China's Nuclear Weapons and Fissile Materials Holdings:

Uncertainties and Concerns

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Mr. Chairman, members of the commission, I want to thank you for allowing me to testify before you today on the question of what China's nuclear weapons materials holdings and production might be and what their security implications might be.

Some of What We Know

As is noted in the most definitive current, public assessments of Chinese fissile materials assets and production capabilities, 2010 *Global Fissile Material Report*, there is little official information about China's nuclear arsenal. One can speculate but, as this analysis explains,

> Without knowledge of the operating history and power of China's plutonium-production reactors and the capacities of its uranium enrichment plants, any estimates of China's fissile material stocks will necessarily have great uncertainties.[1]

China, unfortunately, keeps nearly all information about its stocks of fissile materials and nuclear weapons secret. Unlike the other four other permanent members of the United Nations Security Council, China has made no declaration of how much fissile material it has in excess of its military requirements or announced whether or not it has ceased production of weapons plutonium or uranium.

Regarding current production of enriched uranium, China is known to operate several relatively new Russian-designed uranium centrifuge enrichment plants and an indigenous centrifuge plant that are believed together to be capable of producing roughly 2 million separate work units (SWUs) per year.[2] The International Panel on Fissile Materials offers a conservative estimate that China has 16 tons of weapons grade uranium (plus or minus 4 tons) – enough to make between roughly 1,000 (crude first-generation design) and 3,000 (advanced design) nominal 20-kiloton explosive devices.[3]

As for plutonium, it is unclear to what extent, if any, China has dismantled its existing military plutonium production plants but it is believed to have shut them down. Precisely when they were shut down and precisely how much plutonium they produced is not known. The most definitive, public estimates of how much plutonium China has produced presume that the plants in question, which have not been visited, are "like" ones that China built underground for reserve production and has recently put on public display.[4]

As a result, estimates of how much separated plutonium China has on hand are hardly hard and fast. If one assumes even the most conservative estimates made in the International Fissile Material Panel report of 2011 (i.e., 1.8 tons), though, China could build an arsenal of as many as 450 crude plutonium devices and roughly twice as many advanced designed plutonium warheads.[5]

As for electrical power plutonium activities, China currently has a pilot reprocessing plant that can separate plutonium from spent fuel and is planning on having AREVA build it a much larger plant capable of separating nearly 1,000 crude bombs' worth of

plutonium annually. China wants to site this reprocessing plant adjacent to a major nuclear military production facility at Jiayuguan.

Some of What We Don't

Just from this brief discussion, it is easy to see how difficult pinpointing precisely how many nuclear warheads China has, how many it might build with the non-militarized nuclear materials it has on hand, and how many it might be able to build in the future. To cope with these difficulties, the most popular estimates, which cluster close to 200 deployed nuclear weapons, depend heavily on how many nuclear missiles China has deployed. A single, large, thermonuclear warhead is assumed for each observed long-range nuclear missile. A few gravity bombs for bomber delivery are added along with a handful of spares.

Much is presumed here. Among the assumptions are that there are no missile reloads for any of growing number of Chinese mobile missile launchers, that most of the growing number of long-range Chinese cruise missiles are solely conventional, that there are no Chinese tactical nuclear weapons, and that the Chinese have fielded mostly or entirely large, thermonuclear warheads that use large amounts of fissile material rather than smaller, less fissile consumptive designs.

All of these assumptions may or may not be warranted. At a minimum, we risk confusing ourselves by emphasizing only the most optimistic assumptions. Recently, one of the nation's leading experts on Chinese nuclear forces knocked down concerns that China might have 3,000 deployed warheads. He explained, in some detail, why theoretically the Chinese could have no more than 1,660 nuclear weapons, i.e., roughly the number of warheads the U.S. currently has deployed. His analysis, of course, was intended to reassure. Yet, it is difficult to see how such a wide range of uncertainly could do anything but rattle.[6]

What to Worry

As the U.S. and Russia try to reduce or contain their nuclear weapons deployments, most other nuclear weapons states (France, UK, Israel, Pakistan, India, North Korea) would require at least one to three decades of continuous, flat-out military nuclear production to catch up even to U.S. and Russian reduced nuclear weapons numbers. It is quite clear, moreover, that none of the listed states have yet set out to meet or exceed the U.S. or Russian nuclear weapons deployments as a national goal.

