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China's nuclear force structure

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CHINA'S NUCLEAR FORCE STRUCTURE AND MODERNIZATION

Since the country's first nuclear test in 1964, the nuclear policies of the People's Republic of China (PRC) have been strikingly different from those of the superpowers. Despite the superior nuclear firepower of the U.S. and Russia, Beijing has maintained a relatively small arsenal whose role appears to have been exclusively retaliatory. Throughout the Cold War and beyond, China's leadership has also maintained a pledge of absolute no-first-use (NFU) of nuclear weapons, and held its nuclear forces at a low alert level.

At the same time, China's nuclear forces are currently undergoing a major modernization effort. In recent years, there have been some important breakthroughs, leading to the deployment of a new generation of Intercontinental Ballistic Missiles (ICBM) and ballistic missile submarines (SSBN). These developments are followed closely in the Asia-Pacific region and beyond, and are increasingly causing concern among China's neighbors. Some analysts are arguing that China is about to break with its traditional nuclear force posture and initiate a major nuclear build-up, possibly triggering an arms race in the region.

I set out in this paper to analyze China's policy of deterrence and nuclear force modernization. First, I describe China's traditional nuclear posture and the strategic rationale that has guided the development and deployment of its strategic forces. Second, I analyze current modernization efforts, and to what extent they remain in line with China's traditional nuclear stance. Finally, I point to some potential challenges likely to face China's deterrent in the future linked with changes in U.S. nuclear posture and the deployment of missile defense systems. I outline how China has so far chosen to respond to these challenges, and discuss how the country may opt to respond in the future.

THE CHARACTERISTICS OF CHINA'S NUCLEAR ARSENAL

The exact size and specifics of the strategic weapons force of the PRC remain unknown, as China has traditionally been highly secretive about the development and deployment of its nuclear forces. However, it is generally acknowledged that China's nuclear arsenal has remained relatively limited since its first nuclear test in 1964. While estimates differ, most analysts concur that the Chinese nuclear stockpile is currently in the range of 80–200 operationally deployed nuclear warheads. This has not changed significantly in recent years (Lewis 2007, 25; Carnegie Endowment for International Peace 2009; Kile et al. 2010, 353).[1] In contrast, even after significant cuts in the post-Cold War era, the U.S. recently declared that it keeps 5,113 nuclear warheads in its stockpile, as well as "several thousand" retired warheads waiting to be dismantled (Department of Defense 2010). Russia is believed to have more than 11,000 strategic and nonstrategic warheads either in storage, retired, or waiting to be dismantled (Kristensen and Norris 2011).

In addition to being relatively small, the Chinese nuclear force has long remained the most technologically unsophisticated of those of the five recognized nuclear states. It has also arguably been relatively vulnerable, with Western analysts questioning whether China has had a reliable second-strike capability (Lieber and Press 2006, 7–8; Saunders and Yuan 2006, 84). Until recently, the backbone of China's arsenal has been a force of approximately 20 DF-5 ICBMs, the only missiles in the Chinese inventory that could reach the continental United States. The silo-based, liquid-fueled DF-5 has been claimed to be vulnerable to a first nuclear strike or high-precision conventional strike (Fravel and Medeiros 2010, 54; Lewis and Hua 1992, 24–25).[2] The missiles are also believed to be kept un-fueled, off-alert, and with their warheads stored separately, which exacerbates vulnerability by increasing preparation time (Lewis 2007, 1; Norris and Kristensen 2008, 43).

China has continued to rely heavily on land-based systems; the air-based and sea-based components of its nuclear forces have been relatively underdeveloped (Gill, Mulvenon, and Stokes 2002, 536). The Chinese strategic bomber force is believed to be vulnerable, and is not seen as a credible threat to adversaries with modern

