25 weighs more than 100 tons) makes location easier as only certain roads and areas are suitable for patrol. Imagery of the regions surrounding mobile missile bases can thus be used to help rule out locations. This imagery can also help indicate which directions a mobile missile can or cannot move. For example, an SS-25 identified to be on a certain road is likely to move in either direction on the road but is much less likely to change direction to go off-road (and would move much more slowly if it did). If the terrain around the road was very rough it might not be able to leave the road at all, greatly simplifying targeting.

Having mapped and tracked mobile missiles, US strategic forces would have to target them. If the mobile missile is only very roughly located, as would likely be the case for locations from SIGINT, then a fairly large area would need to be barraged with nuclear warheads in order to ensure destruction.[69] This barrage would also have to be relatively prompt as the mobile missiles could move relatively quickly after their position was identified.

This requirement for rapid targeting naturally led to a requirement for ballistic missiles, the fastest delivery system, to be able to quickly change aim points. Due to limitations on communication with ballistic missile submarines, the requirement was initially imposed on the land based ICBM force. By 1988, the US Air Force had commissioned several studies on procedures to speed up Minuteman ICBM retargeting. An analysis that year indicated that adopting a hybrid of the recommendations from these studies could reduce the time to retarget

[67]Ibid, 15.
[68]Ibid., 53–4.
[69]On barrage targeting of mobile missiles, see Office of Technology Assessment, *MX Missile Basing* (Washington DC 1981), 258–65.

ten Minuteman missiles in a wing to just under 12 minutes.[70] In the 1990s these time saving enhancements were fielded as the Rapid Execution and Combat Targeting (REACT) upgrade to the Minuteman force, with a further upgrade completed in 2006. Once barriers to communication had been surmounted, the SLBM force received a similar upgrade allowing rapid retargeting.[71]

Barrage targeting, though fast, is not efficient with warheads and also lacks the certainty of having eyes on the target. The B-2 'stealth bomber' was potentially tasked to penetrate Soviet airspace and hunt for mobile missiles.[72] This would have been much easier with SIGINT to at least provide the general area to search. It would have been even easier if AARS had been present to continuously track SS-25s in real time. However, there were real doubts about how well the B-2 could penetrate Soviet airspace.

It should be clear that these techniques must be applied continuously over time to mobile missile deployments to develop a deep understanding of how and where these missiles deploy.[73] This pattern cannot be created overnight, a point that will become relevant in subsequent discussion. Yet at the same time, these techniques had at least some success in tracking Soviet mobile missiles, according to available sources. These techniques are potentially usable against contemporary mobile missiles.

Relocatable Targets Today

Mobile missiles are the primary targeting problem for contemporary counterforce operations. Among many analysts, the difficulties anticipated during the Cold War have only been confirmed by recent experience with missile hunting in conventional settings. The *Gulf War Air Power Survey*'s (GWAPS) analysis of the Scud hunt during the 1991 Gulf War is a common reference point. James Acton notes that during the war 'the United States launched about 1,500 sorties against Scud launchers … not a single mobile launcher was

[70]Douglas Hill, 'Minuteman Rapid Retargeting,' US Air Command and Staff College Student Report, 1988.

[71]Amy Woolf, *Strategic Nuclear Forces: Background, Development, Issues* (Washington DC: Congressional Research Service 2009), 13; William Arkin, 'The Six-Hundred Million Dollar Mouse,' *Bulletin of the Atomic Scientists* (Nov./Dec. 1996). Arkin specifically links REACT to '… the increasing ability to track mobile missiles- whether SS-25 maneuvers in Russia or Scuds in Iraq…' (p.68).

[72]See Ball and Toth, 'Revising the SIOP', 79–81.

[73]See discussion in Alan Vick *et al.*, *Aerospace Operations Against Elusive Ground Targets* (Santa Monica, CA: RAND 2001), 74–5.

confirmed destroyed.'[74] Gerson cites GWAPS to the effect that '[E]ven in the face of intense efforts to find and destroy them, the mobile launchers proved remarkably elusive and survivable.' Michael Gerson also raises the US experience suppressing Serb air defenses in Operation 'Allied Force', which 'were routinely relocated to avoid destruction.'[75] The Israeli mobile hunting campaign in the 2006 war against Hizballah in southern Lebanon is also sometimes invoked in this regard.

