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TECHNOLOGY, DOCTRINE AND THE RISK OF NUCLEAR WAR

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*Arms and military organizations can hardly be considered the exclusively determining factors in international conflict, but neither can they be considered neutral.*¹

Thomas C. Schelling (1966)

Introduction

The last few years have seen serious—and what are likely to be sustained—increases in tensions between the United States and its nuclear-armed potential adversaries. Following Russia’s annexation of Crimea in 2014, its relations with the United States, which were already strained, have declined precipitously. Sino-U.S. relations are not nearly as bad and have not declined as quickly, but they are subject to significant stresses that show no signs of abating, including from China’s land reclamation efforts in the South China Sea. Meanwhile, in the four years since Kim-Jong Un assumed the leadership of North Korea, Pyongyang’s nuclear-weapon development efforts and military provocations have sunk U.S.-North Korean relations to a level not seen in over twenty years.

These disquieting developments have increased the chance of a deep crisis or conflict between nuclear-armed states and hence increased the likelihood of nuclear weapons being employed. But they are not the only reason why nuclear use is becoming more likely. Although frequently overshadowed, changes in military technology and doctrine—especially in the context of

¹ Thomas C. Schelling, *Arms and Influence* (New Haven, CT, Yale University Press, 1966), 234.

emerging nuclear multipolarity—are also making nuclear deterrence more precarious. And they are doing so even where nuclear-armed rivals, such as India and Pakistan, are not suffering from especially bad political relations.

Technological and doctrinal changes have two distinct effects. First, programs to build-up nuclear arsenals, develop new nuclear capabilities or modernize existing ones are increasing tensions between nuclear-armed states. Such tensions can be magnified by multipolarity as the steps that a state takes to counter one rival can spark concern in another. These dynamics do not increase the chance of nuclear use directly; rather they do so indirectly by increasing both the chance of conflict and the difficulty of implementing arms control measures that might reduce nuclear dangers. The nuclear order is, in other words, becoming more difficult to manage.

Second, in the event that a crisis or conflict does occur, developments in military doctrine for both nuclear *and* conventional warfighting are increasing the likelihood of escalation—whether deliberate or inadvertent—to nuclear use. Technological changes are having a similar effect. Some drivers of this growing danger—such the development of potentially vulnerable nuclear forces in China, Russia and Pakistan—are well known from the Cold War. Others are less familiar, but include the development, by the United States in particular, of nonnuclear technologies that can threaten—or are perceived as being able to threaten—nuclear forces and their enabling capabilities.

The day-to-day likelihood of nuclear use is still probably not as high as it was in the Cold War (and certainly the *risk* of nuclear use—defined as the product of consequence and probability—almost certainly remains much smaller). But even so, there is little cause to be sanguine. Not only is the chance of a breakdown in nuclear deterrence increasing, but today's nuclear dangers are—in at least some important respects—*different* from the Cold War's in ways that make them more difficult to manage. As a result, there is reason to worry that, absent significant and sustained improvements in political relations, the likelihood of nuclear use is set to continue to rising.

Managing the nuclear order

Over the course of the Cold War, eight states developed nuclear weapons, yet strategic relations—like international politics more generally—remained decidedly bipolar in character. China represented the most significant third pole, although political conditions generally permitted it to keep its nuclear weapons in the background of international politics. France and the United Kingdom were military allies of the United States. Although both states explicitly retained the option of using nuclear weapons independently of Washington (and Paris went so far as to withdraw from NATO’s unified military command structure), neither ever came remotely close to needing to do so. Meanwhile, the arsenals of India, Israel and South Africa remained highly recessed. India tested what it termed a peaceful nuclear explosive in 1974, but thereafter moved very slowly to develop nuclear weapons and neither deployed nor advertised them. Israel and South Africa also developed nuclear weapons but did not acknowledge their existence (and, indeed, by 1991 South Africa had dismantled its program).

Today, nuclear multipolarity is asserting itself more, albeit rather gradually. This change results primarily not from the small net increase in the number of nuclear-armed states (South Africa has left the nuclear club, while Pakistan and North Korea have joined), but from increasingly competitive dynamics within the web of inter-locking deterrence dyads.

This web is shown graphically in figure 1. Israel is not part of any deterrence dyad because, today at least, its nuclear weapons serve exclusively as a hedge against a loss of either conventional superiority or its nuclear monopoly in the Middle East. France, the United Kingdom and North Korea do have deterrence relations with other nuclear-armed states. However, their nuclear forces are unlikely to have much influence on the evolution of the world’s other arsenals over the next few decades (although, as discussed further below, there are serious risks of nuclear escalation in a crisis involving North Korea). The other five nuclear-armed states are part of two triangles: one involving the United States, Russia and China, and a second involving China, India and Pakistan.² Within each triangle, each state seeks to deter both of these others, except for Pakistan and China, which enjoy more cooperative relations.

² James M. Acton, “Bombs Away? Being Realistic about Deep Nuclear Reductions,” *The Washington Quarterly* 35, no. 2 (Spring 2012): 38-41.

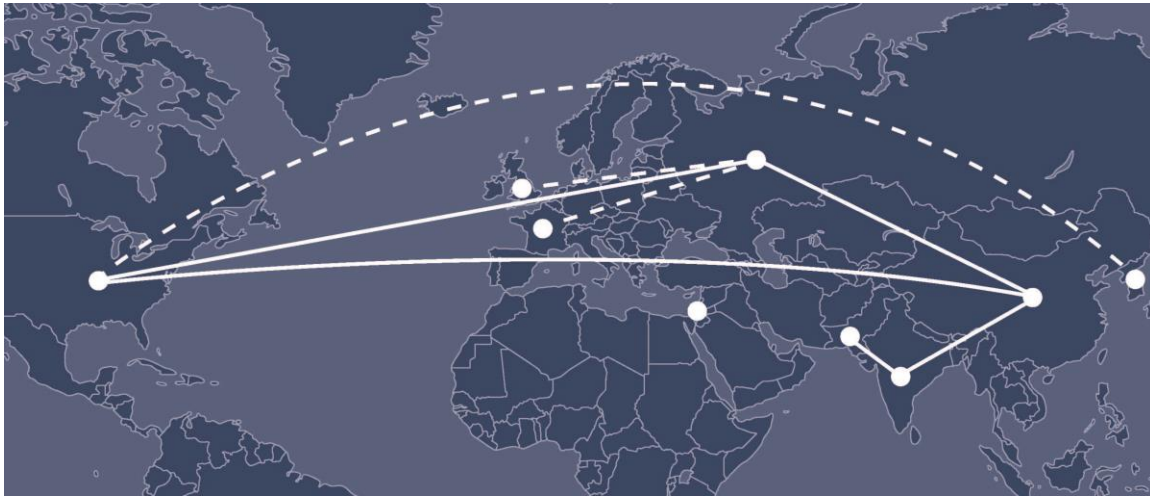


Figure 1: **Deterrence dyads among the world’s nuclear armed states**

Each of these five states has embarked on ambitious programs to develop new nuclear weapons, modernize existing ones, and/or expand their arsenals. Within each deterrence dyad, these programs tend to enhance tensions. However, because of the multipolar structure of deterrence relations, these dyads are not entirely isolated from one another creating the possibility of multi-player competitions. One particular risk is that strategic procurement programs aimed at countering one adversary can inadvertently spark concern—and potentially a counter-reaction—in another. This form of the security dilemma involving three states has been termed a “trilemma.”³ These dynamics can be further stoked by cooperation that assists (or is perceived as assisting) a state to enhance its military capabilities. To complicate matters yet further, multipolarity can increase the challenge of arms control since states might worry that by entering into a bilateral arrangement they would disadvantage themselves relative to any unconstrained third parties. The result is a nuclear order that is more difficult to manage and hence more prone to crises.