CHINESE NUCLEAR FORCES, JANUARY 2010

Type/Chinese designation (NATO designation)	No. deployed	Year first deployed	Range (km)[a]	Warhead loading	No. of warheads
Land-based missiles[b]	134				
DF-3A (CSS-2)	12	1971	3,100[c]	1 x 3.3 Mt	12
DF-4 (CSS-3)	12	1980	5,500	1 x 3.3 Mt	12
DF-5A (CSS-4)	20	1981	13,000	1 x 4–5 Mt	20
DF-21 (CSS-5)	60	1991	2,100[d]	1 x 200–300 kt	60
DF-31 (CSS-10 Mod 1)	~15	2006	>7,200	1 x . .	15
DF-31A (CSS-10 Mod 2)	~15	2007	>11,200	1 x . .	15
SLBMs	(36)				
JL-1 (CSS-N-3)	(12)	1986	>1,770	1 x 200–300 kt	(12)
JL-2 (CSS-NX-14)	(24)	(2010)	>7,200	1 x . .	(24)
Aircraft[e]	>20				
H-6 (B-6)	20	1965	3 100	1 x bomb	(20)
Attack (. .)	..	1972-..	..	1 x bomb	(20)
Cruise missiles	150–350				..
DH-10	150–350	2007	>1500	1 x . .	..[f]
Total					**(~200)**[g]

. . = not available or not applicable; ( ) = uncertain figure; SLBM = submarine-launched ballistic missile.

a Aircraft range is for illustrative purposes only; actual mission range will vary.
b China defines missile ranges as short-range, <1000 km; medium-range, 1000–3000 km; long-range, 3000–8000 km; and intercontinental range, >8000 km.
c The range of the DF-3A may be greater than is normally reported.
d The DF-21A (CSS-5 Mod 2) variant is believed to have a range of up to 2500 km.
e Figures for aircraft are for nuclear-configured versions only.
f The DH-10, which is also known by the Chinese designation CJ-10, may have a nuclear role. It is apparently employable from H-6 bombers and ground-based launchers.
g Additional warheads are thought to be in storage to arm future DF-31, DF-31A and JL-2 missiles. The total stockpile is believed to comprise c. 240–300 warheads.

TABLE 1: Reproduced from SIPRI 2010 yearbook (Kile et.al 2010, 354).

air defense systems. Furthermore, China does not seem to prioritize improving its capabilities in this area (Yuan 2007, 293). While its SSBN force has been under development since 1958, it has encountered numerous technical setbacks and progress has been very slow. Until recently, Beijing possessed only a single Xia-class SSBN, which was launched in 1985. The Xia-class submarine has been fraught with problems, and has supposedly rarely left port and never conducted a deterrent patrol (Kristensen, Norris, and McKinzie 2006, 79; Yuan 2007, 292).

Unlike the U.S. and Russia, China never developed any major inventory of tactical nuclear weapons for war-fighting purposes either. According to some Western analysts, China has no tactical nuclear weapons of any kind, only strategic weapons for retaliatory use (Lewis 2007, 1). Others have argued that the PRC probably maintains an inventory of tactical nuclear warheads for use with fighter-bomber aircraft, and may also have developed nuclear warheads for short-range missiles as well as nuclear land-mines. However, these analysts also point out that this inventory is likely to be relatively small (Kristensen, Norris, and McKinzie 2006, 98).