China, however, is a different matter. It clearly sees the U.S. as a key military competitor in the Western Pacific and in North East Asia. It also has had border disputes with India and historically has been at odds militarily with both it and Russia. China has actively been modernizing its nuclear-capable missiles to target key U.S. and Indian military air and sea-bases with advanced conventional munitions and is developing similar 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 an emerging anti-satellite capability.[7]

Would China want to ramp up its nuclear weapons capabilities? We don't know.

In its official military white papers since 2006 and in other forums, Chinese officials insist that Beijing would never be the first state to use nuclear weapons and would never threaten to use them against any nonnuclear weapons state. China also supports a doctrine that calls for a nuclear retaliatory response that is no more than what is "minimally" required and to use nuclear weapons only for its defense.[8]

Most Western Chinese security experts have interpreted these statements to mean Beijing is only interested in holding a handful of opponents' cities at risk, which, in turn, has encouraged interpreting uncertainties regarding Chinese nuclear warhead deployments toward the low end.

What China's actual nuclear use policies might be, though, is open to debate. As one analyst recently quipped, with America's first use of nuclear weapons against Japan in 1945, it is literally impossible for any country other than the U.S. 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 to use nuclear weapons against this island "province." Finally, 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 the U.S. would not being willing to risk Los Angeles to save Taipei).[9]

It is fair to note that how willing China is to use its nuclear weapons is more important than how many nuclear weapons it may have. Yet, a country's willingness to risk or engage in nuclear conflict may well turn on calculations of how many targets it might be able to destroy in a nuclear first strike and how many of its nuclear systems might survive after an adversary has attempted to strike back. In these matters, quantity, to paraphrase Stalin, may have a quality all of its own.

Does China only have 200 or so nuclear weapons? Perhaps. But if nuclear-capable missile deployments is the current driver of how many nuclear weapons China has deployed, perhaps not. The Chinese, after all, claim that they have built 3,000 miles of tunnels to hide China's missile forces and related warheads and that it continues to build such tunnels.[10] If we can't see all of the nuclear-capable missiles China might have, there's a chance it may have more than we currently assume. If, in turn, the number of such missiles is a major driver of Chinese nuclear warhead deployments, the later number could be much higher than most assume.

How much larger? We don't know. It is in our interest, however, to find out.

Indeed, the first issue such uncertainty raises is how sound current U.S. and Russian nuclear modernization and missile defense plans are. It hardly would be in Washington's or Moscow's interest to let Beijing believe it could risk using Chinese conventional forces (including China's growing fleet of conventional missiles) against Taiwanese, Japanese, American, Indian, or Russian targets because China's nuclear forces could out deter Russian or American nuclear forces.

Another question a large Chinese nuclear strategic force would raise is how it might impact Washington's and Moscow's current strategic arms negotiations. How

eager would the U.S. and Russia be to make much deeper nuclear weapons cuts if they thought China might, as a result, end up possessing more deployed weapons than either Washington or Moscow? Appendix I (below) suggests why this might be a worry. If so, wouldn't we have to factor China into our arms control calculations?

Finally, there is the question of how China's nuclear arsenal and potential ramp up capabilities might impact the nuclear activities of states besides the U.S. and Russia.

Interested Parties

Japan would certainly be one neighbor to watch. It already has nearly 2,500 weapons worth of separated plutonium on its soil that it was supposed to use to fuel its light water reactors and fast reactors. Now, however, Japan has decided not to build more nuclear power reactors domestically. It also is reviewing the merits of continuing its fast reactor efforts, a program that is technically premised on Japan expanding its current domestic fleet of light water reactors.

A related and immediate operational question is whether or not Japan will bring a $20 billion civilian nuclear spent fuel reprocessing plant capable of producing 1,000 bombs worth of plutonium a year at Rokkasho on-line as planned in late 2012. This plant and Japan's plutonium recycling program can be tied to internal Japanese considerations in the late 1970s and early 1980s for 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 over its lifetime.[11]

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 nuclear weapons arsenal. What, then, would one have to make of a Japanese decision to open Rokkasho if this decision came on the heels of news that China actually had many more nuclear weapons than was previously believed?

South Korea, which has attempted to get its own nuclear weapons at least once, and is asking the U.S. to back Seoul's efforts to separate "peaceful" plutonium from U.S.-origin spent fuel in Korea, is sure to be watching what Japan decides. After North Korea's sinking of the Cheonan and the bombardment of Yeonpyeong Island, South Korean parliamentarians called for a possible redeployment of U.S. tactical nuclear weapons. Washington, however, rejected this request.[12] This raises the worry that Seoul might again consider developing a nuclear weapons option of its own. South Korea already has its own nuclear-capable rockets and cruise missiles. How North Korea might react to South Korea developing a nuclear weapons option is anyone's guess.