Before showing how these dynamics play out in practice, it is worth highlighting two underlying assumptions, even if limitations of space preclude making a detailed argument for either. Both

³ Linton Brooks and Mira Rapp-Hooper, “Extended Deterrence, Assurance, and Reassurance in the Pacific during the Second Nuclear Age” in *Strategic Asia 2013–14: Asia in the Second Nuclear Age*, eds. Ashley J. Tellis, Abraham M. Denmark, and Travis Tanner (Seattle: The National Bureau of Asian Research, 2013), 292-93.

assumptions are controversial—although, in fairness, *no* statements about what makes for safe and stable relations between nuclear-armed states—other than the blandest and most asinine—would engender any less dispute.

First, arms build-ups and military modernization and development programs—especially where they occur competitively—tend to exacerbate international tensions. While there is certainly some truth to the claim that international tensions catalyze arms racing, there is also empirical evidence that arms races exacerbate those tensions.⁴ To be sure, this conclusion is not a blanket argument against all strategic procurement programs. It is simply a recognition of the potentially aggravating effect that such programs can have on interstate tensions (even if the root causes of such tensions almost invariably lie elsewhere).

Second, arms control—originally defined, broadly and helpfully, as “all the forms of military cooperation between potential enemies”—can play a significant role in mitigating both the tensions induced by strategic procurement programs and the likelihood of escalation in a crisis.⁵ In this regard, the main value of arms control is not in reducing numbers of nuclear weapons *per se*, but in limits and transparency that together create predictability and can mitigate the pressures on states to augment their nuclear arsenals. Even more importantly perhaps, arms control can enhance states’ confidence in the survivability of their nuclear forces and hence mitigate escalatory pressures in a crisis.

The two triangles

The Asian triangle—involving Pakistan, India and China—is characterized by both nuclear competition and nuclear cooperation. The most obvious rivalry is between India and Pakistan, which are frequently described as being locked in an arms race. Yet, this description is potentially misleading; while Pakistan may be racing India, New Delhi is taking part in an altogether different competition with Beijing.

⁴ Susan G. Sample, “Military Buildups, War, and Realpolitik: A Multivariate Model,” *The Journal of Conflict Resolution* 42, no. 2 (April 1998): 156–75. For a review of the debate about arms racing see Charles L. Glaser, “The Causes and Consequences of Arms Races,” *Annual Review of Political Science* 3 (2000): 251-76.

⁵ This definition of arms control is from Thomas C. Schelling and Morton H. Halperin, *Strategy and Arms Control* (New York: The Twentieth Century Fund, 1961), 2, which also provides an exceptionally cogent argument in favor of arms control. For a counter-argument see Colin S. Gray, *House of Cards: Why Arms Control Must Fail* (Ithaca, NY: Cornell University Press, 1992).

Nuclear technology is one of many serious irritants in the Pakistani-Indian bilateral relationship. Worried about India's conventional strength, Pakistan is rapidly augmenting its capacity to produce fissile material and appears to be building up its nuclear arsenal faster than any other state. This build-up creates friction with India.

So far at least, India has not responded in kind. In fact, it has recently shut down one of its two plutonium-production reactors (although this closure was a political sop to the United States and a reflection of the reactor's age and inefficiency, and not an act of strategic restraint).⁶ But, India does have the *potential* to build up its arsenal quickly, even without building new fissile material production facilities—the unintended side-effect, in part at least, of nuclear cooperation with the United States. India's weapon program could, for example, coopt various nuclear power reactors and a fairly large quantity of reactor-grade plutonium that were conspicuously excluded from international safeguards when New Delhi separated its civilian and military nuclear programs pursuant to a 2005 agreement with the United States that was designed to facilitate nuclear commerce with India. This agreement could also enable India to devote its limited domestic uranium resources to the production of weapons. As such, the agreement has exacerbated tensions with Pakistan and is almost certainly another driver of Islamabad's nuclear build-up.⁷

The “missile race” between India and Pakistan is also more complex than it might first appear. While both states have very active missile development programs, they have different emphases. Pakistan's primary focus is on short-range systems to offset to Indian conventional strength. India, however, is primarily pursuing long-range systems to target China. Nonetheless, these missiles still contribute to the rivalry with Pakistan and are thus the manifestation of a trilemma.

Historically, India has probably been a very minor consideration for China in its nuclear strategy. Indeed, even in private, Chinese officials have generally denied that Indian nuclear weapons are

⁶ Indeed, India has plans to replace the reactor. On the decision to close it see Dinshaw Mistry, *The U.S.-India Nuclear Agreement: Diplomacy and Domestic Politics* (Cambridge: Cambridge University Press, 2014), 69-70.

⁷ Conceptually, it provides an example of how cooperation, as well as competition, can stimulate arms accumulations within a multipolar system. China's provision to Pakistan of both highly enriched uranium and a nuclear weapon design in 1982 is another—more direct—example. See also Zia Mian and M.V. Ramana, “Asian War Machines,” *Critical Asian Studies* 46, no. 2 (2014): 345–60.

even a consideration for them. Now, however, Beijing appears to paying more attention. In 2012, for example, a serving Chinese officer, Maj. Gen. Yao Yunzhu of the People's Liberation Army's Academy of Military Sciences took the unusual—perhaps unprecedented—step of acknowledging that “China and India have been securely locked in a relation of mutual deterrence.”⁸ A retired admiral, Yang Yi, has stated that the “indisputable fact” of India's expanding and modernizing its nuclear arsenal requires measures to “enhance strategic mutual trust”—with the implication that India's program is viewed as a potential threat in Beijing.⁹ Now, China appears to be responding in kind. The U.S. Department of Defense, for example, assesses that India's nuclear arsenal is a “driver,” albeit not a primary one, of China's own nuclear modernization programs.¹⁰

China sits at the intersection of the two triangles. Within the U.S.-Russia-China triangle each state seeks to deter the other two, even if the Sino-Russian deterrence relationship is largely “recessed.”¹¹ The United States is, beyond doubt, the main driver of nuclear planning in both Moscow and Beijing. A significant point of friction is both states' concerns about the survivability of their nuclear forces, particularly in light of developments in U.S. *nonnuclear* weapons, including long-range, high-precision, conventional weapons and ballistic missile defenses. Both attribute their strategic modernization programs to this concern. In some significant part, these dynamics represent another trilemma since U.S. strategic ballistic missile defense programs are not oriented at either Russia or China.¹²

⁸ Interestingly, Yao's context is expressing concern about Indian developments in ballistic missile defense. Yao Yunzhu, “Linking Strategic Stability and Ballistic Missile Defense: The View From China,” in *The China-India Nuclear Crossroads*, ed. Lora Saalman (Washington DC: Carnegie-Tsinghua Center for Global Policy, 2012), 74.

⁹ Yang Yi, “Bridging Historical Nuclear Gaps: The View From China,” in *The China-India Nuclear Crossroads*, 24.

¹⁰ Office of the Secretary of Defense, U.S. Department of Defense, *Military and Security Developments Involving the People's Republic of China 2015*, Annual Report to Congress, 31, http://www.defense.gov/Portals/1/Documents/pubs/2015_China_Military_Power_Report.pdf.