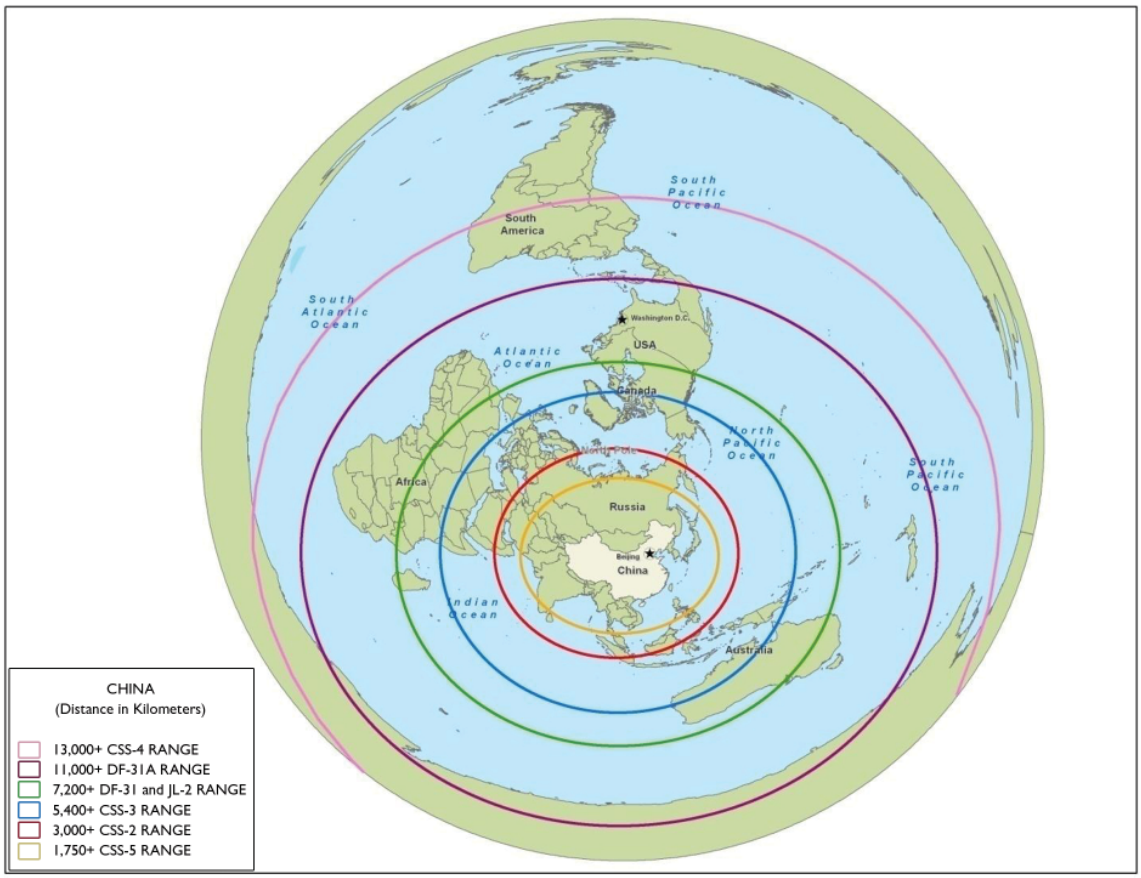

FIGURE 1. Range of China's Medium Range and Intercontinental Ballistic Missiles. US Department of Defense, 2010. *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2010*, 35.

CHINA'S NUCLEAR RATIONALE

What led China to develop this specific nuclear posture? Why has China maintained a small, unsophisticated and relatively vulnerable arsenal, instead of developing a larger, more diverse and more credible nuclear deterrent?

From the outset, the limited size and lack of diversity of China's nuclear forces represented a deliberate choice by the Chinese leadership. While lack of resources may have constrained China during the Maoist age and limited the leadership's options (Goldstein 2000; Hua 1998, 61), the PRC has had the possibility of developing a much larger arsenal, at least since the 1980s (Johnston 1996, 548; Roberts, Manning, and Montaperto 2000, 57).[3] In other words, at least for the past three decades China has chosen to constrain the development of its strategic forces.

The most common explanation offered for this restraint is that China pursues a policy of "minimum deterrence" (Chu and Rong 2008; Huang 2001; Lewis 2007; Roberts, Manning, and Montaperto 2000). This concept has been defined as "threatening the lowest level of damage necessary to prevent attack, with the fewest number of nuclear weapons possible" (Committee on the U.S.-Chinese Glossary of Nuclear Security Terms 2008, 36). With such a strategy, a small number of warheads able to inflict "unacceptable damage" to a handful of enemy urban-industrial centers constitute a credible deterrent (Huang 2001, 40–41).

The Chinese leadership's belief in the sufficiency of a small nuclear force was apparent already in the early periods of China's nuclear program. The Chinese leadership's decision to build nuclear weapons was largely a response to repeated threats of nuclear attack from the U.S. during the 1950s. In order to "frustrate nuclear blackmail" and deter adversaries from launching a nuclear attack on China, the Chinese leadership during the Maoist period held that a limited retaliatory capability would be adequate (Lewis and Xue 1996, 232–233). A large arsenal was not considered necessary, as nuclear weapons were deemed to be psychological and political instruments, rather than weapons for war-fighting (Yuan 2007, 276). The belief in limited military utility of nuclear weapons has endured to this day, and continues to influence China's nuclear policies.