In addition to Japan and South Korea possibly reacting negatively to news of a Chinese nuclear ramp up, there is India. It already has hedged its nuclear bets with plans to build five unsafeguarded plutonium-producing breeder reactors by 2020 and by laying the foundations of an enrichment plant that may double its production of weapons-grade uranium.[13] It too has roughly 1,000 bombs worth of separated plutonium it claims it can convert into nuclear weapons. It also has pushed development of a nuclear submarine, submarine launched ballistic missiles, missile defenses, and long-range cruise missiles. Late in 2011, it announced it was working with Russia to develop a terminally guided intercontinental ballistic missile in order to off-balance Chinese medium range ballistic

missile deployments near India's borders.[14] India has never tried to compete with China weapon-for-weapon but if Chinese nuclear warhead numbers were to rise substantially, India might have no other choice but to try.

Pakistan, of course, will do its best to keep up with India. 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 might want to cooperate on nuclear weapons related activities with Pakistan to help Saudi Arabia hedge against Iran's growing nuclear weapons capabilities.

What to Do

Clarify What Offensive Strategic Military Capabilities China Has or Will Have

In the first instance, this means clarifying precisely what strategic nuclear forces China has deployed and is building. Beijing's recent revelations that it has built 3,000 miles of deep tunnels to protect and hide its dual-capable missiles and related nuclear warhead systems more than suggests the need to review our current estimates of Chinese nuclear-capable missile and nuclear weapons holdings.

It also would be useful to know what China is planning to do to expand its existing nuclear forces. How much military fissile material does China currently have on hand? How likely is it that it has or will militarize or expand these holdings? How many missile reloads does China currently have and is planning to acquire? Have or will the Chinese develop multiple warheads for its missiles? If so, for which missile types and in what numbers? How many nuclear and advanced conventional warheads is China deploying on its missiles, bombers, submarines and artillery? What are its plans for using these forces? How might these plans relate to China's emerging space, missile defense, and anti-satellite capabilities and its conventional long-range missile force? All of these questions and more deserve review unilaterally, in classified and unclassified annual assessments, with our allies and, to the extent possible, in cooperation with the Chinese.

Game the Future

In addition, it would be useful to game alternative war and military crises scenarios relating to China's possible use of these forces at senior political levels within the U.S. and allied governments. Such gaming would likely impact allied arms control and U.S. and allied military planning. With regard to the later, a key focus would have to be on how one might defend, deter, and limit the damage Chinese nuclear and nonnuclear missile systems would otherwise inflict against the U.S., its bases in the Western Pacific, America's friends and Russia. This could entail not only the further development and deployment of active missile defenses, but of better passive defenses (e.g., base hardening and improving the capacity to restore operations at bases after attacks) and possibly new offensive forces (e.g., more capable, long-range conventional strike systems) to help neutralize possible offensive Chinese operations.

Such gaming also should prompt a review of our current arms control agenda. In specific, it should encourage discussion of the merits of initiating talks with China and Russia and other states about limiting ground-based, dual-capable ballistic and cruise missiles. Unlike air and sea-based missiles, these ground-launched systems can be fired instantaneously and are easiest to command and control in protracted nuclear exchanges – ideal properties for employment in a first strike. These dual-capable missiles also can inflict strategic harm against major bases and naval operations conventionally.

Explore 'Nuclear Missile' Controls

Ronald Reagan referred to these weapons as "nuclear missiles" and looked forward to their eventual elimination. Toward this end, he concluded the Intermediate Nuclear Forces (INF) Treaty agreement, which eliminated an entire class of ground-based nuclear-capable missiles, and negotiated the Missile Technology Control Regime (MTCR), which was designed to block the further proliferation of nuclear-capable systems (i.e., missiles capable of lifting 500 kilograms or more at least 300 kilometers). With the promotion of space-based missile defenses, he hoped to eliminate all such ground-based missiles.