¹¹ Alexei Arbatov and Vladimir Dvorkin, *The Great Strategic Triangle*, Carnegie Paper (Washington, DC: Carnegie Endowment for International Peace, April 2013), 12-14, http://carnegieendowment.org/files/strategic_triangle.pdf.

¹² The United States has, however, stated explicitly that regional missile defenses are aimed against China. U.S. Department of Defense, *Ballistic Missile Defense Review Report*, February 2010, 34-35, http://archive.defense.gov/bmdr/docs/BMDR%20as%20of%2026JAN10%200630_for%20web.pdf.

China is certainly augmenting its nuclear force qualitatively (most significantly by enhancing mobility) and probably also quantitatively—although the growth in numbers is slow.¹³ These efforts spark concern in the United States and among some of its allies that Beijing’s intentions are not purely defensive. For its part, China has repeatedly stated that it “will never enter into a nuclear arms race with any other country.”¹⁴ Chinese analysts generally explain this statement as being a coded pledge not to seek numerical parity with the United States and Russia. However, given the opacity surrounding China’s nuclear forces—which Chinese officials and experts argue is necessary to ensure their survivability—Beijing’s declaratory policy does not appear to have had much effect on Moscow’s or Washington’s threat perceptions.

Between Russia and the United States, the New Strategic Arms Reduction Treaty (New START) ensures a high degree of mutual transparency and helps to mitigate their mutual concerns about each other’s strategic modernization programs. Tactical nuclear weapons are, however, not covered by New START. The United States periodically publishes figures on its total nuclear-weapon holdings, which imply continuing reductions of its tactical forces. By contrast, both the size and future trajectory of Russia’s tactical forces are highly uncertain. This opacity sparks significant concern in both the United States and its European allies.

A multipolar nuclear future

As much as this picture already gives cause for concern, its more worrying feature is probably the potential for much more competitive and more damaging dynamics to emerge quite quickly. For starters, the future of the U.S.-Russian arms control process is far from assured. There are currently no negotiations towards a successor agreement—a result partly of the decline in bilateral relations but also of numerous Russian preconditions (such as the removal of all tactical nuclear weapons from Europe before the *commencement* of any negotiations over this type of weapon). It is at least possible that, faced with the expiry of New START in 2021, Moscow will become more pliable. But, even if it does, it may not find a willing and able negotiating partner in Washington. It seems unlikely that a Republican president would support a new treaty, and even a Democratic president would probably find her negotiating space severely constrained by

¹³ Compare, for example, Hans M. Kristensen and Robert S. Norris, “Chinese Nuclear Forces, 2015,” *Bulletin of the Atomic Scientists* 71, no. 4 (2015): 77-84 to previous editions.

¹⁴ For example, The State Council Information Office of the People's Republic of China, *China's Military Strategy*, May 26, 2015, sec. IV, http://news.xinhuanet.com/english/china/2015-05/26/c_134271001_4.htm.

the almost inevitable need to gain some Republican votes to ensure the Senate's advice and consent for ratification. To be fair, even many Democratic senators may be unwilling to vote for new arms control agreement while the United States assesses that Russia is in non-compliance with the Intermediate-Range Nuclear Forces Treaty.¹⁵

Multipolarity compounds these challenges. While the United States has indicated an interest in further bilateral arms control, Russia's official position is that the *next* round must include *all* nuclear-armed states.¹⁶ While this extreme position may well be moderated in any future negotiations, the general trend is clear: as Russia and the United States build down, and as China builds up, both Moscow and Washington are likely to seek some form of involvement from Beijing in arms control (which, initially at least, may simply be greater transparency as opposed to binding limits). U.S. and Russian calculations are, in part, strategic. But within the United States, domestic politics also has an impact. China's lack of involvement in New START was, for the first time, a real issue in an American domestic debate over the ratification of an arms control agreement. And, unless U.S.-China relations take an unexpected turn for the better, the salience of China in future such debates is likely to continue rising. However, given China's stated concerns about the survivability of its own nuclear forces and its possible concerns about the future trajectory of India's nuclear forces (not to mention potential bureaucratic barriers), the prospects for its involvement in any form of arms control are currently very poor. The result is an increase in the likelihood that the U.S.-Russian arms control process will collapse. Such a break down, however it occurs, would remove much of the predictability from the U.S.-Russia strategic relationship and perhaps even pave the way for a new arms race.

There are other potential triggers of arms races. India, for example, might decide to accelerate its production of nuclear weapons. Such a decision—which could be motivated by strategy, domestic pressure or both—might be a response to Pakistan or it could be aimed at Beijing. But, whatever the cause, if India does start to build-up more quickly, China might do so too. If New Delhi's build-up was actually a response to Islamabad, but Beijing misperceived itself as the

¹⁵ In fact, the compliance dispute over this treaty could lead to the demise of New START even before its expiry date.

¹⁶ For a recent example, see "Moscow Slams Washington Over Development of 'Prompt Global Strike' System," Sputnik, February 6, 2016, <http://sputniknews.com/military/20160206/1034340105/prompt-global-strike.html>.

target, then these dynamics would constitute a trilemma. Similarly, if China started to increase its arsenal rapidly, the United States or Russia might respond in kind. This would represent another trilemma, if Beijing actions had actually been a response to New Delhi.

Finally, even without further proliferation, new deterrence dyads could emerge, most obviously between Israel and Pakistan. Today, there is little evidence of a deterrence relationship between these two states, not least because both appear to lack delivery systems capable of reaching the other—a result, perhaps, of mutual restraint.¹⁷ Pakistan is, however, openly developing a medium-range ballistic missile, the Shaheen III, which it claims will have a range of 2,750 km—enough to reach Israel from western Pakistan. Israel, meanwhile, is reported to be developing the intermediate-range Jericho III with a range of 4,000 km. If deployed, or perhaps even if not, these missiles could enable the emergence of a new deterrence dyad, depending on bilateral political relations.

An Israel-Pakistan deterrence dyad might be the consequence of another trilemma—two in fact since it is entirely possible that neither state is seeking to target the other with longer range missiles (Israel may be focused solely on targeting all of Iran, whereas Pakistan’s only goal may be to reach all of India). Nonetheless, regardless of each state’s true intentions, deterrence relations between them would have obvious potential to be particularly fraught and dangerous. Indeed, it would be the first dyad involving one country that did not recognize the other’s right to exist.¹⁸ As such, the advent of Israeli-Pakistani deterrence relations would be unique among the consequences of nuclear multipolarity discussed here in that it would bear directly on crisis dynamics—at least in so far as it could create a new deterrence dyad in which a crisis could occur. Moreover, its emergence could further fuel multipolar arms race dynamics. For example, if Israel were to start augmenting its long-range forces significantly, Pakistan might respond in kind and, in so doing, stir new concerns in India.

¹⁷ At their closest points, Israel and Pakistan are about 2,400 km apart. However, key targets in eastern Pakistan are about 3,500 km from Israel. In theory, aircraft could manage this distance with mid-air refueling. Israeli F-15I aircraft may also have just enough range to reach Pakistan on a one-way mission.

¹⁸ While the United States recognized the Republic of China (Taiwan), and not the People’s Republic of China, until 1979, it did not question China’s right to exist.

Crises and escalation

Rising tensions between nuclear-armed states increase the chance that they will become embroiled in deep crises or even serious conventional conflicts. In such a conflict, there is always some risk that one of these states, in a last ditch effort to stave off a catastrophic conventional defeat, would resort to the use of its nuclear weapons. Today, however, this risk—of deliberate escalation—is growing as a result, in particular, of apparent doctrinal developments in Russia, Pakistan and North Korea.