That nuclear weapons were seen mainly as instruments of retaliation helps explain another feature of Chinese nuclear strategy, namely the country's pledge of no-first-use. Immediately after its first nuclear test on October 16, 1964, China declared that it "will never at any time or under any circumstances be the first to use nuclear weapons" (Statement of the Government of the People's Republic of China, October 16, 1964). China has continued to uphold this pledge, and routinely pressed for other states to make similar declarations.

A number of political and economic factors also seem to have contributed to the Chinese policy of nuclear restraint and holding internal voices calling for a more aggressive nuclear posture at bay (Johnston 1996).[4] For the last two decades, building an image as a "responsible major power" and avoiding fear among its neighbors over its rapidly increasing international clout have been central concerns for China's leaders. A major nuclear buildup could unsettle this image and prove damaging politically, and both foreign and Chinese analysts have pointed out that Beijing wants to avoid such costs (Huang 2001, 48; Saunders and Yuan 2006, 103; Zhu 2005, 212). In addition, with economic growth being their overarching priority since the late 1970s, Chinese leaders seem to have been concerned with avoiding excessive spending on nuclear weapons (Gu and Nie 1999, 275). This idea was reinforced in China after the collapse of the Soviet Union, which many Chinese experts attributed partly to bloated military budgets and the arms race with the United States (Shambaugh 2008, 76–77).

CHINA'S NUCLEAR MODERNIZATION

While China's calculus has remained remarkably stable over time, the country is continually modernizing and upgrading its nuclear arsenal. In recent years, these modernization efforts have led to significant improvements in China's nuclear forces. First, with the deployment of the new DF-31 and DF-31A missiles in 2006 and 2007, China obtained a road-mobile, solid-propellant ICBM force able to replace the older silo-based, liquid-fueled systems. The deployment of these new missiles will be important for the reliability and credibility of China's nuclear arsenal, as they are much less vulnerable to conventional and nuclear strikes than older systems. Second, with the launch of the Jin-class SSBN in 2004, China is one step closer to having a credible sea-based deterrent. One submarine is reported to have entered into service, with two more apparently being outfitted. While it is unclear how many new SSBNs China plans to build, the U.S. Department of Defense considers that China "may field up to five new SSBNs" (2010, 3).

The Chinese modernization program is being watched closely by neighboring states and has, unsurprisingly, led to speculations about Beijing's intentions. The recent deployment of new ICBMs and SSBNs has led analysts in the U.S. to believe that China's nuclear rationale is about to change. Some even argue that China is presently conducting a major nuclear buildup and seeking to develop a warfighting capability (Schneider 2009).

That notwithstanding, rather than representing a dramatic shift in China's nuclear calculus, the current modernization of its nuclear force seems to be driven by an ambition to strengthen the credibility of its traditional posture of minimum deterrence. These efforts can be traced back to the 1990s, when Chinese strategists became increasingly concerned with the importance of ensuring a reliable second-strike capability (Interview with arms control expert, Shanghai, May 10, 2010). According to Evan Medeiros, these concerns led many in China to believe the country needed to "move towards a credible and visible minimum deterrent that relies on the mobility, invulnerability, and penetrability of its nuclear forces" (2007, 54).

Several factors support the notion that the purpose of China's nuclear modernization program is to develop a small but secure and survivable nuclear force. First of all, there are so far few signs of any major quantitative expansion of the Chinese arsenal. Nor is it given that the size of the arsenal will increase in the future. According to a study by the Federation of American Scientists, in the next decade the number of deployed nuclear weapons is likely to remain stable while the total megatonnage in the Chinese arsenal could very well *decline*, as China retires older missiles and replaces them with DF-31s and DF-31As that carry smaller warheads (Kristensen, Norris, and McKinzie 2006, 42–46). What is also interesting to note is that China seems to have chosen not to implement Multiple Independently Targetable Re-entry Vehicle (MIRV) technology – whereby each missile is equipped with several warheads – even though it probably has the ability to do this (Kristensen, Norris, and McKinzie 2006, 54). MIRVing its missiles would arguably also have been an indication of willingness to move away from nuclear minimalism. In short, China seems to be stressing survivability rather than quantity and complexity in its nuclear modernization.