What states have an incentive to eliminate these missiles? The U.S. has no intermediate ground-launched missiles. It eliminated them under the INF Treaty. Most of our shorter range missiles are either air-launched or below MTCR range-payload limits. As for our ground-based ICBMs, they are all based in fixed silos and as such are vulnerable to being knocked out in a first strike. Russia, on the other hand, has a large, road-mobile ICBM force. Yet, Moscow too is worried about growing Chinese precision missile strike capabilities that it cannot defend against.[15]

India and Pakistan have ground-launched ballistic missiles but some of their most seasoned military experts have recently called for the elimination of short-range missiles since these can only serve to escalate border disputes. As for China, it has much to gain by deploying more ground-launched missiles unless, of course, it causes India, Russia, and the U.S. to react. The U.S. has been developing hypersonic boost glide systems that could provide it with prompt global strike options. It also has hundreds of silo-based ICBMs that it could affordably convert to deliver conventional warheads precisely. None of this would be in China's interest. Talks about reducing such nuclear-capable ground launched missiles, should be explored.[16]

Encourage China and Its Neighbors to Forswear Making HEU or Plutonium

Finally, although it may not be possible to conclude a fissile material cutoff treaty, all of the other nuclear weapons state members of the United Nations Security Council should press China to follow their lead in unilaterally forswearing making fissile material usable for weapons (i.e., recycling plutonium and making highly enriched uranium or HEU). In this regard, it would be helpful to call for a limited moratorium on commercial reprocessing with China and as many other states as possible. The U.S. Blue Ribbon Panel on nuclear energy recently determined that it would not be in America's interest to pursue commercial reprocessing in the near or mid-term. Japan, meanwhile, is reviewing its own commercial reprocessing and fast reactor program given its decision to move away from nuclear power. South Korea wants to recycle plutonium but is having

difficulty persuading the U.S. to grant it permission to do so with the many tons of U.S.-origin spent fuel South Korea has.[17]

China is committed to having AREVA build it a commercial reprocessing plant that is nearly identical to the one Japan is now reconsidering opening late next year at Rokkasho. As already noted, these "peaceful," commercial reprocessing plants can produce at least 1,000 bombs worth of nuclear weapons-usable plutonium annually. Still, they are not technically necessary for the operation of nuclear power and are uneconomical compared to using fresh fuel and not recycling it. Promoting a limited plutonium recycling moratorium, in short, would be useful and could garner some support for more general fissile material production restraints.

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1. See International Panel on Fissile Materials, *Global Fissile Material Report 2010: Balancing the Books, Production and Stocks*, pp. 97-98., available at http://fissilematerials.org/library/gfmr10.pdf.

2. See International Panel on Fissile Materials, *Global Fissile Material Report 2011: Nuclear Weapon and Fissile Material Stockpiles and Production*, January 2012, available at http://fissilematerials.org/library/gfmr11.pdf. For reference, it takes roughly 200 separative work units (swus) to produce 1 kilogram of weapons grade highly enriched uranium (HEU) and roughly 20 kilograms of HEU to make a crude nuclear weapon. A crude nuclear weapon is defined as a first generation device like that used in the Second World War. The Hiroshima bomb used 29 kilograms of HEU and the Nagasaki bomb used 6 kilograms of plutonium. Today, a first generation bomb is assumed to require a bit less HEU (20 kilograms) and plutonium (4 kilograms). An advanced weapons design would reduce the amounts of fissile required to produce a given yield by between a factor of two and a factor of three. On these points, see Thomas B. Cochran, "The Problem of Nuclear Energy Proliferation," in Patrick L. Clawson, editor, *Energy and National Security in the 21st Century,* (Washington DC: National Defense University Press, 1995), pp. 96-99.

3. The approximate fissile material requirements for crude and advanced design highly enriched uranium nominal 20 kiloton nuclear weapons -- 16 and 5 kilograms -- is taken from Cochran, "The Problem of Nuclear Energy Proliferation," p. 98 cited above in note 2.

4. See *Global Fissile Material Report 2010*, pp. 20-21.

5. *Global Fissile Material Report 2011*, p. 18. As detailed in note 122, this estimate is for a plutonium bomb requiring between 4-5 kilograms of separated plutonium, i.e., a crude weapons worth. An advanced weapon design plutonium weapon might use half as much or less. See note 2 below.

6. See Hans Kristensen, "No, China Does Not Have 3,000 Nuclear Weapons," *FAS Strategic Security Blog*, December 3, 2011, available at http://www.fas.org/blog/ssp/2011/12/chinanukes.php.