Simultaneously, developments in both doctrine and technology are creating a growing danger of inadvertent escalation—escalation that is an unintended consequence of authorized military threats and operations. While there are numerous potential causes of inadvertent escalation, two are particularly important.

First, crisis instability can occur if, in a deep crisis or conventional conflict, a state becomes worried about the survivability of its nuclear forces (as an empirical matter, states tend to think their nuclear arsenals are much less survivable than their adversaries do).¹⁹ In this case, the state could attempt to enhance the survivability of its forces by modifying its posture, such as by pre-delegating launch authority, or it could attempt to ward off an attack by issuing nuclear threats—either of which could trigger further escalation. *In extremis*, it might even employ nuclear weapons first, most likely in limited ways.

A second pathway to inadvertent escalation is the transmission of unintended escalatory signals. Giving political leaders the *option* of signaling their willingness to use nuclear weapons is, on balance, stabilizing since it can facilitate a form of crisis communication. However, escalatory signals that are sent out without the knowledge of—or perhaps even contrary to the wishes of—political leaders can be very dangerous since it lessens those leaders' ability to manage a crisis effectively.

¹⁹ The seminal discussion is Thomas C. Schelling, *The Strategy of Conflict* (Cambridge, MA: Harvard University, 1960), ch. 9

To be sure, neither deliberate nor inadvertent escalation risks are necessarily undesirable; nuclear deterrence relies on their being some chance of the nuclear threshold being crossed if redlines are. Indeed, at least some newly emerging escalation risks may be the result of conscious attempts by states to enhance deterrence in the face of growing security challenges. Even if this is the case, however, then it in no way contradicts the claim that likelihood of nuclear use is rising. On the contrary, it actually reinforces this thesis since states that have failed to properly consider escalation risks are likely to be more amenable to changing course than those that are seeking to manipulate them as a conscious strategy.

Doctrine and escalation

Three out of the four deterrence dyads in which a large-scale military conflict is foreseeable in the near future—India-Pakistan, the United States-Russia, and the United States-North Korea—are characterized by serious and lasting asymmetries in conventional power. In each dyad, the weaker state is believed to have potential incentives to initiate conventional violence *and* to contemplate the use of nuclear weapons to offset its weakness—a potentially combustible combination not seen during the Cold War. The stronger power in each dyad, meanwhile, has been developing a military doctrine that seeks to bring its conventional advantage to bear most effectively, but also exacerbates escalation risks. In the fourth dyad, between the United States and China, the conventional balance is more fluid—though the United States still enjoys an advantage even in the West Pacific, let alone further afield. Escalation risks result, nonetheless, from U.S. efforts to maintain its advantage and Chinese efforts to narrow the gap.

The development of anti-access/area-denial (A2/AD) capabilities—by China in particular, but also by Russia and Iran—appears to be driving significant changes in U.S. doctrine for fighting a conventional war. These capabilities seek to prohibit or slow U.S. forces from entering a conflict zone or maneuvering within it. China’s anti-ship ballistic missile, the DF-21D, may be the most headline-grabbing A2/AD weapon, but it is just one part of a larger suite of capabilities. To try and ensure its freedom to maneuver, the United States military has been exploring a concept of operations originally called Air-Sea Battle, which has now been subsumed within the somewhat less ear-catching Joint Concept for Access and Maneuver in the Global Commons. According to the Pentagon, the three goals of this concept are to “disrupt adversary command, control, communications, computers, intelligence, surveillance, and reconnaissance..., destroy adversary

A2/AD platforms and weapons systems, and defeat adversary employed weapons and formations.”²⁰

With the caveat that the concept formerly known as Air-Sea Battle is both classified and under development—making any discussion necessarily speculative—it appears to present certain risks of crisis instability. The most serious of these would arise if, as some U.S. analysts suspect, China’s conventional and nuclear missiles share the same command and control system.²¹ In this case, U.S. strikes designed to deny Beijing control of its conventional ballistic missiles could be mistaken for a first strike on China’s nuclear forces. However, even if China has two entirely separate command-and-control systems, it is still possible the United States might misidentify the assets associated with the conventional one and accidentally attack its nuclear counterpart.

Other aspects of Air-Sea Battle are also potentially escalatory.²² Strikes against China’s air defense system or its strategic early-warning system could generate fears that its nuclear forces had suddenly become vulnerable to follow-on attacks. Alternatively, the United States might attack a nuclear-armed DF-21A after misidentifying it as a nonnuclear DF-21D, which is superficially similar. Escalation could result if Beijing assessed this strike to be the start of a broader campaign against its nuclear forces—which is possible given that some Chinese strategists argue that the United States might try to pick off China’s nuclear forces one-by-one, dismissing each strike as an “accident.”²³

Although much less noticed, China’s strategy for offsetting the United States’ conventional strength could also prove dangerous. Chinese strategists have, for example, advocated attacking enabling assets, including early warning satellites, that have both conventional and nuclear

²⁰ Air-Sea Battle Office, *Air-Sea Battle: Service Collaboration to Address Anti-Access & Area Denial Challenges*, May 2013, 7, <http://archive.defense.gov/pubs/ASB-ConceptImplementation-Summary-May-2013.pdf>.

²¹ John W. Lewis and Xue Litai, “Making China’s Nuclear War Plan,” *Bulletin of the Atomic Scientists* 68, no. 5 (September/October 2012): 56-62.

²² Although focused on a U.S.-Soviet confrontation in the Cold War, the basic principles of escalation set out in Barry R. Posen, *Inadvertent Escalation: Conventional War and Nuclear Risks* (Ithaca, NY: Cornell University Press, 1991) remain very relevant.

²³ Fiona S. Cunningham and M. Taylor Fravel, “Assuring Assured Retaliation: China’s Nuclear Posture and U.S.-China Strategic Stability,” *International Security* 40, no. 2 (Fall 2015): 22.

functions.²⁴ Since such satellites provide cueing information to ballistic missile defenses, Beijing might attack them to try and ensure the survivability of its conventional missiles, especially if it were losing a war. The United States, however, might interpret such attacks as the prelude to nuclear use; after all, the primary of function of early-warning satellites is to detect incoming nuclear weapons and China might well want to suppress such capabilities if it were about to use nuclear weapons. To try and persuade Beijing to back down, Washington might issue its own nuclear threats, escalating the crisis toward the nuclear threshold.

In Europe, a Russian move against the Baltic States, which no longer seems entirely unthinkable given Moscow's annexation of Crimea, represents the most likely starting point for a major conflict involving Russia and the United States. Although NATO enjoys a wide margin of conventional superiority in Europe as a whole, it is significantly weaker than Russia around the Baltic (although efforts are now underway to at least start to address this problem). This imbalance creates the risk that Russia could take NATO territory relatively quickly and painlessly, and then use nuclear threats to attempt to deter a counterattack (which would, in any case, be much costlier and bloodier than Russia's initial *fait accompli*).²⁵ This strategy—sometimes termed “escalate to de-escalate”—creates significant risks of deliberate escalation. Moreover, even if Russia did not act on its nuclear threats following a counterattack, there would still be risks of inadvertent escalation, not least as a result of NATO efforts to suppress Moscow's A2/AD capabilities. These risks would, however, probably be somewhat smaller than in a war against China because Russia's nuclear arsenal is significantly more survivable.

