With most of the world’s advanced economies in slow growth, Western support for major defense spending uncertain, and a major emerging Asian power increasingly at military odds with its neighbors and the United States, it is tempting to view our times as rhyming with a decade of similar woes—the disorderly 1930s. Might we again be drifting toward


some new form of mortal national combat? Or, will our future more likely ape the near-half-century that defined the Cold War—a period in which tensions between competing states ebbed and flowed but peace mostly prevailed by dint of nuclear mutual fear and loathing?

The short answer is, nobody knows. This much, however, is clear: The strategic military competitions of the next two decades will be unlike any the world has yet seen. Assuming U.S., Chinese, Russian, Israeli, Indian, French, British, Pakistani, and North Korean strategic forces continue to be modernized and America and Russia freeze or further reduce their strategic nuclear deployments, the next arms race will be run by a much larger number of contestants with highly destructive strategic capabilities far more closely matched and capable of being quickly enlarged than in any other previous period in history.

**Looking Back: The Past Half-Century of Nuclear Competition**

To grasp the dimensions of this brave new world, one need only compare how capable states were of striking their adversaries suddenly a half-century ago, with what damage they might inflict today. In 1962, Washington and Moscow engaged in the most significant of Cold War nuclear confrontations over the Soviet deployment of nuclear-capable missiles in Cuba. At the time, the United States had over 24,000 operationally deployed nuclear weapons. Russia had nearly 2,500. The other nuclear powers—the UK and France—had an aggregate of no more than 50 (with France possessing few, if any, deployed nuclear weapons). The

difference in nuclear weapons deployment numbers between the top and bottom nuclear powers—a figure equal to at least three orders of magnitude—was massive. America, moreover, was clearly dominant.

Today, the United States has less than 2,000 deployed strategic and tactical nuclear warheads and Russia roughly 3,500.\textsuperscript{72} India, Paki-

\textsuperscript{72} As of early 2018, the official number of deployed strategic warheads as counted under the New START Treaty (which count heavy bombers as one warhead) places the number of U.S. warheads at 1,350 and Russia at 1,444. See U.S. Department of State, “New START Treaty Aggregate Numbers of Strategic Offensive Arms,” February 2018, available at \url{https://www.state.gov/t/avc/newstart/278775.htm}. Other sources count more than one warhead per bomber. An average of their estimates places the number of U.S. deployed strategic warheads at 1,740, plus 150 tactical warheads deployed in Europe for a total of 1,890 deployed warheads. The average estimate of Russian deployed strategic warheads is 1,950. Russia is also estimated to have around 2,000 tactical warheads that the Russian government says are in central storage, which brings the total of Russian warheads to 4,300. The figures for each country do not include warheads considered to be nondeployed or awaiting dismantlement. See Hans M. Kristensen and Robert S. Norris, “United States Nuclear Forces, 2017” \textit{Bulletin of the Atomic Scientists} 73, no. 1, January/February 2017, pp. 48-57, available at \url{http://www.tandfonline.com/doi/full/10.1080/00963402.2016.1264213}; Hans M. Kristensen, “Tac Nuke Numbers Confirmed?” \textit{FAS Strategic Security Blog}, Federation of American Scientists, December 7, 2010, available at \url{http://fas.org/blogs/security/2010/12/tacnukes/}; Hans M. Kristensen and Robert S. Norris, “Russian Nuclear Forces, 2017” \textit{Bulletin of the Atomic Scientists} 73, no. 2, March/April 2017, pp. 115-126, available at \url{http://www.tandfonline.com/doi/pdf/10.1080/00963402.2017.1290375}; Hans M. Kristensen, “Status of World Nuclear Forces,” \textit{Federation of American Scientists}, updated May 26, 2016, available at \url{https://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/}; and Shannon Kile and Hans Kristensen, “Trends in World Nuclear Forces, 2016,” \textit{Stockholm International Peace Research Institute}, June 2016, available at \url{https://www.sipri.org/sites/default/files/FS%20201606%20WNF_Embargo_Final%20A.pdf}. President Trump has signaled a willingness to continue reducing America’s nuclear weapons stockpile, saying about nuclear weapons buildups “If they stop, we’ll stop,” and frankly I’d like to get rid of a lot of them. And if they want to do that, we’ll go along with them. We won’t lead the way; we’ll go along with them.” See, David Martosko, “‘We’ll stop in two minutes!’ Trump says America won’t build more nuclear weapons – IF other
stan, the UK, France, and Israel have between 100 and 400 each; China anywhere from 190 to 900, and North Korea as many as 60. Thus, the difference in the numbers of nuclear deployments between the top and bottom nuclear powers has fallen roughly two full orders of magnitude and is projected to decline even further (see Figure 2).

As tight as the nuclear deployments between the world’s nuclear-armed states has become, the potential for this nuclear balance to shift quickly and dramatically is far greater than it was a half-century ago. In 1962, the United States, Russia, the UK, and France had militarized nearly all of the nuclear weapons materials they produced. They held little or nothing back in reserve. Nor could any of them militarize significant civilian stockpiles of separated plutonium or highly-enriched uranium (HEU), as no such stockpiles were then available.

Today, things are different. First, the United States and Russia alone can redeploy thousands of reserve nuclear weapons and reconfigure stockpiled fissile materials into tens of thousands of additional nuclear weapons. Second, officials in Japan have publicly allowed they have the means to militarize nearly 11 metric tons of civilian

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74. The information used to generate this graph was drawn from the sources in notes 71-73. In the case of the United States, Russia, UK, and France, only deployed warheads are shown. For all other countries, both deployed and stored warheads are shown.
plutonium (i.e., enough to make more than 2,000 first-generation bombs)\(^{75}\) material domestically.\(^{76}\)


India, meanwhile, has many hundreds of bombs’ worth of separated reactor-grade plutonium on tap, is planning to expand its capacity to produce more of this material significantly over the next 3 to 10 years, and has claimed to have tested a nuclear device using this reactor-grade material. Third, China has produced tons of nuclear material that it might yet militarize and is considering building a civilian plutonium reprocessing plant that could produce over 1,500 bombs’ worth of plutonium annually.

former defense minister in 2012, Satoshi Morimoto, is quoted saying that the country’s nuclear power reactors have “very great defensive deterrent functions,” available at http://www.publicintegrity.org/2014/03/12/14394/plutonium-fever-blossoms-Japan; and a radio interview of former Japanese Prime Minister Naoto Kan noted that having plutonium on hand to have an option to make bombs was one of the reasons why Japan under Nakasone originally backed nuclear power. See “Ex-Japanese PM on How Fukushima Meltdown was Worse Than Chernobyl and Why He Now Opposes Nuclear Power,” Democracy Now, March 11, 2014, available at http://www.democracynow.org/2014/3/11/ex_japanese_pm_on_how_fukushima.