The failure in the 'Scud hunt' is seen as particularly relevant to targeting Chinese nuclear forces. In discussion of China's movement to road mobile ICBMs, for example, China analyst James Mulvenon notes:

> If one factors in US continuing failures with 'Scud-hunting' for mobile missiles, China may soon arrive at a stable equilibrium … whereby a US preemptive first strike would not be capable of sufficiently degrading China's forces such that the currently planned architecture of missile defenses could reliably catch the stragglers.[76]

Furthermore, a 2010 assessment by Matthew Hallex presented at the Center for Strategic and International Studies' Program on Nuclear Issues also takes the problems of the Scud hunt as its starting point for assessing counterforce targeting against Chinese mobile ICBMs. The verdict of history would seem to be that mobile missiles are beyond the reach of US intelligence.[77]

In this section we argue the intelligence situation is quite different. The 'lessons' of recent campaigns against mobile missiles that are cited as proof of their invulnerability are misleading when taken out of their conventional context. Furthermore, there have been tremendous advances in SIGINT, surveillance, and other technologies that greatly facilitate the targeting mobile missiles. Given these intelligence capabilities, the United States is likely to have a useable counterforce option in many plausible scenarios.

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[74] Acton, 'Managing Vulnerability,' 147. For the source of the statistic, see Eliot Cohen (ed.), *Gulf War Air Power Survey*, Vol. 3, Part 2 (Washington DC: US Air Force 1993), 330.

[75] Gerson, 'No First Use,' 27, 28.

[76] James Mulvenon, 'Chinese and Mutually Assured Destruction: Is China Getting MAD?', in Henry Sokolski, (ed.), *Getting MAD: Nuclear Mutual Assured Destruction, Its Origins and Practice* (Carlisle, PA: Institute for Strategic Studies 2004), 255.

[77] Matthew Hallex, *Chinese Mobile Ballistic Missiles: Implications for US Counterforce Operations* (Washington DC: Center for Strategic and International Studies 2010).

Intelligence, Operations, and the Scud Hunt Myth

The Scud hunt is both a misleading analogy and a distant data point from a technology perspective. As an analogy, the Scud hunt bears little to no resemblance to either the effort to track Soviet mobile ICBMs during the Cold War or future mobile missile scenarios, for at least five reasons.

First, unlike the effort to track Soviet mobile ICBMs, the Scud hunt did not involve careful and long term analysis of the Scud force. Indeed almost nothing had been done to build up a pattern of Scud deployment or even basing. As the *Gulf War Air Power Survey* notes: 'Key portions of the target set – notably the pre-surveyed launch sites and hiding places used by the mobile launchers – were not identified prior to 17 January 1991 ...'.[78] This was not apparently the case with tracking Soviet ICBMs and it need not be the case with regard to future mobile missile forces.

Second, the Scud force in 1991 operated in a way that was quite unlike how either the Soviet mobile ICBM force or other future mobile nuclear missiles will likely be operated. Communications with Scuds were apparently all done either via landline or couriers, which limited Scud mobility to major roads but greatly limited US SIGINT-based targeting.[79] This command and control (C2) arrangement was acceptable for non-nuclear tactical missiles but seems an unlikely method to control nuclear forces as there would be minimal and slow contact with deployed forces. Such a C2 system would limit both the speed of use of the nuclear force as well as the security of the mobile missile force. It would also constrain the mobility of the missiles as they would need to connect to landlines or be available for couriers. For example, mobile missiles would presumably have to meet couriers at specific times and places agreed upon prior to the missile patrol. Finally, it creates vulnerabilities if the landline system and/or the national command authority is destroyed (for example, by nuclear preemption).

Some of these challenges can be answered by pre-delegating nuclear launch authority to the mobile missile complex commanders. However, this is both dangerous and only partly effective. Mobile missile complexes in remote locations that are not using radio frequency communications would be extraordinarily isolated, so the ability to retaliate in a timely manner would be limited. While the timeliness of retaliation may not matter intrinsically, slow retaliation would give the United States more time to use other assets, including manned and unmanned aircraft, to locate the missile complex.

It is also important to note that even countries facing high levels of threat and/or significant need for rapid nuclear use have been reluctant to pre-delegate nuclear use, particularly strategic nuclear use. For

[78] *Gulf War Air Power Survey*, Vol. 2, Part 2, 330.
[79] *Gulf War Air Power Survey*, Vol. 2, Part 2, 334, fn. 154.

example, while Vipin Narang and others have highlighted the pressures on Pakistan that might drive it to pre-delegate tactical nuclear use. Yet there is at present no available evidence to suggest Pakistan has taken this step.[80] Even then it seems unlikely Pakistan would pre-delegate strategic (rather than tactical) use to individual missile battery commanders.