In North East Asia, the prospects of a North Korean invasion of the South may be slim, but Pyongyang does have a long history of launching “provocations” against its neighbor. To date, Seoul has shown great restraint in its responses. In a future crisis, however, it might hit back more forcefully, motivated by domestic pressure perhaps. Indeed, following the shelling of

²⁴ Michael S. Chase, Andrew S. Erickson, and Christopher Yeaw “Chinese Theater and Strategic Missile Force Modernization and its Implications for the United States,” *Journal of Strategic Studies* 32, no. 1 (February 2009): 83.

²⁵ While inconsistent with Russia's declaratory policy, this strategy is consistent with what senior U.S. senior civilian officials and military officers have stated they believe Russia's nuclear doctrine to be. See, for example, Robert Work and James Winnefeld, statement to the U.S. House of Representatives, Committee on Armed Services, June 25, 2015, 4, <http://docs.house.gov/meetings/AS/AS00/20150625/103669/HHRG-114-AS00-Wstate-WinnefeldJrUSNJ-20150625.pdf>.

Yeonpyeong Island in 2010 and public criticism of the government's weak response, then President Lee Myung-bak vowed that "war can be prevented and peace assured only when such provocations are met with a strong response."²⁶ Retaliation by Seoul would, however, also create the possibility of escalating conflict involving the United States, which has defense commitments to South Korea. Faced with a potentially catastrophic defeat, North Korea might resort to the employment of nuclear weapons to try and coerce the United States into backing down. Indeed, although Pyongyang has committed not to use weapons first, it has also stated that this promise only applies if "hostile forces for aggression do not encroach upon its sovereignty."²⁷

Inadvertent escalation could also be a serious problem in such a conflict. As the U.S. political scientists Keir Lieber and Daryl Press argue, "the new American way of war" involves attempts "to blind, confuse, and overwhelm the enemy. *Even if the United States decided to leave the adversary's leaders in power...*, how would Washington credibly convey the assurance that it was not seeking regime change once its adversary was blinded by attacks on its radar and communication systems and command bunkers?"²⁸ Inadvertent escalation could also occur if North Korea incorrectly believed that U.S. attempts to suppress its conventional missiles were actually aimed at its nuclear forces. These two escalation pathways become more likely to the extent that North Korea expects the United States to pursue regime change or to attempt to deny it the ability to use its nuclear weapons. In this context, whether or not they are correct, media reports that the United States and South Korea practiced "decapitation" and strikes against North Korea's nuclear forces during major exercises in March 2016 could compound North Korea's fears.²⁹

²⁶ Quoted in Ethan Kim, "North Korean Soldiers Boast of Yeonpyeong Island Attack," *Los Angeles Times*, December 27, 2010, <http://articles.latimes.com/2010/dec/27/world/la-fg-korea-clash-20101227>.

²⁷ Korean Central News Agency (KCNA), Statement by the Government of Democratic People's Republic of Korea, Pyongyang, January 6, 2016.

²⁸ Keir A. Lieber and Daryl G. Press, "The Nukes We Need: Preserving the American Deterrent," *Foreign Affairs* 88, no. 6 (November/December 2009): 43. My italics. Indeed, Pyongyang has repeatedly observed in official statements the fates of Saddam Hussein and Muammar Gaddafi, both of whom gave up their nuclear weapons and subsequently lost conventional wars to the United States.

²⁹ For example, Anna Fifield, "In Drills, U.S., South Korea Practice Striking North's Nuclear Plants, Leaders," *Washington Post*, March 7, 2016, https://www.washingtonpost.com/world/in-drills-us-south-korea-practice-striking-norths-nuclear-plants/2016/03/06/46e6019d-5f04-4277-9b41-e02fc1c2e801_story.html.

Finally, it is also possible to trace a clear causal pathway between sub-conventional violence and nuclear use in South Asia. The Pakistani government—or at least elements of it—has a long history of sponsoring terrorism against India. Following the December 2001 terrorist attacks on the Indian parliament and the ensuing crisis, the Indian army began to develop a doctrine, popularly known as Cold Start, to respond to further attacks.³⁰ It calls for rapid mobilization, followed by a shallow incursion into Pakistan in an effort to punish Islamabad and force it to clamp down on terrorism. Pakistan has explicitly threatened to use nuclear weapons in response—a relatively credible threat given that such use could be on Pakistani soil after Indian troops had crossed the border. Paradoxically perhaps, an Indo-Pakistani crisis could be most dangerous if was sparked by a terrorist atrocity emanating from Pakistan that was *not*, in fact, authorized by Islamabad. In this case, as U.S. analyst George Perkovich notes, India might still blame Pakistan and, each side, believing itself to be the victim of aggression, might be particularly reluctant to back down.³¹

To be sure, whether India’s civilian leaders, who do not appear to have endorsed Cold Start, would actually authorize an attack against Pakistan in response to terrorism is unclear—not least because the Indian army may currently lack the capability to execute the strategy successfully. However, the army is enhancing relevant capabilities, including through major exercises, and following a major terrorist attack, Cold Start could be the only available option muscular enough to satisfy public opinion. As a result, there is a real possibility that politicians will turn to the army—and to Cold Start—in a future crisis.

Nuclear weapons and escalation

Programs to develop new strategic capabilities or modernize existing ones, as well as changes to military doctrine for contingencies involving a nuclear-armed adversary, invariably spark a debate about whether they are “stabilizing” or “destabilizing.” It’s only a slight exaggeration to say that for “nuclear hawks” the distinction depends only on whether their own country is

³⁰ The Indian Army has denied the existence of an official doctrine by the specific name of “Cold Start”, but it has endorsed the concept’s essential elements and practiced them in exercises. For a recent discussion of Cold Start and its escalation risks see George Perkovich and Toby Dalton, *Left of Boom: Motivating Pakistan to Prevent Cross-Border Terrorism* (Oxford: Oxford University Press, forthcoming), ch. 3.

³¹ George Perkovich, *The Non-Unitary Model and Deterrence Stability in South Asia*, (Washington, D.C.: Stimson and Carnegie Endowment for International Peace, November 13, 2012), http://carnegieendowment.org/files/George_Perkovich_-_The_Non_Unitary_Model_and_Deterrence_Stability_in_South_Asia.pdf.

conducting the program (in which case it's stabilizing) or another country is (when it's not). As judged by "nuclear doves," meanwhile, all such programs, it seems, are destabilizing. A more nuanced evaluation must consider the implications of nuclear-weapon systems for inadvertent escalation on a case-by-case basis.

The most worrying developments are occurring in North Korea, which is developing land-based mobile missiles and sea-launched ballistic missiles, with the presumed goal of enhancing the survivability of its nuclear forces. Such efforts may enhance crisis stability. But any reduction in inadvertent escalation risks is likely to be more than offset by an increased likelihood of deliberate escalation. Specifically, Pyongyang is developing longer range missiles, with the explicit goal of holding at risk targets in the United States, which guarantees the security of both Japan and South Korea. If North Korea reaches the point (if it hasn't already) where it believes it has attained mutual vulnerability with the United States then it might be more inclined to act aggressively against U.S. allies at the conventional and sub-conventional levels—the so-called stability-instability paradox.³²

Two developments in nuclear weaponry elsewhere appear particularly dangerous from the perspective of exacerbating inadvertent escalation risks. Programs to develop tactical nuclear weapons—particularly "battlefield" systems, such as short-range missiles, weapons delivered by short-range aircraft, and nuclear artillery—probably present the most acute risks. Pakistan is openly developing and deploying nuclear-armed, land-based ballistic and cruise missiles, which are reported to have ranges as low as 60 km.³³ Russia is probably also modernizing its force of battlefield weapons as part of an apparently extensive but highly opaque effort to update its large arsenal of tactical nuclear weapons.³⁴ (There has even been some informed speculation that North Korea may also be developing nuclear artillery.³⁵)

³² The concept of the stability-instability paradox, if not that specific phrase, originates in Glenn Snyder, "The Balance of Power and the Balance of Terror" in *Balance of Power*, ed. Paul Seabury (New York, Chandler, 1965), 184-201.