Pakistan, Iran, Israel, South Korea, and North Korea also either make or are planning to produce such nuclear fuels (see Figure 3):

**Figure 3. National Stockpiles of Separated Plutonium.**

As for enriched uranium, the United States and Russia each still easily have more than 10,000 crude bombs’ worth of surplus weapons-grade uranium on hand (see Figure 4).

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fissilematerials.org/library/gfmr15.pdf.

The amount China may have deployed in weapons is unclear but a conservative estimate of the HEU it has produced is 16 metric tons—i.e., enough to make roughly 800 first-generation implosion weapons. India, meanwhile, has enough highly-enriched uranium.


81. A 10-to 20-kiloton yield nuclear weapon would roughly require between 12-20 kilograms of weapons-grade uranium. If the Chinese should choose to use the advanced nuclear weapons designs that they clearly have on hand, the fissile requirements could drop to between 4 to 5 kilograms of weapons-grade uranium per 10-to 20-kiloton yield device. It also should be noted that plutonium can be used with highly enriched uranium in a manner that would significantly reduce the amount of HEU required. Thus, the amount of weapons-grade uranium required for a given critical mass can be reduced by roughly 50 percent simply by using two kilograms of plutonium in the core. On these points and China’s estimated HEU holdings, see Cochran and Paine, “The Amount of Plutonium and Highly-Enriched Uranium;” Harold A. Feiveson, Alexander Glaser, Zia Mian and Frank N. von Hippel, Unmaking the Bomb: A Fissile Material Approach to Nuclear Disarmament and Nonproliferation, Cambridge, MA: MIT Press, 2014, pp. 38-39 and 54-56; Gregory S. Jones, “An Iran Nuclear Deal That Spreads Nuclear Weapons,” August 10, 2015, available at http://nebula.wsimg.com/de41a0d1cf9f9c51df7637d3b8df3d05?AccessKeyId=40C80D0B51471CD869
stockpiled to make several hundred additional crude nuclear implosion weapons, as do France and the UK (again, see Figure 4). As for the future, both Japan and China plan on expanding their uranium enrichment capacity significantly. South Korea would like to enrich uranium as well as North Korea expands its plutonium and highly enriched uranium stockpiles. As will be discussed, all of these efforts are likely to be in excess of anything called for commercially.

This, then, brings us to the next qualitative strategic metric of interest, long-range missile delivery systems. In 1962, only the United States and the Soviet Union had missiles capable of delivering a first-generation nuclear weapon. Today, 24 states do. To be sure, many of these states only have theater-range systems. But most of these states are in hotspots like the Middle East, where missiles of such range are more than sufficient to strike several neighbors. Meanwhile, the rest of the world’s nuclear-capable missile states can target this same region with either intercontinental or medium-range systems.

As for the total number of nuclear-armed states, this figure has increased as well. A half-century ago, only the United States, Russia, the UK, and France had nuclear arms, and an overwhelming


number of these weapons were in the hands of the United States (see Figure 5):

![Figure 5. Four Nuclear Weapons States in 1962.](image)

Now, there are nine nuclear-armed states. Two—the UK and France—are within NATO and, to a limited extent, coordinate their nuclear weapons efforts. North Korea, meanwhile, is a state that the major powers hope will give up its nuclear arms in negotiations. In this world, U.S. officials view not just Britain and France, but India, Pakistan, and Israel, as either U.S. allies or strategic partners (see Figure 6):

This world, however, may not last. Certainly, Tehran may yet militarize its nuclear holdings, and Turkey, Saudi Arabia, Egypt, Algeria, South Korea, and Japan must now all be viewed as nuclear weapons aspirants. Also, unlike France, China, Russia, and the UK, these post-Cold War nuclear-weapons aspirants may not announce their acquisition of their first nuclear weapon by testing it. Instead, they are likely to develop “peaceful” nuclear energy programs, as Iran, India, Iraq, and North Korea did, and then move toward nuclear weapons only when they conclude it is useful to do so.

Whether or not “safety” and nuclear stability in this new world will be “the sturdy child of [mutual] terror” (Winston Churchill’s description of Cold War stability), remains to be seen. Certainly,

the stool of nuclear deterrence will have many more strategic legs that could give way in many more surprising ways than were possible a half century ago (see Figure 7 below):

![Figure 7. Possible Proliferated Future.](image)

**What May Go Wrong?**

As already noted, a fashionable rejoinder to such broodings is to insist that all of these states will be mutually deterred. Any intelligent state, it is argued, should know that using nuclear weapons is militarily self-defeating and that these weapons’ only legitimate
mission is to deter military threats. According to this view, fretting about nuclear use and proliferation is mistaken or overwrought.\textsuperscript{86}

But is it? Can states deter military threats with nuclear weapons if their actual use is universally viewed as being self-defeating? Which nuclear-armed states, if any, actually believe they are militarily useless? As noted earlier, the Russians and Pakistanis clearly do not. Just the opposite: They have gone out of their way to develop low-yield theater nuclear weapons and say they may use them to deter and possibly defeat opposing advanced conventional forces. As for the United States, France, and the UK, all have studiously refused to renounce first use. Israel, meanwhile, insists that while it will not be first to introduce nuclear weapons in the Middle East, it will not be second. This leaves North Korea—a wild card—and India and China, whose declared no first use policies are either unclear or under reconsideration.\textsuperscript{87}


But aren’t the days of highly destructive wars—nuclear or nonnuclear—behind us? Certainly, with the events surrounding 9/11, this view gained support from a number of U.S. and allied military analysts and pundits. Reflecting this outlook, the United States and its European allies have turned several Cold War nuclear “survival” bunkers into private real estate offerings or historical tourist sites.