Moreover, pre-delegation would presumably only take place in a period of crisis. In normal times there would likely be some communication, just as there is for SSBNs. This could allow significant mapping of deployment in pre-crisis periods.

Third, the Scud hunt was not prosecuted using nuclear armed ballistic missiles. This may seem obvious but it is important to bear in mind when considering the utility of the Scud hunt as an analogy. Uncertainty about target location matters much less when using fast nuclear weapons rather than much slower fighter-bombers armed with conventional weapons.

Fourth, the Scud is significantly smaller than a mobile ICBM, weighing less than half as much as an SS-25, which makes it both more mobile and more difficult to detect. Future efforts against mobile missiles may involve systems more similar to the SS-25 than the Scud. This would certainly be the case with Chinese mobile ICBMs as the DF-31A and its associated launcher weighs roughly the same as the SS-25.[81]

Fifth, the stakes for the Scud hunt were significantly different from those involved in the hunt for SS-25 and may be very different from the stakes in future efforts to track mobile nuclear missiles. The threat posed by the Scud was largely a matter of alliance politics, as it carried only an inaccurate conventional payload and only had the range to reach Israel or Saudi Arabia. Despite the importance of the coalition, the United States was therefore unwilling to assume much risk in

[80]Vipin Narang, 'Posturing for Peace? Pakistan's Nuclear Postures and South Asian Stability,' *International Security* 34/3 (Winter 2009/2010), 38–78 and Shashank Joshi, 'Pakistan's Tactical Nuclear Nightmare: Deja`Vu?' *Washington Quarterly* 36/3 (Summer 2013), 159–172.

[81]The weight of a Scud and associated TEL is roughly 40 tons. The weight of an SS-25 and associated TEL is roughly 105 tons. The Chinese DF-31A has been shown with several different TELs but the most recent is estimated to have a weight of about 108 tons. The DF-31A missile alone weighs 70 tons. All weights are from *Jane's Strategic Weapon Systems* database. Even if shorter range missiles were used to threaten allies and increase mobility, potential adversaries would be vulnerable to the 'no cities' coercive elements of counterforce strategies in a way that Saddam Hussein was not. See, for instance, the way the Kennedy administration planned to neutralize Soviet theater missiles in its famous 1961 memo on a first strike: Carl Kaysen to Maxwell Taylor, 5 Sept. 1961, National Archives, Record Group 218, Records of the Joint Chiefs of Staff, Annex A.

prosecuting the Scud hunt. The *Gulf War Air Power Survey* dryly noted '[i]t can be argued – and was, during the war, by the Israelis – that the tactics employed by Coalition aircraft flying airborne "Scud patrols" were less than aggressive.'[82] This would not have been the case with SS-25s that posed a thermonuclear risk to the US homeland. Future mobile missiles may likewise pose a much higher threat to the United States, which would be more willing to assume risk to track and target them.[83]

The other cases that are sometimes cited as example of the difficulty of tracking mobile missiles, including the 1999 failures during Operation 'Allied Force' and the 2006 Israeli failure to destroy all rockets in southern Lebanon, suffer from similar limitations. Indeed, they may be even more misleading. For example, the Israeli Air Force actually destroyed most of the longest range rockets in Lebanon on the first day of the war – only systems much smaller (and shorter ranged) than the Scud survived. Such systems are unlikely to be nuclear armed in the future and regardless are unlikely to pose a threat to the US homeland.[84]

Moreover, due to the relatively low risk posed by individual Hizballah rockets Israeli forces were relatively restrained in targeting in terms of force applied and rules of engagement.[85] If, hypothetically, a small number of Hizballah long-range rockets had been nuclear armed Israeli forces would have been much less restrained, possibly preempting with Israeli nuclear weapons rather than conventional bombs.

Post-Scud Hunt Intelligence Developments

In addition to the limits of the Scud hunt as an analogy, it is important to remember that the United States has had more than two decades to

[82]*Gulf War Air Power Survey*, Vol. 2, Part 2, 336, fn. 158.

[83]We thank Tom Ehrhard for this latter point.