³³ For details see Hans M. Kristensen and Robert S. Norris, "Pakistani Nuclear Forces, 2015," *Bulletin of the Atomic Scientist* 71, no. 6 (November/December 2015): 59-66.

³⁴ The arsenal also includes air defense weapons and long-range cruise missiles, which cannot properly be described as battlefield weapons.

³⁵ Jeffrey Lewis, "More Rockets in Kim Jong Un's Pockets: North Korea Tests a New Artillery System," *38 North* (blog), March 7, 2016, <http://38north.org/2016/03/jlewis030716/>.

The risks associated with the doctrines that such weapons are intended to enable are compounded by their defining technical characteristic—their short ranges, which necessitates their deployment near the battlefield, where they are potentially highly vulnerable to nonnuclear strikes or even to being overrun by a rapid advance. Although destruction of these weapons would not comprise a state’s ability to threaten an adversary’s homeland, it would undermine the state’s strategy for war termination on acceptable terms, raising the prospect of a catastrophic conventional defeat. As a result, “use ‘em or lose ‘em” dynamics could still trigger nuclear escalation. Moreover, to compensate for the inherent vulnerability of battlefield nuclear weapons and also, perhaps, to ensure operational flexibility, states might pre-delegate launch authority to field commanders, further exacerbating escalation risks.

The second development is Russian and Chinese efforts to field silo-based ICBMs armed with multiple independent reentry vehicles (MIRVs). Russia has openly advertised its development of a new “heavy” missile, that is, a silo-based, liquid fueled ICBM capable of delivering a large number of warheads. (Exactly how many warheads this weapon will carry is not known—but it may well be about the same as the ICBM it is intended to replace, the SS-18 *Satan*, which can be loaded with ten.) Meanwhile, according to the U.S. Department of Defense, China is currently in the process of fielding its first MIRVed missile by converting some old, single-warhead, silo-based DF-5 ICBMs into a multiple-warhead variant.³⁶

These programs may be financially attractive to Russia and China since putting multiple warheads on one missile is cheaper than building one missile for every warhead. But they are likely to come with the cost of an increase in the already acute fears that these states have for the survivability of their nuclear forces. Because it is generally assumed that two nuclear warheads would be used to destroy one silo, placing multiple warheads on the missile inside turns it into a much more attractive target. Doing so is also likely to compound Moscow’s and Beijing’s

³⁶ Office of the Secretary of Defense, *Military and Security Developments Involving the People’s Republic of China 2015*, 8.

concerns about the vulnerability of their nuclear forces to conventional weapons since silos are potentially vulnerable to advanced nonnuclear penetrators.³⁷

At the other end of the spectrum, various modernization programs—including U.S. efforts to develop a new SSBN, and Russian and Chinese efforts to field new land-mobile missiles—should promote stability by enhancing survivability. Some of the potential benefits may, however, be seriously compromised by states' deployment practices. Mobile weapons are survivable only after being dispersed—and the act of dispersing them, if motivated by purely defensive considerations, could send unintended escalatory signals. This risk can be mitigated by keeping some weapons permanently dispersed, as a number of nuclear-armed states do with their SSBNs. However, Russia and China do not appear to have adopted this practice with their mobile missiles.

An apparent shift in China's nuclear strategy may further exacerbate this risk. Historically, Beijing is believed to have planned to “ride out” a nuclear attack before retaliating. However, an important, officially sanctioned textbook, the 2013 edition of *Science of Military Strategy*, states that China has now developed the capability to launch its nuclear weapons on receiving warning of an incoming attack.³⁸ Moreover, China's early-warning modernization program appears to be geared toward enabling a switch to such a “launch on warning” posture.³⁹ However, given that China still appears to keep its warheads and missiles stored separately (as it has always done), it may now be planning to alert its forces early in a crisis instead of keeping them on alert on a day-to-day basis. If so, China's strategy would necessitate sending highly escalatory signals regardless of whether its leaders actually wanted to. Moreover, China's missile forces could be particularly vulnerable while warheads are being mated to missiles. In fact, if China is to move

³⁷ James M. Acton, *Silver Bullet? Asking the Right Questions about Conventional Prompt Global Strike* (Washington, DC: Carnegie Endowment for International Peace, September 2013), 82-7, <http://carnegieendowment.org/files/cpgs.pdf>. Because mobile ICBMs are significantly less vulnerable than silo-based weapons, Moscow's new MIRVed mobile ICBMs are much less of a concern, as would any such systems fielded by Beijing in the future.

³⁸ Gregory Kulacki, *The Chinese Military Updates China's Nuclear Strategy* (Cambridge, MA: Union of Concerned Scientists, March 2015), 4, <http://www.ucsusa.org/sites/default/files/attach/2015/03/chinese-nuclear-strategy-full-report.pdf>. See also Joshua H. Pollack, “Boost-glide Weapons and U.S.-China Strategic Stability,” *Nonproliferation Review* 22, no. 2 (2015): 160-1.

³⁹ According to media reports, this program involves the development of early-warning satellites. For example, Kyodo News, “China Plans to Launch Test Satellite for Missile Defense,” August 24, 2015.

away from its traditional policy of riding out an attack, it would probably be safer for it to “go all the way” and keep at least some of its forces permanently alerted. Compared to a policy of alerting in a crisis, such a posture would slightly increase the risks of an accidental launch but significantly lower risks of inadvertent escalation.

From a stability perspective, it is not only the survivability of a weapon itself that matters; also important is the extent to which it can threaten an opponent’s. From this perspective, U.S. efforts to modernize the B-61 gravity bomb, which appear to involve improving the weapon’s accuracy and thus its hard-target kill capability, could exacerbate escalation risks with Russia and China.⁴⁰ In this case, such an outcome was not inevitable—the B-61 could have been modernized without increasing its military capabilities—but in other cases irresolvable trade-offs between different escalation risks can arise. For example, bombers are the most effective type of nuclear weapon delivery system for signaling and so contribute to stability. And, indeed, the United States has announced plans for a new bomber, the B-21. If nuclear signals sent using this aircraft are to be credible, it must be able to penetrate the advanced air defenses that Russia and China are currently developing. However, given that these defenses are likely to have a role in protecting Moscow’s and Beijing’s nuclear forces, the capability to penetrate them is unavoidably escalatory. (Indeed, given that the B-21 is set to be dual capable, it is could be seen as enhancing the U.S. capability for both nuclear and conventional counterforce.)

Nonnuclear weapons and escalation

The escalation risks resulting from developments in nuclear weaponry are at least familiar. Historical experience provides some kind of an empirical basis for understanding these risks since perceived first-strike threats really did generate actual crisis instability during the Cold War—such as the dispersal of forces in crises out of fear they were vulnerable—even if such instability did not culminate in nuclear use.⁴¹ Moreover, the Cold War experience may lead military planners to have some awareness of the escalation risks (even if it simultaneously points to the difficulty of negotiating concrete risk reduction measures). By contrast, the escalation risks

⁴⁰ Hans M. Kristensen, *The B61 Life-Extension Program: Increasing NATO Nuclear Capability and Precision Low-Yield Strikes*, Information Brief (Washington, DC: Federation of American Scientists, June 2011), http://fas.org/programs/ssp/nukes/publications1/IssueBrief_B61-12.pdf.