Second, China's official declaratory policy has remained largely unchanged. In its most recent government white paper on national defense, China continues to guarantee its adherence to the policy of no-first-use "at any time and in any circumstances", and will continue to refrain from entering into arms races. It has "always exercised the utmost restraint in the development of nuclear weapons" and "will limit its nuclear capabilities to the minimum level required for national security" (Information Office of the State Council of the People's Republic of China 2010). While some dismiss such points as government propaganda, declaratory policies matter inasmuch as they signal intent to other countries and influence and shape the plans of military leaders (Sagan 2009, 177). China's leaders would likely have

introduced certain rhetorical shifts if they had wanted to change the country's nuclear posture dramatically. The lack of such changes further underscores the continuity in China's nuclear calculus.

Third, China is modernizing its delivery vehicles, but does not seem to be developing new warheads. China has signed the Comprehensive Test Ban Treaty, and has not tested nuclear weapons since 1996. For a nuclear weapons state, developing new "nuclear package" concepts such as miniaturized warheads is much more difficult with a test ban in place (Dahlman, Mykkeltveit, and Haak 2009, 15). Lack of previous testing data exacerbates this problem, and of the legally recognized nuclear weapons states, China is the country with the least amount of testing data at its disposal. If Beijing wanted to initiate a major nuclear buildup and break with its minimum deterrence policy, resuming nuclear testing in order to develop new warheads would probably be preferable. So far, however, there are no signs that China is preparing to break with its treaty obligations (Gill 2000; Johnston 1996; National Academy of Sciences 2002; Zou 1998).

In sum, the recent deployment of new ICBMs and SSBNs does mark an important evolution, and will give a significant boost to the credibility of China's nuclear force. However, there are few indications that it represents a radical break with its "minimum deterrence" posture or the initiation of a major nuclear buildup program. In fact, the deployment of the new systems will probably strengthen China's confidence in the sufficiency of a small arsenal. By improving survivability, China can maintain a relatively limited nuclear force with confidence in its deterrence capability. Without such qualitative improvements, China would perhaps have found a larger arsenal to be necessary to ensure its second-strike capability (Li 2001).[5]

FUTURE CHALLENGES TO CHINA'S STRATEGY AND POSTURE

While there are currently few signs of any major changes in China's nuclear rationale, Beijing's nuclear posture is facing a set of increasingly serious challenges. In particular, these challenges stem from recent developments in the nuclear posture and declaratory policy of the U.S., and what some analysts have termed the latter's growing "nuclear primacy" (Lieber and Press 2006). China sees the U.S. as its main potential great power adversary. In the medium to long term, these changes in U.S. posture could produce a strong response in Beijing and lead to changes in China's nuclear policies.

The issue that has sparked the greatest controversy is U.S. missile defense plans. With the Missile Defense Act of 1999, the U.S. Congress made it official policy to deploy such a system "as soon as it is technologically possible" (1999). When George W. Bush took office as president, the funding of the missile defense programs was also substantially increased. In 2002, the U.S. unilaterally withdrew from the Anti-Ballistic Missile Treaty (ABM) to remove the legal obstacles to missile defense deployment, a move that undermined many Chinese experts' belief in U.S. willingness to commit to international arms control (interview with arms control expert, Beijing, June 29, 2010).

Even though Washington has tried to persuade the Chinese on numerous occasions that the missile defense system is not directed against the PRC, the Chinese are not convinced, and have argued that such programs will be "detrimental to international strategic balance and stability" (Information Office of the State Council of the People's Republic of China 2010). Chinese experts have claimed that the missile defense could challenge China's deterrent. For example, Professor Li Bin notes that the U.S. would not dare to launch a first strike against China's small arsenal without missile defenses in place, because it would always have to worry that a few ICBMs could survive and be launched as retaliation. With a missile defense, however, the American public would potentially have "the illusion that the several surviving retaliatory Chinese ICBMs would be intercepted by the [missile defense] system", which could promote nuclear risk-taking from the U.S. (Li 2001). Other Chinese scholars have even argued that the mis-