The problem is that at least two states have not. U.S. intelligence agencies have determined that Russia invested over $6 billion to


expand a 400 square mile underground nuclear complex at Yamantau a full decade after the Berlin Wall fell. This complex is burrowed deep enough to withstand a nuclear attack, and is large enough and provisioned sufficiently to house 60,000 people for months. U.S. intelligence officials believe it is one of a system of as many as 200 Russian nuclear bunkers (see Figure 8 below).\(^90\)

![Figure 8. Russian Underground Nuclear Complex at Yamantau.\(^91\)](image)

China’s nuclear passive-defense is no less impressive. In 2009, China’s strategic missile command, the 2nd Artillery Corp, revealed that it had completed 3,000 miles of dispersed, deep,


\(^{91}\) Ibid.
underground tunnels for the deployment of its nuclear-capable cruise and ballistic missile forces. China spent enormous sums to build this system and is still expanding the complex, which is known as the Underground Great Wall. The system is said to be designed and provisioned to house thousands of military staff during a nuclear exchange (see Figure 9 below):\(^92\)

![Figure 9. China’s Underground Great Wall.](image)

North Korea also has gone to extensive lengths to protect its strategic assets. Almost all of its nuclear and long-range military systems have underground tunnelled bases or host areas. South Korean

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93. See Wan, “Georgetown Students Shed Light on China’s Tunnel System for Nuclear Weapons.”
intelligence estimates that North Korea has an excess of 10,000 underground facilities to protect its key military and civilian assets.\textsuperscript{94}

\textit{Going Ballistic}

All of this suggests that several nuclear-armed states still believe they may have to endure or engage in nuclear exchanges. Fortifying this suspicion is the increasing capacity states have to deliver both nuclear and nonnuclear payloads quickly against one another. Back in 1962, only the United States and Russia had nuclear-capable missile systems—i.e., cruise or ballistic missile systems capable of delivering a first-generation nuclear warhead (i.e., one that weighed 500 kilograms or more) 300 kilometers or farther.\textsuperscript{95} Now, no fewer than 24 countries have perfected or acquired such systems, and ten can launch a satellite into orbit—i.e., have mastered all that’s needed to deploy an intercontinental ballistic missile (ICBM). In addition, the United States, China, Iran, South Korea, Israel, and key NATO states are all working on precision conventional missiles capable of knocking out large military bases and major naval surface combatants that only a few decades ago were difficult or impossible to


destroy *without* using nuclear weapons. More nuclear-capable missile states are likely to emerge (see Figure 10 on the next page):

![Map of nuclear-capable missile countries today](image)

**Figure 10. Nuclear-Capable Missile Countries Today.**

The strategic uncertainties these missile trends can generate are difficult to exaggerate. First, the proliferation of long-range missiles allows many more countries to play in any given regional dispute. One way to measure a state’s diplomatic potential to influence others militarily is simply to map out the range arcs of its deployed missiles. Today, increasingly, these arcs and the diplomatic-political “power” shadows they cast overlap. Consider Iran. Its missiles now target Israel, Egypt, the UAE, Russia, Pakistan, France, Saudi Arabia, China, and the UK.


97. See note 82.
This is a very different world than that of a half-century ago. In 1962, when alliance loyalties within the Communist and Free World Blocs were at their height, only Russia and America had missiles aimed at each other. Now, there is no Communist Bloc, what remains of the Free World alliance system (e.g., NATO; Australia, New Zealand, United States Security Treaty [ANZUS], etc.) is relatively weak, and nuclear-capable missiles in hotspots like the Persian Gulf could be fired from any number of states—both near and far. For nuclear-armed states, this situation places a premium on protecting their nuclear weapons-related systems against surprise attack.\footnote{On the vulnerability of U.S. strategic command and control systems and its land base ballistic missile force, see, e.g., Bill Gertz, “Stratcom: China Continuing to Weaponize Space with Latest Anti-Satellite Missile Shot,” \textit{Washington Free Beacon}, August 13, 2014, available at \url{http://freebeacon.com/national-security/stratcom-china-continuing-to-weaponize-space-with-latest-anti-satellite-missile-shot/} and Bruce Sugden, “China’s Conventional Strikes against the U.S. Homeland,” \textit{Center for International Maritime Security}, accessed August 18, 2014, available at \url{http://cimsec.org/china-conventional-strike-us/11829}.} It also raises first-order questions about nuclear escalation, which brings us to the second reason more missiles in more hands is a major worry: These missiles also can act as conventional catalysts for nuclear wars.

Increasingly, with precision guidance and advanced munitions technologies, it is possible to destroy targets that once required nuclear weapons—e.g., large air strips and air fields, command centers, naval ports, and even large, moving surface ships—with a handful of precise, conventionally-armed missiles instead. This has raised the prospect of states being able to knock out a significant portion of an opponent’s key military forces \textit{without} having to use nuclear weapons.\footnote{An example of the spread of increasingly accurate missiles spreading to dangerous regions is the cooperation between North Korea and Syria in the Syrian maneuverable re-entry vehicle Scud D project in 2008. See United Nations Security Council, Final report of the Panel of Experts submitted pursuant to...}
The good news is that this should make the initial use of nuclear weapons less likely. The bad news is that with enough precision guidance capabilities, a state might be tempted to initiate combat in the expectation of winning without ever having to go nuclear and end up miscalculating badly.

**War Scenarios**

A real-world case, much discussed by Pakistani security analysts, is the mid-term prospect of an Indian conventional missile decapitation of Pakistani nuclear strategic command and control centers. The Indians, in this scenario, would use precise, offensive, long-range missiles to knock these centers out. Then, New Delhi could deter any remaining Pakistani retaliatory nuclear strike with India’s much larger nuclear forces and with Indian nonnuclear missile defenses. Finally, India could prevail against Pakistani armor and artillery, with superior Indian military conventional forces.

To hedge against this prospect, Pakistan has ramped up its nuclear arms production and is deploying its nuclear weapons in ways designed to complicate Indian efforts to knock them out (e.g., delegation of launch authority under certain circumstances, forward deployment, dispersal, mobility, etc.). All of these methods only increase the prospects for nuclear use and have goaded India to develop new nuclear options of its own.