[84]David Makovsky and Jeffrey White, *Lessons and Implications of the Israel-Hizballah War: A Preliminary Assessment* (Washington DC: Washington Institute for Near East Policy 2006), 51; Benjamin S. Lambeth, *Air Operations in Israel's War Against Hezbollah: Learning from Lebanon and Getting It Right in Gaza* (Santa Monica, CA: RAND Corporation 2011), 92–110. Lambeth notes that the longest range rockets, the Zelzals, were never fired during the war despite Hizballah rhetoric about using them to target Tel Aviv, suggesting either complete Israeli success in preemptively destroying them or extreme pressure from Iran on Hizballah not to use them. It is worth noting in this context that the Zelzal weighs almost 40 per cent less than the Scud and more than 90 per cent less than the SS-25, making it both more difficult to detect and more mobile. See *Jane's Strategic Weapon Systems* database.

[85]Lambeth claims that the Israeli government anticipated as many as 500 civilian casualties from preemptive targeting of long range rockets but ultimately the operations killed only 20. Lambeth, *Air Operations in Israel's War against Hezbollah*, 100.

develop additional technology to remedy deficiencies observed in 1991. There are at least three major areas where US intelligence capability for tracking and targeting mobile missiles has improved since the 1991 Gulf War. These are a stealthy high altitude UAV, increased SIGINT geolocation capability, and networked ground sensors.

The most notable improvement in US capability was revealed in 2009 when the existence of the RQ-170 stealth UAV became publicly known.[86] The RQ-170 is very clearly the lineal descendant of AARS and DarkStar, operating at high altitude and apparently having a long loiter time in addition to being stealthy. While the payload is unknown, reports indicate that it has both video and SIGINT sensors. It has penetrated both Iranian and Pakistani airspace undetected, though in the case of Iran an RQ-170 crashed in December 2011 while in Iranian airspace.[87]

The implications of the RQ-170 for the ability of the United States to track mobile missiles are striking. At least in countries with limited air defenses (e.g. Pakistan, Syria, North Korea, and Iran) the United States can potentially track mobile missiles on patrol with real time video imagery and SIGINT. Mapping deployments and field launching sites would therefore be extraordinarily effective over time.

Even in countries with more advanced air defense (Russia and China) the RQ-170 can potentially be routed to avoid air defense concentrations. Such route planning is standard for stealth aircraft but may be particularly effective for countries such as China, which have extensive borders.[88] So while an RQ-170 might not be able to penetrate the dense air defense near China's coast, careful route planning, for example, from Afghanistan across northern Pakistan might allow penetration into western and even central China.[89]

The ability to conduct effective route planning to avoid radar has also been substantially enhanced since 1991 as part of a US Air Force electronic attack effort known as Senior Suter (sometimes shortened just to Suter). Senior Suter, in conjunction with another program

[86] David Fulghum, 'Stealth Over Afghanistan,' *Aviation Week and Space Technology*, 14 Dec. 2009. The RQ-170 was first sighted flying out of Kandahar Airfield in Afghanistan in 2007 but was not publicly acknowledged until 2009.

[87] Scott Shane and David Sanger, 'Drone Crash in Iran Reveals Secret US Surveillance Effort,' *New York Times*, 7 Dec. 2011 and Greg Miller, 'CIA Flew Stealth Drones into Pakistan to Monitor bin Laden House,' *Washington Post*, 17 May 2011.

[88] See Myron Hura and Gary McLeod, *Route Planning Issues for Low Observable Aircraft and Cruise Missiles: Implications for the Intelligence Community* (Santa Monica, CA: RAND 1993).

[89] In any event, operating mobile ICBMs in China's heavily populated coastal areas may prove quite challenging. The Soviet Union preferred to operate the SS-25 deep within its territory and away from large population centers.

known as Network Centric Collaborative Targeting, precisely locates enemy transmitters and broadcasts 'customised [*sic*] signals, including specialised [*sic*] algorithms and malware' into enemy air defense systems. This can then be used to produce false positives or other misleading data in the air defense system, or even to hijack the system entirely. This attack method is much more subtle than traditional electronic warfare and may not even be perceptible. In conjunction with careful route planning, such technology, apparently already used by the Israelis against Syria in 2007, could allow RQ-170 to penetrate all but the most heavily defended airspace.[90]

Moreover, the United States is alleged to be already hard at work on an even more capable successor stealthy UAV. This new model, dubbed the RQ-180, is intended to be larger yet stealthier and have longer range than its predecessor. This would expand potential targets, loiter time on station, and the array of sensors that could be carried by the drone.[91]

The second improvement in US mobile missile tracking is the explosion of US SIGINT capability for geolocation after September 11, 2001. The demands of the war on terror and the wars in Iraq and Afghanistan pushed the US intelligence community to develop ways to more rapidly and precisely geolocate individuals. This demand was coupled with resources that enabled the intelligence community to make full use of the boom in computing and communications technologies since 1991.