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Country	Year of first nuclear test	Deployd warheads	Other warheads	Total
United States	1945	2150	6350	~ 8500
Russia	1949	2427	8570	~ 11 000
United Kingdom	1952	160	65	225
France	1960	290	10	~ 300
China	1964	--	200	~ 240
India	1974	--	80-100	80-100
Pakistan	1998	--	90-110	90-110
Israel	--	--	80	80
North Korea	2006	--	--	?
Total		~ 5027	~ 15 500	~ 20 530

TABLE 2: Reproduced from SIPRI 2011 Yearbook (Kile et al. 2011, 320).

sile defense plans are part of a U.S. scheme to trick China into an expensive arms race that will ruin its economy, just as the U.S. did with the Soviet Union (Shi 2000). Few accept the notion that a missile defense system is merely defensive (Urayama 2004, 125).

Nevertheless, the Chinese reaction to U.S. missile defense efforts has been relatively measured so far. According to some analysts in the U.S., this is because China does not have to change its posture significantly in order to overcome a U.S. missile defense system, as the country has had an advanced program developing countermeasures for decades. Furthermore, the current nuclear modernization programs "will be sufficient to overcome threats posed by the most plausible combination of U.S. offensive and defensive strategic systems" (Lewis 2007, 154).[6] Many Chinese experts seem to have reached similar conclusions, believing that time is on China's side, and that an effective missile defense system that could threaten China's deterrent may not even be technologically feasible (Urayama 2004, 124; Li, Zhou, and Liu 2001). These latter conclusions find support in the 2010 Ballistic Missile Defense Review Report, which states clearly that the currently deployed U.S. system of 30 ground-based interceptors (GBI) "does not have the capacity to cope with large scale Russian or Chinese missile attacks, and is not intended to affect the strategic balance with those countries" (Department of Defense 2010, 13). Nor are there any current plans to deploy more GBIs, the report adds.

At the same time, Chinese analysts are still unease at the prospect of unanticipated major technologi-

cal breakthroughs in the future (Li, Zhou, and Liu 2001). While the 2010 Ballistic Missile Defense Review Report points out that those capabilities that have been proven to work will be prioritized, research in more advanced systems continues. U.S. plans to improve the so-called standard missile 3 (SM-3) interceptors may also worry Beijing. At the moment, the SM-3 is only capable of intercepting short and medium range ballistic missiles. However, there are plans to upgrade the missile and deploy it on both sea- and land-based sites. By 2020, the U.S. hopes to field the Block IIB upgrade of the missile, which is supposed to have the capability to intercept ICBMs during early stages of their flights. That the SM-3 is being developed in cooperation with Japan, is hardly comforting to Beijing.

For these reasons, it should not be taken for granted that Beijing will not consider more drastic responses. In fact, the missile defense efforts have arguably already triggered a Chinese reaction, one with a likely negative effect on strategic stability. In 2007, China tested an Anti-Satellite (ASAT) weapon, shooting down an aging weather satellite with a ground-launched ballistic missile. This was met with international condemnation, because of the potential for harmful debris, and because it was seen as an event that could trigger an arms race in space. A large part of the rationale for the test, however, was probably to develop an asymmetric response to the U.S. missile defense system. For a missile defense system with sensors based in space, ASAT weapons constitute a relatively cheap, reliable and effective countermeasure (Hui 2004, 116).

That China will initiate a significant nuclear buildup as a reply to U.S. missile defense plans does not seem likely, but cannot be ruled out. Professor Shen Dingli has noted that China "might expand and MIRV its strategic missile forces to a total number of deployed warheads ten times higher than current levels" (2001). Professor Li Bin, while advocating the development of less politically costly penetration aids placed on missiles as a countermeasure, has argued that "the buildup option is so mathematically simple to understand and so certain to work" and may "easily win some support from non-technical people" (Li 2001; see also Li, Zhou, and Liu 2001). Similarly, Chinese expert Sun Xiangli has argued that while China seeks to maintain a small arsenal, the number is not fixed, as China will need a sufficient number of missiles to penetrate an adversary's missile defenses after a first strike (Sun 2006). Thus, China is probably hedging its bets, and keeping the possibility of a nuclear buildup open.