Beyond this, advanced conventional weapons might ignite a nuclear conflict directly. Again, consider India and Pakistan. After being hit by so many Pakistani-backed terrorist attacks, the Indian government has developed a conventional counterstrategy known as “Cold Start.” Under this approach, India would respond to Pakistan-backed terrorist attacks by quickly seizing a limited amount of Pakistani territory, with quick alert, forward deployed Indian forces (i.e., that could launch from what Indian military planners call a cold start). The idea here would be to threaten to take a limited amount of territory that Pakistan holds dear, but not enough to prompt Pakistan to attack India with its nuclear weapons.

Unfortunately, India’s discussion of a Cold Start plan has had nearly the reverse effect. Shortly after New Delhi broached this strategy, Pakistani military officials announced their intent to use tactical nuclear weapons against any invading Indian force and deployed new, short-range nuclear-capable tactical missiles along the Pakistani-Indian border precisely for this purpose. India has responded by deploying tactical missiles of its own. It is unclear just how serious either India or Pakistan are about carrying out these war plans but this uncertainty is itself a worry.

Of course, relying on nuclear weapons to counter conventional threats is not unique to Pakistan. Moscow, faced with advanced Chinese and NATO conventional forces, has also chosen for now to emphasize its theater nuclear weapons. For Russia, employing these weapons is far less stressful economically than quickly trying to field a complete advanced conventional force. China, in response, may be toying with deploying additional tactical nuclear systems of its own.101

China and the Nuclear Rivalries Ahead

All of these trends are challenging. They also suggest what the next strategic arms competition might look like. First, if the United States and Russia maintain or reduce their current level of nuclear weapons deployments, it is possible that at least one other nuclear weapons state may be tempted to close the gap. Of course, in the short and even mid-term, Pakistan, Israel, and India could not hope to catch up. For these states, getting ahead of the two superpowers would take great effort and at least one to three decades of continuous, flat-out military nuclear production. It is quite clear, moreover, that none of these states have set out to meet or beat the United States or Russia as a national goal.

China, however, is a different matter. It clearly sees the United States as a key military competitor in the Western Pacific and in Northeast Asia. China also has had border disputes with India and historically has been at odds with Russia. It is not surprising, then, that China has actively been modernizing its nuclear-capable missiles to target key U.S. and Indian military air and sea bases with advanced conventional missiles, and is developing even more advanced missiles to threaten U.S. carrier task forces on the open seas. In support of such operations, China is also modernizing its military space assets, which include military communications, command, surveillance, and imagery satellites and emerging antisatellite capabilities.102

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Then there is China’s nuclear arsenal. For nearly 30 years, most respected Western security analysts have estimated the number of deployed Chinese nuclear warheads to be between 190 and 300.\footnote{Cf. Kristensen and Norris, “Chinese Nuclear Forces, 2013” and Gertz, “The Warhead Gap.”} Yet, by any account, China has produced enough weapons-usable plutonium and uranium to make up to four times this number of weapons. Why, then, have Chinese nuclear deployments been judged to be so low?

First, China has experienced first-hand what might happen if its nuclear weapons fell into the wrong hands. During the Cultural Revolution, one of its nuclear weapons laboratories test fired a nuclear-armed medium-range missile over heavily populated regions of China and exploded the device. Not long after, Mao ordered a major consolidation of China’s nuclear warheads and had them placed under much tighter centralized control. Arguably, the fewer nuclear warheads China has, the easier it is for its officials to maintain control over them.\footnote{See Mark Stokes, “Securing Nuclear Arsenals: A Chinese Case Study,” in Henry Sokolski, ed., Nuclear Weapons Security Crises: What Does History Teach? Carlisle, PA: Strategic Studies Institute, 2013, pp. 65-85, available at...
Second, and possibly related, is China’s declared nuclear weapons strategy. In its official military white papers since 2006 and in other forums, Chinese officials insist that Beijing would never be first to use nuclear weapons and would never use them against any non-nuclear weapons state. China also supports a doctrine that calls for a nuclear retaliatory response that is no more than what is “minimally” required for its defense. Most Western Chinese security experts have interpreted these statements to mean Beijing is interested in holding only a handful of opponents’ cities at risk. This, in turn, has encouraged Western officials to settle uncertainties regarding Chinese nuclear warhead numbers toward the low end.  

What China’s actual nuclear use policies might be, though, is open to debate. As one analyst quipped, with America’s first use of nuclear weapons against Japan in 1945, it is literally impossible for any country other than the United States to be first in using these weapons. More important, Chinese officials have emphasized that Taiwan is not an independent state and that under certain circumstances, it may be necessary for China to use nuclear weapons against this island “province.” Also, there are the not-so-veiled nuclear threats that senior Chinese generals have made against the United States if it should use conventional weapons against China in response to a Chinese attack against Taiwan (including the observation that

http://npolicy.org/books/Security_Crises/Ch3_Stokes.pdf.

the United States would not be willing to risk Los Angeles to save Taipei).  

Finally, as China deploys more land-mobile and submarine-based nuclear missile systems, there will be increased technical and bureaucratic pressures to delegate more launch authority to each of China’s military services. China’s ballistic missile submarines already have complete nuclear systems under the command of their respective submarine captains. As China deploys ever more advanced road-mobile nuclear missiles, their commanders may want to have similar authority. Historically, in the United States and Russia, such delegation of launch authority came with increased nuclear weapons requirements.

The second cause for conservatism in assessing China’s arsenal is the extent to which estimates of the number of Chinese warheads have been tied to the observed number of Chinese nuclear weapons missile launchers. So far, the number of these launchers that have been seen is relatively low. Moreover, few, if any, missile reloads are assumed for each of these missile launchers, and it is presumed that only a handful of China’s missiles have multiple warheads. The number of battlefield nuclear weapons, such as nuclear artillery, are also presumed to be low or nonexistent.


All of this may be right, but there are reasons to wonder. The Chinese, after all, claim that they have built 3,000 miles of tunnels to hide China’s nuclear-capable missile forces and related warheads and that China continues to build such tunnels. Employing missile reloads for mobile missile systems has been standard practice for Russia and the United States. It would be odd if it was not also a Chinese practice, particularly given China’s growing number of land-mobile solid-fueled rocket and cruise missile systems. With China’s recent development of the DF-41, a massive, mobile, nuclear-armed ICBM, and its deployment of multiple independently targetable re-entry vehicles (MIRVs) on its silo-based DF-5s, U.S. authorities believe China is deploying a new generation of MIRVed missiles.108 Also, as already noted, several experts believe China may be considering battlefield artillery for the delivery of tactical nuclear shells.