One of the major results was the development of Real Time Regional Gateway, a system to take SIGINT collected on a given signal from all platforms (ground, airborne, or satellite) and rapidly fuse that data to provide geolocation. While the exact capabilities remain classified, retired Air Force Colonel Pete Rustan, who helped develop the system, offered a general description:

> The Real Time Regional Gateway concept started in Iraq as a concept that I helped to develop with our partners. Imagine that you are in Iraq. You have insurgents. They are on the telephone, making phone calls. That signal would be intercepted by ground [antennas], by the aircraft network and by the space network. If you're smart enough to combine all that data in real time, you can determine where Dick is out there. He's in block 23 down there, and he just said he's going to place a bomb. That's the real-time

[90]Richard Gasparre, 'The Israeli "E-tack" on Syria – Part I,' 10 March 2008 and 'The Israeli "E-tack" on Syria – Part II,' 11 March 2008, <www.airforce-technology.com>.
[91]Amy Butler and Bill Sweetman, 'Secret New UAS Shows Stealth, Efficiency Advances,' *Aviation Week & Space Technology*, 6 Dec. 2013.

> regional gateway: the ability to integrate the signals [for] geolocation.[92]

This capability is equally applicable to SIGINT collected against mobile missile targets.

Finally, another significant advance since 1991 is the development of much more sophisticated networked ground sensors. These sensors come in two varieties. The first are unattended ground sensors (UGS) which detect various emissions from vehicles. The second are tagging, tracking, and locating (TTL) devices, which can be concealed on vehicles and then used to track them.

UGS originally date to the Vietnam era, when the United States was interested in locating another mobile target, trucks moving down the so-called Ho Chi Minh Trail from North Vietnam through Laos to South Vietnam. These air delivered sensors initially detected sound emitted by the trucks as they drove but subsequently the sensors expanded to include detecting seismic vibration, radio emissions, magnetic signature, and infrared. The sensors would either hang in the ubiquitous tree cover or bury into the ground.[93]

These initial systems had substantial limitations but have continued to evolve over time. In the 1980s the US military fielded the Remote Battlefield Sensor System (REMBASS) and subsequently an Improved REMBASS and then REMBASS-II. It combines seismic/acoustic, infrared, and magnetic sensors to detect and classify vehicles in denied areas.[94]

Since the fielding of REMBASS, UGS have become smaller and even more power efficient, potentially allowing persistent covert surveillance of vehicle traffic for long periods of time. These UGS, small enough to disguise as rocks, could be emplaced by special operations forces or even potentially air delivered. These systems rely on low probability of intercept burst transmissions to satellites to communicate, making them difficult to detect.[95]

[92]Interview with Pete Rustan, *C4ISR Journal*, 8 Oct. 2010. See also *C4ISR Journal*'s description of the system in the 'Big 25 Awards' section of the Oct. 2010 issue.

[93]Seymour Deitchman, 'The "Electronic Battlefield" in the Vietnam War,' *Journal of Military History* (July 2008), 879. Deitchman was extensively involved in the development of the overall system to interdict the Ho Chi Minh trail known as 'Igloo White'. See also Anthony Tambini, *Wiring Vietnam: The Electronic Wall* (Lanham, MD: Scarecrow Press 2007).

[94]See L3 Communications, Remotely Monitored Battlefield Sensor System-II Product Description, 2004.

[95]Noah Shachtman, 'This Rock Could Spy on You for Decades,' *Wired*, 29 May 2012. See for example Northrup Grumman Scorpion II Unattended Target Recognition Systems Product Description, 2011.