⁴¹ James M. Acton, “Reclaiming Strategic Stability,” in *Strategic Stability: Contending Interpretations*, eds. Elbridge A. Colby and Michael S. Gerson (Carlisle, PA: Strategic Studies Institute and U.S. Army War College Press, 2013), 123-28.

resulting from developments in *non*nuclear weapons are much less familiar. Looking forward, however, the emerging interactions between nuclear and nonnuclear weapons—sometimes termed “entanglement”—may prove to be a defining feature of nuclear deterrence.

One manifestation of entanglement is dual-use delivery systems (that is, systems that can carry both nuclear and conventional warheads) as well as nuclear delivery systems that are superficially very similar to nonnuclear ones. Such entanglement creates concern that a state might mischaracterize an incoming nonnuclear weapon as nuclear armed and launch a nuclear response. “Warhead ambiguity” is, for example, a major argument against the United States’ development of a new nuclear-armed cruise missile.⁴² Supporters of the missile counter by noting—entirely correctly—that “the United States has used dual-capable cruise missiles around Russia’s periphery multiple times...all without starting a nuclear war.”⁴³ Yet, on none of these occasions was the United States at war with Russia itself, so they provide little evidence about how Moscow (or Beijing or Washington) might react—or not react—if it were the target. Indeed, part of the reason why this debate is both static and rancorous is the almost complete absence of evidence for either side, making it extremely difficult to assess the severity of the risk.

Moreover, the focus on warhead ambiguity may be overshadowing a potentially much more serious risk arising from the fielding of dual-use delivery systems—preemptive pressures *prior* to their employment. In 2015, for example, China advertised its deployment of a new intermediate-range ballistic missile, the DF-26. According to apparently authoritative sources, the same missile body can be loaded with either nuclear or conventional warheads (in contrast to other Chinese missiles, which have slightly different nuclear-armed and conventionally armed variants).⁴⁴ This capability—termed “change the warhead, not the missile”—increases

⁴² William J. Perry and Andy Weber, “Mr. President, Kill the New Cruise Missile,” *Washington Post*, October 15, 2015, https://www.washingtonpost.com/opinions/mr-president-kill-the-new-cruise-missile/2015/10/15/e3e2807c-6ecd-11e5-9bfe-e59f5e244f92_story.html.

⁴³ Matthew Costlow, “The New Nuclear Cruise Missile and the Stability Argument,” RealClearDefense, February 9, 2016, http://www.realcleardefense.com/articles/2016/02/09/the_new_nuclear_cruise_missile_and_the_stability_argument_109003.html.

⁴⁴ Andrew S. Erickson, “Academy of Military Science Researchers: ‘Why We Had to Develop the Dongfeng-26 Ballistic Missile’—Bilingual Text, Analysis & Related Links,” December 5, 2015, <http://www.andrewerickson.com/2015/12/academy-of-military-science-researchers-why-we-had-to-develop-the-dongfeng-26-ballistic-missile-bilingual-text-analysis-links/>.

inadvertent escalation risks because the United States might find itself attempting to destroy nuclear-armed missiles preemptively if military intelligence incorrectly assessed that they were loaded with conventional warheads. By contrast, it seems very unlikely that the “classic” warhead ambiguity problem could trigger inadvertent escalation after a DF-26 missile had been launched. The U.S. arsenal is highly survivable so, once DF-26 missiles were actually in flight, Washington would have little to reason to use nuclear weapons until the incoming missiles had detonated, allowing the nature of their payloads to be definitively determined (though, of course, Washington might well take other steps, such as attempting to intercept the missiles while still in flight).

A second manifestation of entanglement is nonnuclear threats—whether actual or perceived—to nuclear weapons and their enabling capabilities. During the Cold War, such risks were subject to serious analysis by Western analysts only during the decade or so before the collapse of the Soviet Union, with a focus on threats to Soviet SSBNs and its command-and-control system.⁴⁵ At the time, Soviet analysts were already starting to worry about whether advanced nonnuclear munitions might soon pose a direct threat to all components of their nuclear forces. Twenty five-years later, this possibility is probably the dominant concern of Russian nuclear strategists and, perhaps even more so, their counterparts in China, which has a smaller and less survivable arsenal than Russia.⁴⁶ These concerns have been most vocally expressed in the context of opposition to U.S. ballistic missile defense deployments. However, they extend to U.S. high-precision conventional weapons, including cruise missiles and even guided gravity bombs, and to improvements in the U.S. ability to identify and track mobile targets. Most worrying of all to Moscow and Beijing, however, is the *combination* of precise conventional weapons and ballistic missile defense on the grounds that, even if U.S. missile defenses cannot defeat a large-scale attack, they might be able to “mop up” the smaller number of warheads that might survive a conventional first-strike. In fact, some Russian and Chinese strategists even argue that

⁴⁵ Barry R. Posen, *Inadvertent Escalation: Conventional War and Nuclear Risks* (Ithaca, NY: Cornell University Press, 1991), ch. 2; John J. Mearsheimer, “A Strategic Misstep: The Maritime Strategy and Deterrence in Europe,” *International Security* 11, no. 2 (Fall 1986), especially 14-17, 40-42 and 45-54.

⁴⁶ For a flavor of these concerns see Alexei Arbatov, Vladimir Dvorkin, and Sergey Oznobishchev, *Non-Nuclear Factors of Nuclear Disarmament: Ballistic Missile Defense, High-Precision Conventional Weapons, Space Arms* (Moscow: IMEMO RAN, 2010), http://www.nuclearsecurityproject.org/uploads/publications/NON_NUCLEARFACTORSOFNUCLEARDISARMAMENT_062210.pdf; Chinese source to follow.

threatening to retaliate with these weapons after a purely conventional U.S. attack lacks credibility.

These concerns can appear fanciful to U.S. officials and analysts and are sometimes dismissed as either paranoid or insincere. Indeed, for the foreseeable future, it is inconceivable that U.S. nonnuclear weapons will be able to undermine Russia's or even China's nuclear deterrents. Moreover, it is undoubtedly sometimes very useful for Russian and Chinese officials to play up their concerns, such as when arguing for greater military spending at home or scoring diplomatic points abroad. Yet, the evidence suggests that, by and large, Russian and Chinese concerns are real—which matters because, ultimately, the risk of crisis instability depends primarily on perceptions of force survivability.

For starters, the U.S. Department of Defense has consistently credited Chinese concerns. For example, in the 2015 version of its annual report on *Military and Security Developments Involving the People's Republic of China*, the Pentagon assesses that Chinese strategic modernization efforts are “intended to ensure the viability of China's strategic deterrent in the face of continued advances in U.S. and, to a lesser extent, Russian strategic [intelligence, surveillance and reconnaissance], precision strike, and missile defense capabilities.”⁴⁷ A very similar statement has appeared in every iteration of this report since 2010.