Precisely how large is China’s nuclear arsenal, then? The answer is unclear. The Chinese say they are increasing the size of their nuclear weapons arsenal “appropriately.”109 They have not yet said by how much. General Viktor Yesin, the former chief of Russia’s strategic rocket forces, in 2012 told U.S. security experts that China


may have more than 900 deployed nuclear weapons and another 900 nuclear weapons stored in reserve. This estimate, which is roughly seven times greater than most analysts believe Beijing possesses, would give China roughly as many warheads as the United States currently has deployed.

Putting aside how accurate this Russian projection might be, the first problem it and other larger estimates present is how sound long-term U.S. and Russian strategic plans might be. It hardly is in Washington’s or Moscow’s interest to let Beijing believe it could threaten Taiwanese, Japanese, American, Indian, or Russian targets conventionally because China’s nuclear forces were so large Beijing could assume they would deter any of these states from ever responding militarily (see Figure 11):


111. A sharp critic of recent estimates that China might have as many as 3,000 nuclear weapons, though, was hardly reassuring in emphasizing that China could only “theoretically” have as many as 1,660 nuclear weapons. For more on this controversy, see Hans Kristensen, “No, China Does Not Have 3,000 Nuclear Weapons,” FAS Strategic Security Blog, December 3, 2011, available at http://fas.org/blogs/security/2011/12/chinanukes/.
Figure 11. The Next Decade: Nuclear Weapons Uncertainties.\textsuperscript{112}

Yet another question that a much larger Chinese nuclear strategic force would raise is how it might impact future U.S.-Russian strategic arms negotiations. As China has increased its deployments of highly precise, nuclear-capable missile systems, Moscow has chaffed at the missile limits that the Intermediate-Range Nuclear Forces Treaty (INF Treaty) imposes on it fielding similar systems. Since the conclusion of New START in 2011, Moscow has balked at making any further cuts unless China is included in the

\begin{footnotesize}
\end{footnotesize}
negotiations. Shortly after several U.S. security analysts and members of Congress spotlighted Russian moves to break out of the INF Treaty,\textsuperscript{113} the State Department announced that Russia had, in fact, violated the treaty.\textsuperscript{114} American hawks, meanwhile, have warned against the United States making further nuclear cuts lest other states, like China, quickly ramp up their force levels to meet or exceed ours. Yet, President Trump has voiced a desire to do so.\textsuperscript{115} All of this suggests the imperative for Washington and Moscow to factor China into their arms control and strategic modernization calculations. The question is how.

\textit{Other Interested Parties}

Unfortunately, getting a sound answer to this question is not possible without first considering the security concerns of states other than the United States, Russia, and China. Japan, for one, is an interested party. It already has roughly 2,000 weapons’ worth of


separated plutonium on its soil. This plutonium was supposed to fuel Japan’s light water and fast reactors, a fleet which, before the accident at Fukushima, consisted of 54 reactors. After the accident, Japan shut down all of these plants, decided to reduce its reliance on nuclear power as much as possible, and is projected in the mid-term to bring no more than one-third of its light water reactor fleet back online.116 Meanwhile, Japan’s fast reactor program has been effectively frozen since the 1990s due to a series of accidents, and its only demonstration fast reactor was shut down in 2017. Japan would like to cooperate with the United States, and France to develop such reactors, but it is unlikely to operate any for decades.117

A related and immediate operational question is whether or not Japan will bring a $20-billion-plus commercial nuclear spent-fuel reprocessing plant capable of producing roughly 1,500 bombs’ worth of plutonium a year at Rokkasho online sometime in the spring of 2021. This plutonium recycling effort has been controversial. The original decision to proceed with it was made under Prime Minister Nakasone and can be tied to Japanese considerations of developing a plutonium nuclear weapons option. Although this plant is not necessary for the management of Japan’s spent fuel, the forward costs of operating it could run as high as $100 billion. It is expected to produce eight tons of weapons-usable plutonium annually—enough to produce nearly

116. See Mari Saito, Aaron Sheldrick and Kentaro Hamada, “Japan may only be able to restart one-third of its nuclear reactors,” Reuters, April 2, 2014, available at http://www.reuters.com/article/2014/04/02/us-japan-nuclear-restarts-insight-idUSBREA3020020140402. In private interviews with several leading Japanese nuclear experts, the range of restarts given is somewhat higher—between 15-25 light water reactors. As of March 2018, only five reactors were operating in Japan.


\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{japan_plutonium_stocks.png}
\caption{Japan’s stock of separated plutonium could decline slowly – or climb rapidly if Rokkasho Reprocessing Plant operates.\footnote{See Frank von Hippel, “Options for Disposal of Separated Plutonium,” presentation at the Foreign Correspondent’s Club of Japan, April 19, 2018, available at \url{http://npolicy.org/Articles/FvH%2C%20FCCJ%2019April2018rev11.pdf}.}}
\end{figure}

In light of the questionable technical and economic benefits of operating Rokkasho, it would be difficult for Tokyo to justify proceeding with this plant’s operation unless it wanted to develop an
option to build a large nuclear weapons arsenal.\textsuperscript{120} Given Japan currently retains nearly 11 tons of mostly reactor-grade plutonium on its soil, enough to make roughly 2,000 first-generation nuclear warheads, there is no immediate need to bring Rokkasho online to assure a military nuclear option.

However, Japan says it is committed to eliminating this surplus plutonium stockpile and in 2014 agreed to surrender roughly 800 kilograms of weapons-grade plutonium and uranium to the United States in pursuance of this stated goal.\textsuperscript{121} In this context, keeping Rokkasho on the ready could be seen as a kind of national security insurance policy. Some leading Japanese figures clearly see it in this light\textsuperscript{122} and technically, there is little question that the plutonium

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\textsuperscript{120} By the Japanese Atomic Energy Commission’s own calculations made after the Fukushima accident, starting Rokkasho would only make sense over the next 20 to 30 years if more than 15 percent of Japan’s electricity was produced by nuclear power reactors—i.e., 20 or more power reactors would have to be operating. As of the writing of this volume Japan had only five reactors online and it is unclear if the 15 percent criteria will ever be met. On this point, see note 109 and slides 24-30 from the presentation of former Japanese Atomic Energy Commission Vice Chairman, Tatsujiro Suzuki, “Nuclear Energy and Nuclear Fuel Cycle Policy Options, after the Fukushima Accident,” presentation at the Nonproliferation Policy Education Center East Asian Alternative Energy Futures Conference, Honolulu, Hawaii, February 26, 2014, available at http://npolicy.org/article_file/Suzuki-Japan-energy-nuclear-policy.pdf.


could be used to make effective weapons. In this regard, even


under a much less nationalistic, pro-nuclear government than the one now in office, Japan’s Diet in the fall of 2012 felt compelled to clarify in law that the purposes of the country’s atomic energy program include supporting Japan’s “national security.” Many nuclear observers outside of Japan saw this as a not-so-veiled reference to Japan’s ability to mobilize its “civilian” plutonium-fuel cycle program.