In addition to UGS, TTL technology has made substantial progress. While beacons for target tracking, like UGS, are not new, the cost and size of such systems has decreased dramatically over the past 20 years. They have become small enough, cheap enough, and, thanks to GPS, precise enough that the New York Police Department has been placing them inside fake pill bottles to track thieves breaking into drug stores.[96] The US special operations community also makes extensive, though classified, use of TTL technology. An unclassified overview from a special operations industry tradeshow describes the use of 'TTL Capability To Tag, Track, And Locate High-Value Items Of Interest,' while noting 'Concealment Is Paramount.'[97]

While it is unclear the extent to which the US intelligence community could emplace TTL devices on mobile missiles, the possibility cannot be ruled out. For example, the penetration of the Iranian nuclear program by human agents that enabled the use of the Stuxnet virus could potentially be mirrored in the Iranian missile force.[98] There may also be means to emplace such devices clandestinely from a distance.

Finally, all of these technical advances are mutually supporting, creating synergy in the tracking of mobile missiles. The RQ-170 or other stealthy UAVs could be used to clandestinely seed mobile missile patrol areas with UGS and/or TTL devices from the air. Real Time Regional Gateway and other targeting intelligence fusion systems could then be used to fuse data from RQ-170, UGS, satellite systems, and other collection platforms in real time. Over time an extraordinarily detailed picture of the mobile missile field sites and patrol patterns could be developed that would be updated continuously in real time.

None of these improvements have been significantly analyzed by those who believe mobile missiles to be untargetable. Li Bin's analysis, for example, only examines the ability of US space based radar to continuously monitor Chinese mobile missiles.[99] He does not include SIGINT, ground sensors, or stealthy UAVs in his analysis. While this does not undermine his specific analysis, it suggests that it may say little about many existing and potential US capabilities to track Chinese mobile missiles. Thus, even if one believes that the Scud hunt analogy is useful, it says very little about current capabilities.

[96]Joseph Goldstein, 'Police to Use Fake Pill Bottles to Track Drugstore Thieves,' *New York Times*, 15 Jan. 2013.

[97]Charles Arant, 'Special Operations Surveillance and Exploitation,' Briefing at the Special Operations Forces Industry Conference, nd.

[98]See discussion in Jon Lindsay, 'Stuxnet and the Limits of Cyber Warfare,' *Security Studies* 22/3 (2013), 365–404.

[99]Li Bin, 'Tracking Chinese Strategic Mobile Missiles.'

Implications for Policy and Theory

We have argued here that American intelligence capabilities for counterforce have been have been pursued far more vigorously and successfully than generally credited. In the early nuclear age, skeptics of counterforce argued that intelligence on fixed targets would be unreliable and difficult to obtain – a contention that the American government worked vigorously to prove false. As analysts pivoted to claiming relocatable missiles were essentially untargetable, Washington displayed a similar intensity in developing capabilities to find and track Soviet submarines and mobile ICBMs. The same trend continues today: the nuclear studies community often defends the invulnerability of mobile missiles with misplaced analogies, while the US military has harnessed a technological explosion to significantly improve intelligence capabilities. Although we make no argument about whether or not these efforts have ever produced decisive American nuclear superiority, they certainly cast a shadow over the nuclear balance: secure second strike forces have been more difficult to generate than most experts acknowledge.

Moreover, American intelligence innovation may have broader implications for theory and policy. We conclude by suggesting a few such possibilities in order to help spur the further development of nuclear research inside and outside academe.

Theory

Secure second strike forces hold pride of place in nuclear analysis in part because of the political effects they are said to produce: general stability, crisis stability, status-quo bias, and peace. These pacific consequences are based on the idea that competitions in risk-taking favor the defender of the status-quo. For instance, the purported stability of secure second strike forces relies in part on psychological findings that most people fear (in this case, ultimate) loss more than they value (probably less fundamental) gains. If only the balance of resolve matters in influencing outcomes, calculations about the political values at stake should give defenders a decisive bargaining advantage in a crisis.[100]

However, American intelligence capabilities raise at least the possibility that the nuclear balance might cast more of a shadow over world politics than commonly thought. By raising the standards for a truly secure second strike force, intelligence capabilities could reintroduce risks of rational military preemption during a crisis. These risks are

[100] Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca, NY: Cornell UP 1989), chap. 5.

unlike the risks of inadvertent nuclear escalation that pacify a second strike world, where the decision to trigger a state's own destruction must come from some combination of accident, unauthorized launch, or misperception. Preemptive risks give each side reason to believe that they must 'use or lose' their nuclear weapons. They are likely to be destabilizing and dangerous, as Wohlstetter and other theorists concerned with the 'delicacy' of secure second strike forces have long worried. Bargaining advantages could potentially swing away from the side more willing to tolerate the risk of accident, and toward the side that was perceived to have better intelligence capabilities.