7. See Ian Easton, "The Asia-Pacific's Emerging Missile Defense and Military Space Competition," January 3, 2001, available from *www.npolicy.org/article_file/The_Asia-Pacifics_Emerging_Missile_Defense_and_Military_Space_Competition_280111_1143.pdf*.

8. On China's no first-use policies see China's 2008 White Paper, "China's National Defense in 2008" available from *www.fas.org/programs/ssp/nukes/2008DefenseWhitePaper_Jan2009.pdf*; also see analysis of this paper by Hans M. Kristensen, "China Defense White Paper Describes Nuclear Escalation," *FAS Strategic Security Blog*, January 23, 2009, available from *www.fas.org/blog/ssp/2009/01/chinapaper.php*; and M. Taylor Fravel and Evan S. Medeiros, "China's Sear for Assured Retaliation: The Evolution of Chinese Nuclear Strategy and Force Structure," *International Security*, Fall 2010, available from *www.belfercenter.ksg.harvard.edu/files/Chinas_Search_for_Assured_Retaliation.pdf*.

9. See Jonathan Watts, "Chinese General Warns of Nuclear Risk to US," *The Guardian*, July 15, 2005, available from *www.guardian.co.uk/world/2005/jul/16/china.jonathanwatts*; and Mark Schneider, "The Nuclear Doctrine and Forces of the People's Republic of China," Comparative *Strategy*, Spring 2009, available from *www.tandfonline.com/doi/abs/10.1080/01495930903025276#preview*. Also see an earlier version dated 2007, available from *www.nipp.org/Publication/Downloads/Publication%20Archive%20PDF/China%20nuclear%20final%20pub.pdf*.

10. See "Yamantau," *GlobalSecuirty.org*, available from *www.globalsecurity.org/wmd/world/russia/yamantau.htm*; and "What's Going On in the Yamantau Mountain Complex?" *Viewzone*, available from *www.viewzone.com/yamantau.html*.

11. On these points, see Von Hippel, "Plutonium, Proliferation and Radioactive-Waste Politics"; Henry Sokolski, "The Post-Fukushima Arms Race?" *Foreign Policy Online*, July 29, 2011 available from *www.foreignpolicy.com/articles/2011/07/29/the_post_fukushima_arms_race* ; and Takuya Suzuki, "Nuclear Leverage: Long an Advocate of Nuclear Energy, Nakasone Now Says Japan Should Go Solar," *The Asahi Shimbun*, July 22, 2011, available from *www.asahi.com/english/TKY201107210339.htm*.

12. See Julian Borger, "South Korea Considers Return of US Tactical Nuclear Weapons," *The Guardian*, November 22, 2010 available from *www.guardian.co.uk/world/2010/nov/22/south-korea-us-tactical-weapons-nuclear*; and David Dombey and Christian Oliver, "US Rules Out Nuclear Redeployment in South Korea, Financial Times, March 1, 2011 available from *www.ft.com/cms/s/0/e8a2d456-43b0-11e0-b117-00144feabdc0.html#axzz1oCEG4jBm*.

13. See "India to Commission Breeder Reactor in 2013," *Express Buzz*, February 20, 2012, available from *www.expressbuzz.com/nation/india-to-commission-breeder-reactor-in-2013/365268.html*; and Paul Brannan, "Further Construction Progress of Possible New Military Uranium Enrichment Facility India," *ISIS REPORTS*, October 5, 2011,

available from *www.isis-online.org/isis-reports/detail/further-construction-progress-of-possible-new-military-uranium-enrichment-f/7*.

14. See "Russia to Provide 'Seeker' Tech for Agni-V ICBM," *Pakistan Defense*, October 26, 2011, available from *www.defence.pk/forums/indian-defence/136928-russia-provide-seeker-tech-agni-v-icbm.html*; Air Marshal (retd) B.K. Pandey, "Agni-V to Be Launched By March End," *SP's Aviation.net*, available from *www.spsaviation.net/story_issue.asp?Article=900*; "Why Is This DRDO Official in Moscow?" *TRISHUL*, October 5, 2011, available from *www.trishul-trident.blogspot.com/2011/10/why-is-this-drdo-official-in-moscow.html*.

15. See Jacob Kipp, "Asian Drivers of Russian Nuclear Force Posture" in this volume; and Dr. Mark B. Schneider, "The Nuclear Forces and Doctrine of the Russian Federation and the People's Republic of China," testimony given October 12, 2011 before the House Armed Services Subcommittee on Strategic Forces, available from *www.worldaffairscouncils.org/2011/images/insert/Majority%20Statement%20and%20Testimony.pdf*.