Certainly, South Korean and Chinese officials and commentators spotlighted this prospect with concern. Their apprehensions, then, raise the question: What might happen if Japan ever decided to open Rokkasho? How could this avoid stoking South Korean ambitions to make their own nuclear fuels? What of China’s long-term efforts to modernize its own nuclear weapons systems and its “peaceful” scheme of building a copy of Rokkasho itself? Would not starting up Rokkasho only catalyze these efforts? What if Japan’s startup of Rokkasho came after some Chinese or North Korean military provocation? Might this not trigger an additional round of Chinese, North Korean, and South Korean military and nuclear hedging actions?


Yet another “peaceful” East Asian nuclear activity that bears watching is the substantial plans both Japan and China have to enrich uranium. Both countries justify these efforts as being necessary to fuel their light water reactor fleets. There are several difficulties with this argument. First, both countries already have access to foreign uranium enrichment services that are more than sufficient to supply current demand. Second, any effort to become commercially self-sufficient in enriching uranium in the name of “energy independence” is questionable for Japan and China given their lack of economic, domestic sources of high-grade uranium ore.

Even assuming China could stop importing enrichment services, as it now does from URENCO of Europe and Minatom/Tenex of Russia, then, it still would want to import much of its uranium ore from overseas. Of course, operating commercial enrichment capacity could afford bargaining leverage to secure cheaper foreign enrichment service contracts. But in China’s case (and Japan’s and South Korea’s cases as well), such leverage can be had at enrichment capacities far below those they have or want to acquire. Again, both uranium ore and enrichment services are readily available globally at reasonable prices and are projected to remain so. Uranium yellowcake spot prices are quite low. As for enrichment services, the world’s current surplus of enrichment capacity is projected to persist at least through 2035.127 In short, there is no lack of enrichment services internationally and, given China’s access to Russian and Euro-


pean enrichers, there is little or no immediate economic imperative for building more.

China, however, sees things differently. It currently has enough capacity to fuel a dozen large reactors and is building more than enough centrifuges to fuel 58 gigawatts of nuclear capacity, optimistically projected to be online by 2020. Some of this projected capacity may be set aside for possible reactor exports beyond those China is making to Pakistan. Yet, again, given the foreign enrichment services glut, none of this enrichment expansion makes much economic sense. What is all too clear, however, is just how much of a military option this enrichment capacity affords. By 2020, China’s planned enrichment capacity could fuel all of its planned civilian reactors and still produce additional material sufficient for more than 1,500 nuclear weapons a year.


129. These estimates assume China would employ the advanced nuclear weapons designs it has clearly mastered and that, as such, only 12 kilograms of highly-enriched uranium would be needed per Chinese weapon. See note 81. On China’s projected enrichment capability and plans, see Hui Zhang, Assessing China’s Uranium Enrichment Capacity, Paper, Institute for Nuclear Materials Management 57th Annual Meeting, July 24-28, 2016, Atlanta, Georgia, USA, available at http://belfercenter.ksg.harvard.edu/publication/26984/assessing_chinas_uranium_enrichment_capacity.html?breadcrumb=%2Fexperts%2F13%2Fhui_zhang and World Nuclear Association, “Uranium Enrichment.” For 2020, Zhang forecasts 13.5 million SWU per year.
Japan’s enrichment plans differ only in scale. Like China, it too lacks economic, domestic sources of high-grade uranium ore. As for Tokyo’s current enrichment capacity, it can fuel about eight reactors a year. If Japan used all of this enrichment capacity for military purposes, it could make roughly 4,500 kilograms of weapons-grade uranium annually—enough to make at least 200 first-generation nuclear weapons. Japan plans to upgrade its uranium enrichment centrifuges. The question, in light of the global surplus of commercial uranium enrichment capacity, though, is why (see Figure 13):

![Figure 13. Current and Projected East Asian Uranium Enrichment Capacities.](image)


131. For the number of SWU to make 1 kg HEU or refuel 1-GWe reactor, see
As noted, none of these Japanese nuclear fuel making activities and plans sit well with China or South Korea. Seoul, in a not so well-disguised security hedge, began to press Washington in 2009 for permission to separate “peaceful” plutonium from U.S.-origin spent fuel and to enrich U.S.-origin uranium in Korea.

These requests coincided with several other South Korean security-related demands. The first came after North Korea’s sinking of the Cheonan and the bombardment of Yeonpyeong Island. South Korean parliamentarians asked the United States to redeploy U.S. tactical nuclear weapons on Korean soil. Washington refused. Then, Seoul pushed Washington to extend the range of its nuclear-capable missiles from 300 kilometers to 800 and practically be


freed from range limits on its cruise missile and space satellite launchers. Washington relented. As for South Korea’s nuclear demands, Seoul is likely to continue to press its case.

The question is what’s next? Will Japan start Rokkasho as planned in 2021? What commercial nuclear fuel making activities, if any, might Washington allow South Korea and China to engage in? Will North


134. After more than five years of negotiations, the U.S. and South Korea finally agreed to a nuclear cooperative agreement in June 2015. This agreement initially prevents South Korea from reprocessing or enriching U.S.-origin nuclear materials. The agreement, however, also creates a consultative process that would allow South Korea to change this. There is good reason to believe that South Korea will continue to press its case for such a change. Most recently, President Moon Jae-in pressed President Trump about Seoul’s desire to develop nuclear submarines that would require enriched uranium fuel. On these points, see “Moon Gets US to Agree in Principle to Let South Korea Build Nuclear Subs: Report,” Asia Unhedged, September 20, 2017, available at http://www.atimes.com/article/moon-gets-us-agree-principle-let-south-korea-build-nuclearsubs-report/amp/ and James E. Platte, “Next Steps for U.S.-South Korea Civil Nuclear Cooperation,” Asia Pacific Bulletin, July 1, 2015, available at http://www.eastwestcenter.org/system/tdf/private/apb316_0.pdf?file=1&type=node&id=35218 and Soo Kim, Proliferation Fallout from the Iran Deal: The South Korean Case Study, Washington, DC: FDD Press, October 2015, available at http://www.defenddemocracy.org/content/uploads/documents/Proliferation_Fallout_South_Korea.pdf.