Intelligence capability might carry political weight *even if* retaliation still seems relatively certain. Nuclear risks depend not just on the state of the world, but perceptions of what the adversary believes the state of the world to be. As Jervis argues, 'there is no reality to be described that is independent of people's beliefs about it.'[101] For example, adding preemptive risk into the psychological mix could move the focus of state calculation away from the values at stake and towards the possibility that the other side might believe it has a rational reason to strike. After all, both sides would have watched the nuclear forces of the other during peacetime, including the development of intelligence capabilities and other innovations for counterforce. Why would the adversary have invested such effort, statesmen might wonder, if he believed counterforce to be irrational? These kinds of calculations are not likely to stabilize a crisis. Nor do they seem conducive to easing tensions more generally, since a state that believes it possesses crisis advantages may be more willing to press harder during time of peace.

In short, our analysis suggests that theories of nuclear politics may be more complicated than commonly believed. Additionally, it sheds light on the data used to test nuclear theories. A recent debate on nuclear coercion in *International Organization* is exemplary. Matt Kroenig argues that a numerical advantage in nuclear weapons helps cause crisis victories, while Todd Sechser and Matthew Fuhrmann contend that numerical advantages in weapons do not aid coercion.[102] But the mechanics of counterforce intelligence detailed above demonstrate that simple numerical differences or ratios are a poor way to measure nuclear superiority; the ability to find, track, and surprise nuclear targets is far more important. Neither of the papers just noted considers

[101]Robert Jervis, *The Illogic of American Nuclear Strategy* (Ithaca, NY: Cornell UP 1985), 38.

[102]Matthew Kroenig, 'Nuclear Superiority and the Balance of Resolve: Explaining Nuclear Crisis Outcomes,' *International Organization* 67/1 (2013), 141–71. Todd S. Sechser and Matthew Fuhrmann, 'Crisis Bargaining and Nuclear Blackmail,' *International Organization* 67/1 (2013), 173–95.

the operational requirements of counterforce in assessing the nuclear balance. This important debate can be advanced by a closer attention to the intelligence capability of each side, hopefully resulting in improvements over 'bean counting' measures.

Our arguments also cast historical data in a new light. Richard Betts argues that a 'nuclear golden age' of American strategic superiority is a myth, and that even during the Eisenhower administration the United States never possessed a capability to limit nuclear reprisal after the end of the nuclear monopoly.[103] Daryl Press disagrees, but presents analysis suggesting that any such capability ended by the early 1960s.[104] However, historians like Marc Trachtenberg and Frank Gavin have found that the Kennedy administration believed it had a nuclear edge until just before Kennedy's assassination, and made policy on that basis.[105]

Our arguments point to the role of intelligence in sorting out these differences. Some references to the importance of intelligence during the policymaking process might lend support to the Trachtenberg-Gavin view. Eisenhower was willing to suspend U-2 flights and pursue new negotiations over Berlin because he felt America possessed 'the power to destroy the Soviets without need for additional 'detailed targeting' information.[106] Kennedy ordered a first strike plan to be drafted on the grounds that Corona satellite photos meant 'We now know and have known for some months the Soviets haven't got an operational missile force.'[107] Of course, much more work needs to be done to untangle the effects of nuclear weapons in past cases; we hope that highlighting the role of intelligence will be a useful aid.

Policy

The foregoing analysis also expands on recent policy relevant research demonstrating the extraordinary counterforce capabilities that the United States developed during the Cold War and expanded subsequently. As Keir Lieber and Daryl Press have argued, America's present nuclear capabilities did not come about by accident: 'the effort to neutralize

[103]Richard K. Betts, 'A Nuclear Golden Age?: The Balance Before Parity,' *International Security* 11/3 (1986), 3–32.
[104]Press, *Calculating Credibility*.
[105]Francis J. Gavin, *Nuclear Statecraft: History and Strategy in America's Atomic Age* (Ithaca, NY: Cornell UP 2012), chap. 3.
[106]Eisenhower-McElroy-Bissell meeting, 7 April 1959, in *Foreign Relations of the United States, 1958–1960*, Vol. 10 (Washington, DC: Government Printing Office 1993), 264.
[107]Carl Kaysen, interview with Marc Trachtenberg and David Alan Rosenberg, 3 Aug. 1988. Transcript available on Trachtenberg's website, quote is on pp. 28–9.

adversary strategic forces … spans nearly every realm of warfare.'[108] Their ground-breaking work has shown how a revolution in missile accuracy makes counterforce attacks on even super hardened fixed targets extremely effective. Combined with evidence on the low readiness of adversary nuclear forces, Lieber and Press conclude that the odds of successful first strike on the Russian or Chinese arsenals are lopsidedly favorable to the United States.[109] Our account of past intelligence capabilities and the contemporary intelligence revolution expands their analysis to relocatable targets, reinforcing their conclusions.