The U.S. Department of Defense does not produce an equivalent report on Russia, so its assessment of Russian concerns is not publicly known. However, the cost of Russia's strategic modernization program shows that it is putting its money where its mouth is. Most aspects of this program—including the fielding of new SSBNs and road-mobile ICBMs, and the development of a new rail-mobile ICBMs and yet another road-mobile ICBM—are clearly oriented toward enhancing survivability (if Russia's only goal were to maintain numerical parity with the United States, it could do so much more cheaply by building silo-based ICBMs). Air defenses constitute a second major focus of Russia's military modernization; it is procuring the advanced S-400 system in large numbers and is developing an even more sophisticated variant, the S-500. Given

⁴⁷ Office of the Secretary of Defense, U.S. Department of Defense, *Military and Security Developments Involving the People's Republic of China 2015*, 31.

that both systems will be deployed to protect Russia's nuclear forces, these investments underscore the seriousness of its concerns about its vulnerability to precise conventional weapons.

In fact, Russian and Chinese actions point to other concerns that they have yet to voice publicly. The nuclear forces of both countries are preparing defenses against cyber attacks.⁴⁸ One interpretation of these efforts is that Moscow and Beijing are seeking to prevent the unauthorized use of their nuclear weapons. While this may be partially true, their primary fear is probably that Washington might employ cyber weapons to try to *deny* them control of their nuclear forces (presumably as one element of a nonnuclear first strike). The possibility of cyber attacks against nuclear weapons, or more likely their command-and-control system, might add to the risk of crisis instability. It might also create a virtual form of warhead ambiguity. One characteristic of cyber weapons is that determining the purpose of a virus—especially a complex one—is both difficult and time consuming. As a result, a state that discovered a virus in its nuclear command-and-control system might be unable to determine its purpose and mistake, say, an intelligence gathering operation for an offensive one, sparking a potentially escalatory reaction.

Looking forward, the degree of entanglement between nuclear and nonnuclear forces appears set to increase as a result of further technological developments. The United States is conducting research and development into various enabling technologies for precise, long-range, conventional weapons that could travel at hypersonic speeds (at least five times the speed of sound). The Conventional Prompt Global Strike program, which is focused on the development of rocket-launched gliders, is the most well-known example of such a program but it is not the only one.⁴⁹ Both Moscow and Beijing (which, incidentally, are also exploring these technologies) worry that such weapons might be able to destroy their nuclear forces directly.⁵⁰ Technological developments could also threaten the survivability of nuclear forces by holding command-and-control capabilities at risk. Ground based components, such as antennae and

⁴⁸ Michael Pillsbury, "The Sixteen Fears: China's Strategic Psychology," *Survival* 54, no. 5 (October-November 2012), 157; "Cyber Security Units to Protect Russia's Nuclear Weapons Stockpiles," RT, October 2014, <https://www.rt.com/news/196720-russia-missile-forces-cybersecurity/>.

⁴⁹ For an overview see Acton, *Silver Bullet?*.

⁵⁰ James M. Acton, "Russia and Strategic Conventional Weapons: Concerns and Responses," *Nonproliferation Review* 22, no. 2 (June 2015): 141-54; Pollack, "Boost-Glide Weapons and U.S.-China Strategic Stability."

satellite uplinks, are relatively “soft” targets and may already be vulnerable to high-precision conventional weapons. Meanwhile, reliable anti-satellite weapons, especially if able to reach targets in geostationary orbit, could threaten command-and-control satellites. Such entanglement bodes ill for stability.

Looking forward

The drivers behind the growing likelihood of nuclear use are a mix of the old and the new. Crisis instability remains a major risk of inadvertent escalation and the underlying dynamics, driven by concerns about force survivability, are the same as in the Cold War. The types of nuclear weapon that most exacerbate these risks—heavy ICBMs and short-range tactical systems—also remain the same. What has changed is the perceived emergence of serious nonnuclear threats—both kinetic and non-kinetic—to nuclear forces. Simultaneously, deliberate escalation is becoming more likely, largely as a result of the relatively new risk of conventionally weak powers that rely heavily on nuclear weapons and have potential incentives to start wars.

These risks are likely to become more acute over time. Multipolarity could facilitate the emergence of both damaging new arms races and fraught new deterrence relationships, even if further proliferation is held at bay. Technological developments are likely to create greater entanglement between nuclear and nonnuclear weapons. The grimmest part of this picture is, however, the difficulty of any form of risk reduction, but especially cooperative approaches.

The problem is, in part, technical. Governments have not yet succeeded in subjecting most types of tactical nuclear weapon to arms control (though there are, at least, some promising ideas about potential approaches).⁵¹ These challenges, however, pale in comparison to the difficulty of developing risk mitigation measures for some types of nonnuclear weapon that are becoming increasingly entangled with nuclear forces. Cyber weapons present particularly daunting challenges, but there is also no obvious way forward on anti-satellite weapons or even conventional cruise missiles. (Conversely, some emerging technologies, such as certain

⁵¹ The only exception was weapons eliminated under the 1987 Intermediate Range Nuclear Forces Treaty. For suggestions on next steps in tactical nuclear arms control see Next Generation Working Group, *Beyond New START: Enhancing U.S. National Security Through Arms Control With Russia* (Washington, DC: Center for Strategic and International Studies, 2012), 16-18, http://csis.org/files/publication/110824_Acton_BeyondNewSTART_WEB.pdf.

hypersonic missiles, could be relatively amenable to arms control. It would, for example, be very straightforward, at least from a technical perspective, to make rocket-launched hypersonic gliders accountable under any future strategic arms control treaty).

Yet, the greatest difficulties are, as always, political. In today's multipolar nuclear order, interest in bilateral strategic arms control is on the wane, but there is little appetite to tackle the complexities of multilateral negotiations. Generally poor relations between key states complicate matters further (although, as the Cold War demonstrates, states can take advantages of even temporary thaws to negotiate and implement useful arms control arrangements). The contemporary international challenge is, however, heightened by the generally corrosive effects of domestic politics. While it is simply incorrect to look back at the Cold War as a time when American politics stopped at the border, widespread fear about the possibility of a nuclear war did, from the mid-1960s onwards, help to surmount some of the political barriers to arms control. Today, nuclear weapons lie near the edge of public consciousness almost everywhere and, in the United States, arms control is subject to the furies of a political system that, by any measure, is much more polarized than at any time during the Cold War. Moreover, American domestic politics is not the only problem. In South Korea, for example, popular pressure to respond forcefully to future provocations by North Korea could spark an escalating conflict. Meanwhile, it remains to be seen for how long Indian public opinion will tolerate New Delhi's lack of a response to Pakistan's rapid nuclear build-up.

Under these circumstances, the most promising—or, perhaps, the least unpromising—avenue to risk reduction lies with organizational reform within governments and militaries. In making a similar proposal more than two decades ago, the U.S. political scientist Barry Posen acknowledged that this conclusion might seem “odd.”⁵² But, some escalations risks could be mitigated, at least partially, by organizational reform that led to their being given more serious consideration in military planning and procurement. And, a practical level, while governments and militaries may be difficult to reform, they are at least more susceptible to change than international politics as a whole.

⁵² Posen, *Inadvertent Escalation*, 218.

One problem is the disjuncture in many militaries between conventional war planning and nuclear war planning. In the United States, for instance, the former is the province of the regional combatant commands, such as Pacific Command, while the latter is generally the responsibility of Strategic Command. Such a division of labor impedes consideration of the pathways by which conventional conflicts might escalate to nuclear use. More importantly, militaries, which are tasked with winning battles, are often poorly equipped to make the essentially political judgments required to anticipate potential risks of escalation. For this reason, greater civilian oversight of planning for military contingencies involving nuclear-armed states would probably be beneficial. By itself, organizational reform is almost certainly an inadequate response to the scale of the challenge. But, by institutionalizing greater awareness of escalation risks, it might help pave the way for a more proportionate response.