Korea or China continue to engage in provocations that will increase Japanese or South Korean demands for more strategic military independence from their American security alliance partner?

The two popular rejoinders to these questions are that there is no reason to worry. Most experts insist that neither Japan nor South Korea would ever acquire nuclear weapons. The reasons, they argue, are simple. It would not only undermine the nuclear non-proliferation regime that they have sworn to uphold and strengthen, it would risk their continued security ties with their most important ally, the United States.

Perhaps, but when South Korea first doubted its American security guarantees in the 1970s, it tried to get nuclear weapons. Those doubts continue today as North Korea builds up its nuclear and nonnuclear forces against the South. On May 29, 2014, South Korea’s president noted that if North Korea tested another nuclear weapon, it would make it difficult “to prevent a nuclear domino from occurring in this area”—a clear warning not only to North Korea, but the United States and China, that if they fail to prevent Pyongyang from further perfecting its nuclear force, Japan and South Korea might well acquire nuclear weapons of their own.


After Pyongyang conducted its fourth nuclear test, on January 6, 2016, South Korean and Japanese politicians commented on the legality and desirability of developing nuclear weapons options. They repeated these points when Pyongyang tested its fifth device later in 2016.

Yet another optimistic view argues that it may actually be in Washington’s interest to let Japan and South Korea go nuclear. Letting them arm might actually tighten America’s relations with these key allies while reducing what the United States would otherwise have to spend on their protection. Implicit to this argument is the hope neither Seoul nor Tokyo would feel compelled to acquire many weapons—i.e., that like the UK, they would eagerly integrate their modest nuclear forces with that of America’s larger force, share their target lists with Washington, and that Washington would do likewise with them (as Washington already has with London).

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140. For example after the fifth nuclear test, Rep. Won Yoo-chul from the ruling Saenuri Party said “We need to take steps to be armed with our own nuke not only to protect ourselves, but to preserve peace.” See “Lawmakers call for nukes following N. Korea’s 5th nuclear test,” Yonhap News, September 9, 2016, available at http://english.yonhapnews.co.kr/northkorea/2016/09/09/0401000000AEN20160909008151315.html.

Again, this is plausible. But it is worth noting that neither Japan nor South Korea are the UK. Early on, the UK understood its nuclear weapons efforts would ultimately be subordinate to and in the service of maintaining its “special relationship” with Washington (and scaled down its nuclear efforts accordingly). With the Japanese and South Koreans, though, their nuclear efforts would unavoidably be seen as a vote of no confidence in Washington’s nuclear security guarantees. As such, these efforts would have to deal with demands by nationalists eager to build a truly independent nuclear force of much more ambitious dimensions. More important (and more likely), even if Japanese and South Korean officials wanted to keep their forces subordinate to those of the United States, they might still be driven to acquire larger nuclear forces of their own to deal with the likely military reactions of China, North Korea, and other nuclear states.


143. See note 135.
Consider the action-reaction dynamic of Seoul or Tokyo going nuclear might set into motion with Beijing and Pyongyang. Presumably, in all cases (China included), each state would try to protect its strategic forces against possible attacks by building more passive and active defenses (hardening, mobility, tunneling, missile defense systems, etc.). They also would focus on building up their offensive forces (both nuclear and nonnuclear) so they might eliminate as much of each other’s strategic forces at sea and on land as soon as any war began (this to limit the damage they would otherwise suffer). Finally, they would increase the number of nuclear weapons assets, missile portals, and other strategic aim points to prevent any of their adversaries from thinking they could easily “knock out” their retaliatory forces. This, roughly, is what unfolded during the Cold War rivalry between Washington and the Soviet Union: As was the case for Russia and the United States then, maintaining one’s relative nuclear position today could easily drive East Asian nuclear weapons requirements well beyond scores or even hundreds of weapons.¹⁴⁴

Potentially catalyzing this rivalry further are the actions China’s immediate nuclear neighbors might take. As has already been

¹⁴⁴ At the height of the Cold War, the United States had over 31,000 nuclear weapons; the Soviets 40,000 (see note 26). Some senior military planners, however, considered even these high numbers to be insufficient. For example, in a recently declassified official Department of Defense history, it was revealed that the U.S. Army alone in 1956 had a requirement for 151,000 nuclear weapons. This suggests how nuclear warhead requirements might trend upward in an unconstrained East Asian nuclear weapons competition. See Office of the Assistant to the Secretary of Defense (Atomic Energy), History of the Custody and Deployment of Nuclear Weapons: July 1945 through September 1977, Washington, DC: U.S. Department of Defense, February 1978, p. 50, available at http://www.dod.gov/pubs/foi/Reading_Room/NCB/306.pdf. For a more detailed discussion of the demanding requirements for any state contemplating tactical weapons deployments today of the sort South Korea or China might choose to pursue, see Jeffrey D. McCausland, “Pakistan’s Nuclear Weapons: Operational Myths and Realities,” Stimson Center Analysis, March 10, 2015, available at http://www.stimson.org/summaries/pakistans-tactical-nuclear-weapons-operational-myths-and-realities/.
noted, the Russians are unlikely to reduce their nuclear weapons deployments if the Chinese increase theirs. As for India, it already has roughly 100 nuclear weapons and many hundreds of bombs’ worth of separated reactor-grade plutonium it claims it can fashion into nuclear weapons. It is hedging its nuclear bets even further with plans to build six unsafeguarded plutonium-producing breeder reactors by 2030 and an enrichment plant that may double its production of weapons-grade uranium.¹⁴⁵ Late in 2011, India announced it was working with Russia to develop a terminally guided ICBM in response to Chinese medium-range ballistic missile deployments near India’s borders.¹⁴⁶ New Delhi has also pushed the development of a nuclear submarine force, submarine-launched ballistic missiles (SLBM), missile


defenses, long-range cruise missiles, and improved strategic command and control and intelligence systems. India is not yet competing with China weapon-for-weapon. But if China were to increase its nuclear weapons deployments significantly, Indian leaders might argue that they had no other choice but to increase their own nuclear holdings.