New counterforce capabilities have policy implications that sit within a broader strategic context. American grand strategy relies heavily on its overseas alliances and military commitments. These policies pose a real possibility of confrontations with nuclear armed states. American forward presence potentially increases insecurity among potential adversaries that could spur nuclear proliferation; such nascent nuclear powers may create friction with US backed regional orders.[110] The growth of Chinese power could well bring Beijing into conflict with America's security order in the Pacific. If a regional controversy begins to escalate, Washington will likely perceive credibility stakes that implicate the grand strategy it has pursued since the end of the Cold War, even if the material stakes of the actual conflict are much lower.[111]

In such scenarios, American intelligence capabilities could make preemptive risks acute. American adversaries would have strong incentives to try and secure their nuclear forces by dispersing them, delegating launch authority, or otherwise increasing readiness.[112] If, as Lieber and Press worry, America was simultaneously winning a decisive conventional victory, the threatened enemy might even consider a preemptive strike to de-escalate the conflict.[113] At the same time, signs of increasing readiness or weapons dispersal recorded by new surveillance capabilities would create dangerous windows of opportunity on the US side, as American troop concentrations, American allies, or even the American homeland could be

[108]Keir A. Lieber and Daryl G. Press, 'The New Era of Nuclear Weapons, Deterrence, and Conflict,' *Strategic Studies Quarterly* 7/1 (Spring 2013), 5.

[109]Keir A. Lieber and Daryl G. Press, 'The End of MAD? The Nuclear Dimension of US Primacy', *International Security* 30/4 (Spring 2006), 7–44.

[110]A recent argument along these lines is Nuno P. Monteiro, 'Unrest Assured: Why Unipolarity is Not Peaceful,' *International Security* 36/3 (2011), 9–40.

[111]Benjamin H. Friedman, Brendan Rittenhouse Green, and Justin Logan, 'Correspondence: Debating US Engagement,' *International Security* 38/2 (Fall 2013), 183–192.

[112]Gerson, 'No First Use,' 37–9; Avery Goldstein, 'First Things First: The Pressing Danger of Crisis Instability in US-China Relations,' *International Security* 37/4 (Spring 2013), 80; Glaser and Fetter, 'Counterforce Revisited: Assessing the Nuclear Posture Review's New Missions,' 120–3.

[113]Lieber and Press, 'The New Era of Nuclear Weapons, Deterrence, and Conflict,' 5–6.

potential hostages. Given potentially high stakes and the existence of radically improved US intelligence capabilities, counterforce will likely have advocates in high circles during a crisis.

American intelligence capabilities will also raise policy conundrums outside of a crisis. If China is like past rising great powers, it will not accept decisive nuclear inferiority in perpetuity. A costly nuclear arms race with the United States could ensue, one whose price would be measured not only in dollars and renminbi, but also in the political hostility and tension that accompanies the security dilemma. On the other hand, American intelligence capabilities could provide potential opportunities in dealing with regional powers like Iran. Diplomatic and military emphasis on sensing and surveillance innovation might convince Tehran that the costly work of attaining nuclear capability is only a prelude to an even more intense task: building a true second strike force invisible to American intelligence. In the face of possible preventive war and intense economic pain, Tehran may decide to cease its nuclear efforts. Conversely, Washington's intelligence capabilities might lead it to adopt a more relaxed attitude towards proliferation: an outgunned nuclear power would have strong incentives to 'rein in its horns' politically in order to avoid a crippling security competition.

In any event, the nuclear studies community is only just beginning to come to grips with the policy alternatives raised by the conjunction of American grand strategy and nuclear doctrine. The story of American intelligence against relocatable targets during the Cold War underscores the potential and importance of improving counterforce capabilities against a new generation of less capable adversaries.

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