16. For a fuller discussion, see the "Missiles for Peace" chapter by Henry Sokolski in this volume. Also listen to audio of a panel discussion "Missiles for Peace" held at the Carnegie Endowment for International Peace held in Washington, DC, September 13, 2010, available from *www.d2tjk9wifu2pr3.cloudfront.net/2010-09-13-Sokolski.mp3*.

17. See "U.S Unlikely to Allow S. Korea to Reprocess Nuclear Fuel: Diplomat," Yonhap News Agency, March 3, 2012, available from *www.english.yonhapnews.co.kr/northkorea/2012/03/08/23/0401000000AEN20120308007100315F.HTML* ; and Frank Von Hippel, "Plutonium, Proliferation and Radioactive-Waste Politics in East Asia," analysis published on The Nonproliferation Policy Education Center website January 3, 2011, available from *www.npolicy.org/article.php?aid=44&rid=2*; and Takuya Suzuki, "Nuclear Leverage: Long an Advocate of Nuclear Energy, Nakasone Now Says Japan Should Go Solar," *Asahi.com*, July 7, 2011, available from *www.asahi.com/english/TKY201107210339.html*.

APPENDIX I

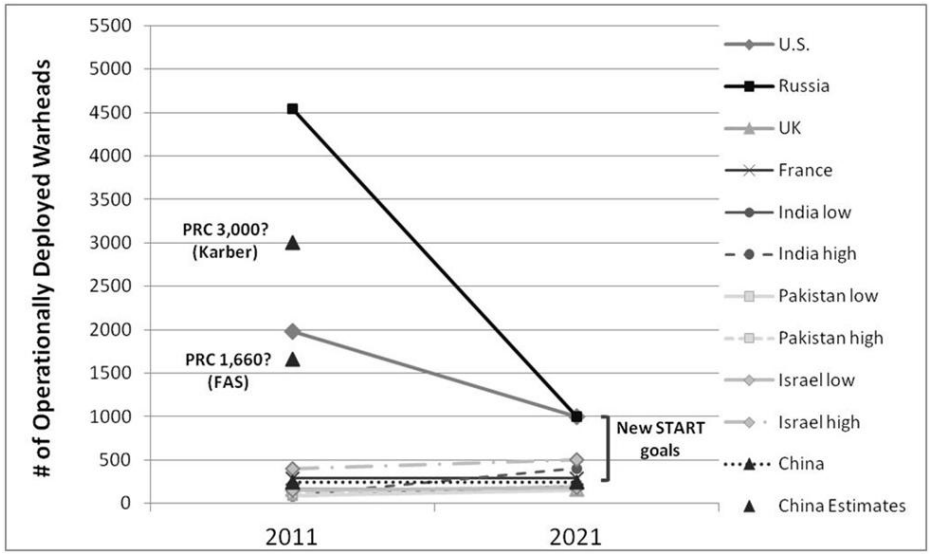

Figure 1: The Next Decade, Nuclear Uncertainties and Competitions

The numbers used to generate this chart came from U.S. Department of State, "New START Treaty Aggregate Numbers" Fact Sheet; Robert S. Norris and Hans M. Kristensen, "US Tactical Nuclear Weapons in Europe, 2011," *The Bulletin of Atomic Scientists* Vol. 67, No. 1, January/February 2011, pp. 64-73, available from www.bos.sagepub.com/content/67/1/64.full; Zia Mian, A.H. Mayyar, R. Rajaraman, and M.V. Ramana, "Fissile Materials in South Asia and the Implications of the U.S.-India Nuclear Deal," in Henry Sokolski, ed., *Pakistan's Nuclear Future: Worries Beyond War,* Carlisle, PA: Strategic Studies Institute, 2008, pp. 167-218; Shannon N. Kile, Vitaly Fedchenko, Bharath Gopalaswamy, and Hans M. Kristensen, "World Nuclear Forces," *SIPRI Yearbook 2011*, available from www.sipri.org/yearbook/2011/07; "Nuclear Weapons: Who has What at a Glance," *Arms Control Association*, available from *www.armscontrol.org/factsheets/Nuclearweaponswhohaswhat*; "Status of World Nuclear Forces," *Federation of American Scientists*, available from www.fas.org/programs/ssp/nukes/nuclearweapons/nukestatus.html;
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