CONCLUSION

In this paper I have explained why China's nuclear calculus has remained very different from those of the U.S. and Russia. Chinese leaders see nuclear weapons mainly as political artifacts with limited military utility, and have deemed a small strategic force sufficient to deter any adversary. This belief seems to have guided the development and deployment of China's nuclear forces throughout the Cold War and beyond.

Currently, there are few signs of any imminent change in this calculus. Even though China is upgrading and improving its arsenal, and has achieved major breakthroughs in recent years, the motivation for its modernization efforts seems to be to strengthen the credibility and reliability of its small nuclear arsenal. As of now, there are no signs of a major quantitative nuclear buildup. Furthermore, China's declaratory policy remains largely unchanged, and there are no indications that China is planning to resume nuclear testing. In sum, China's nuclear policies are characterized by remarkable continuity.

Nevertheless, I have indicated that China's nuclear posture is facing a set of increasingly serious challenges. Particularly, U.S. missile defense plans have caused worry among Chinese strategists and leaders, as it is seen as a potential threat to China's deterren-

ce capability. While China has not reacted by departing from its minimalist nuclear posture as yet, more drastic responses could follow if the U.S. manages to deploy a large and effective missile defense system.

If U.S. missile defense efforts cause China to launch a major nuclear buildup, it could have serious effect on the strategic balance in Asia. An Indian response to a Chinese buildup is not unlikely, which could again cause Pakistan to react. In addition, the missile defense efforts could have serious repercussions on international arms control. As pointed out, China so far appears to have adopted a "wait and see" attitude toward the missile defense plans. Given this attitude and the perception that a more drastic response could be necessary at some future stage, China is likely to be less willing to agree to arms control measures than it would have been without the missile defense in place.

ENDNOTES

1 Sipri also estimates that China has some 40 warheads in reserve or awaiting dismantlement, making the total stockpile approximately 240 warheads.

2 According to Fravel and Medeiros, as compared to China's other missiles, the DF-5s were "even more vulnerable to a first strike because they were based in fixed silos, and their three-stage propulsion system had particularly extensive and dangerous fueling requirements". Lewis and Hua claim that Chinese nuclear engineers have described the silos of the DF-5s as "missile tombs".

3 In terms of delivery vehicles, Roberts et al. claim that China has the ability build up to a thousand missiles in a decade, including 10-12 ICBMs per year. In 1996, Johnston claimed China had the capability to enlarge its arsenal 2–3 times, as it has sufficient fissile material to produce more warheads, and the ability to produce more delivery vehicles.

4 As Johnston's study shows, not everyone in China has been content with the strategic doctrine of "minimum deterrence" and the reliance on a small arsenal. Since the late 1980s, as China's technological and economic muscles have been growing, a growing number of Chinese nuclear strategists have allegedly argued in favor of moving toward what they term "limited deterrence". A strategic doctrine based on this concept would require "sufficient counterforce and counter-value tactical, theater, and strategic nuclear forces to deter the escalation of conventional or nuclear war." This would further require China to undertake a major nuclear build-up and develop a more diverse nuclear force structure, i.e. better command, control and communications and intelligence (C3I) systems; missile defenses; and anti-satellite weapons. However, so far, voices arguing in favor of a more aggressive Chinese nuclear posture and strategy have not been able to win the support of the central leadership.

5 Chinese expert Li Bin made this point explicitly before the deployment of the DF-31 and the DF-31A. If China develops road-mobile and more survivable ICBMs, Li claimed, it would not need to deploy a large number of missiles to ensure the credibility of its arsenal. However, if it had to rely on older silo-based and more vulnerable missiles, it would perhaps have had to initiate a buildup to be confident in its second-strike capability.

6 While not being a response to missile defense plans, China's deployment of solid-propellant ICBMs and a new SSBN force will boost its confidence in the survivability and penetration capability of its deterrent, and limit concerns that the U.S. could eliminate most of China's strategic force without fear of retaliation.

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