This then brings us back to Pakistan. It has done all it can to keep up with India militarily. Since Islamabad is already producing as much plutonium and highly-enriched uranium as it can, it would likely seek further technical assistance from China and financial help from its close ally, Saudi Arabia. Islamabad may do this to hedge against India, whether China or India build their nuclear arms up or not. There is also good reason to believe that Saudi Arabia may want to cooperate on nuclear weapons-related activities with Pakistan to help Saudi Arabia hedge against Iran’s growing nuclear weapons capabilities. It is unclear if either China or Pakistan would actually transfer nuclear weapons directly to Saudi Arabia or choose instead to merely transfer sensitive weapons-related technologies. They might do both.\textsuperscript{147}

In this regard, Saudi Arabia has made it known that it intends to build up its “peaceful” nuclear energy production capabilities and that it will not forswear its “right” to enrich uranium or to reprocess plutonium.\textsuperscript{148} The reactors Saudi Arabia might build also could serve as the basis for developing a nuclear weapons option. As Saudi Arabia’s former head of intelligence told NATO ministers, the kingdom would have to get nuclear weapons if Iran did.\textsuperscript{149} Further underscoring this point, during a March 2018 visit to Washington Saudi Crown Prince Mohammed bin Salman stated that if Iran acquires a nuclear weapon, Saudi Arabia would do so as well “as soon as possible.”\textsuperscript{150}

Saudi Arabia is not the only Muslim state to be pursuing a nuclear future. Turkey also announced an ambitious “peaceful” atomic power program shortly after Iran’s nuclear enrichment efforts were revealed in 2002 and expressed an interest in 2008 in enriching its


\textsuperscript{148} On why the United States should not sign any civilian nuclear cooperative agreement with Saudi Arabia that allowed uranium enrichment or plutonium reprocessing, see Victor Gilinsky and Henry Sokolski, “Don’t Give Saudi Arabia an Easy Path to Nukes,” Foreign Policy, March 1, 2018, available at http://foreignpolicy.com/2018/03/01/dont-give-saudi-arabia-an-easy-path-to-nukes/.


own uranium. Given Turkish qualms about Iran acquiring nuclear weapons, the possibility of Ankara developing a nuclear weapons option (as it previously toyed with doing in the late 1970s) must be taken seriously. In addition, Algeria and Egypt (political rivals) and Syria (a historical ally of Iran) all have either attempted to develop nuclear weapons options or refused to forswear making nuclear fuel, a process that can bring states within weeks of acquiring a bomb. Algeria now has enough plutonium and the skills to separate it from spent fuel to make several bombs’ worth. Egypt, which has long complained about Israeli nuclear weapons and previously attempted to get nuclear weapons, just announced its intention to tender bids for its first, large power reactor. Israel, meanwhile, continues to

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make nuclear weapons materials at Dimona, and all of these states have nuclear-capable missile systems (see Figure 14):

![Figure 14. States Planning to Have Their First Nuclear Power Reactor by or before 2035.](image)

*Note: States in beige already have established nuclear power programs.*

Very little of this rhymes with the world a half century ago. In the early 1960s, the only countries with civilian nuclear power reactors were the United States, the UK, and Russia. The number now is 31 states. Most of these are in Eastern and Western Europe but, as the map above makes clear, other states in far less stable regions are hoping to bring their first nuclear power plants online before 2035.

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This trend, particularly in the Far and Middle East, has strategic implications.\(^{156}\)

As already noted, each of these plants—even the most proliferation-resistant light water reactor types—can be regarded as a “nuclear bomb starter kit.” Although the nuclear industry has consistently promoted the mistaken idea that the plutonium power reactors produce is unsuitable to make bombs, these reactors can be operated not only to produce large amounts of reactor-grade plutonium that can be made into bombs, but of weapons-grade and near-weapons-grade plutonium as well.\(^{157}\) In fact, in their first 12-18 months of normal power production operation, these reactors can produce roughly 50 bombs’ worth of near-weapons-grade plutonium. If refueled every 10 months, they can produce roughly 30 bombs’ worth of weapons-grade plutonium.\(^{158}\) Also, the plants can and have been


\(^{158}\) Lawrence Livermore National Laboratory and Stanford University’s Center for International Security and Cooperation determined that a standard one-
used as covers to acquire weapons related technology, hardware and training. Finally, the massive amounts of low-enriched fresh fuel stored at these reactors for safety reasons can afford a source of enriched uranium to jump start a uranium enrichment weapons option. That’s why efforts are made to control the export of these plants and to have them routinely inspected to guard against military diversions.


160. See Gilinsky, et al., A Fresh Examination of the Proliferation Dangers of Light Water Reactors.

As for declared nuclear fuel making plants—uranium hexafluoride and enrichment facilities, plutonium separation and fuel fabrication plants, etc.—there is a deeper problem that relates to the limits of International Atomic Energy Agency (IAEA) safeguards themselves. Even under ideal circumstances, the agency allows that with commercial-sized plants, it can lose track of special nuclear material. The margins of statistical error associated with the inspection of these plants are egregiously large. Consider the reprocessing plant Japan wants to operate at Rokkasho. In this case, the IAEA can be expected to lose track of roughly 250 kilograms (i.e., roughly 50 first-generation bombs’ worth) a year. Another way to put this is that nearly 50 bombs’ worth of weapons-usable plutonium could possibly go missing from Rokkasho without setting off any international inspection alarms. In addition, enrichment and reprocessing plants and the separated plutonium and enriched uranium they produce can be diverted to make nuclear weapons in a matter of days or weeks —far more quickly than the international community can intervene to prevent bombs from being made.162

Will the world be able to cope with the further spread of such “peaceful” nuclear facilities? Given the additional noted missile, fissile, and weapons trends, what, if anything, can be done to avoid their military diversions or worse—more widespread nuclear weapons competitions and, far worse, a possible accidental or intentional use of nuclear weapons?