

# The Impact of the U.S. NMD on the Chinese Nuclear Modernization

LI Bin

Institute of Science and Public Affairs  
China Youth College for Political Science

## CHINESE NUCLEAR DETERRENCE

The Chinese decision to build its own nuclear weapons was a response to the nuclear threats posed by the United States (US) [note: John Lewis: *China Builds the Bomb*]. In the 1950s, China perceived constant nuclear threats from the U.S. and felt that the threat could be negated nuclear deterrence. China chose to develop its own nuclear force rather than accepting the Soviet nuclear umbrella because it did not want to lose its sovereignty and independence in the military alliance with the former Soviet Union. In the January of 1955, the Chinese leaders made a decision on the development of atomic bombs to defeat the U.S. nuclear blackmail and nuclear monopoly. [Song Renqiong, "Chairman Mao Guided Us in Creating Our Atomic Energy Industry", in China National Nuclear Corporation edited, "Mao Zedong and The Chinese Atomic Industry, In Memory of Mao Zedong on His 100th Birth Date," Atomic Energy Publishing House, Beijing, December, 1993. Page 33.] The next year, China began to organize research on atomic bombs and missiles carrying them. [Nie Rongzhen, *Nie Rongzhens Memoir, Volume 3*, Liberation Army Publishing House, Beijing, 1984, page 788.] After the Soviet Union tried to constrain China from further developing Chinese nuclear weapons, China became more determined in developing an independent nuclear force. [Liu Jie, *Mao Zedongs Thought on Nuclear Strategy*, page 43.]

The purpose of the Chinese nuclear development is to defend its vital national security by countering possible nuclear blackmail. China worries that the superpowers would feel free in offending China's vital security interest without apprehension if China did not have nuclear weapons. It expects that its nuclear arsenal would discourage the use of nuclear weapons or the threat of using nuclear weapons against China. The Chinese leaders believed that (1) a modest nuclear force would be able to neutralize nuclear blackmail made by the superpowers and deter their nuclear attacks; (2) nuclear weapons are not militarily usable and therefore the Chinese nuclear weapons are not for war-fighting. [see, for example, Mao, page 9, 11, 13. And Liu Jie, page 42. in China National Nuclear Corporation edited, "Mao Zedong and The Chinese Atomic Industry, In Memory of Mao Zedong on His 100th Birth Date," Atomic Energy Publishing House, Beijing, December, 1993] Based on Mao Zedongs nuclear strategic thought, China made a no-first-use commitment immediately after its first nuclear test. In this commitment, China pledges not to be the first to use nuclear weapons. Since then, the no-first-use commitment has become an important part of the Chinese nuclear strategy.

To explore the impact of the U.S. National Missile Defense on the Chinese nuclear deterrent, we need to quantitatively understand how the Chinese nuclear deterrent works now. The difficulty here is that the Chinese government has never explicitly explained how to translate the

Chinese nuclear strategy into quantitative requirements for its nuclear force. So we have to make some education guesses in our analysis on the Chinese nuclear deterrent and all the discussions on the Chinese nuclear deterrence in this paper will be only in the China-U.S. context.

The Chinese nuclear development may be divided into three stages. In the first stage, China had only symbolic nuclear deterrence or existential nuclear deterrence until it acquired the capability of launching Inter-Continental Ballistic Missiles (ICBMs) in 1980 [note]. After that the Chinese nuclear deterrence entered into the second stage in which the deterrence is based on the quantitative ambiguity of its nuclear force. In general, the creditability of the nuclear deterrence of a country depends on its rivals' perception about its nuclear retaliatory capability. It is widely believed that China has about twenty liquid-fuel silo-based ICBMs that can reach the U.S. [note] The two dozens land-based ICBMs that have been detected and located by the U.S. intelligence would have very little chance to survive a U.S. preemptive nuclear strike. Because China has neither confirmed nor denied any outside estimates about the size of its long-range nuclear force, it is difficult for the U.S. to rule out some errors in its estimate. If the U.S. considers to launch a preemptive nuclear strike against China, the Americans would understand that they may not know the exact number of the Chinese ICBMs. They may have some confidence in destroying all the two dozens detected Chinese ICBMs in the preemptive strike, but they would have to worry about a Chinese nuclear retaliation with a few undetected ICBMs. Such worry would discourage and deter the U.S. attempt of nuclear strike against China. So, the two dozens detected Chinese ICBMs do not make direct quantitative contribution to the Chinese nuclear deterrence except playing some roles of "demonstration" in the deterrence. The error or uncertainty of the American estimate about the size of the Chinese long-range nuclear force forms the perceived Chinese retaliatory capability in the U.S. and the scope of the uncertainty or error is directly relevant to the creditability of Chinese deterrence.

To deter a first nuclear strike from the U.S., the Chinese nuclear retaliation must be able to cause an intolerable damage in the U.S. There are different estimations about the minimum number of nuclear warheads needed for causing intolerable damage based on different criteria. [note] The criterion used in this paper is drawn from the history of recent U.S. conventional wars. The U.S. ended two wars without winning them in the last half century: Korea War and Viet Nam War. There were several reasons for the U.S. to withdraw from the two wars. One important and common reason is that the two wars had caused tens of thousands of American casualties. So, I assume that the U.S. would choose other options rather than launching a nuclear strike against China in a crisis if the U.S. understands that the strike would initiate a Chinese nuclear retaliation and that the retaliation can cause more American casualties than the above figures: tens of thousands. A nuclear bomb with a yield of about one megaton TNT equivalent exploded over a big city can certainly cause much more casualties than tens of thousands. So, a Chinese retaliatory strike with a few nuclear warheads should be able to deter first nuclear attacks from the U.S. It seems that the mutual deterrence in the U.S.-China context is stable now if there is no missile defense. This indicates that the American perceived measurement uncertainty about the Chinese long-range nuclear force is not fewer than a couple

ICBMs.

The above discussions show that the nature of the Chinese minimum nuclear deterrence is quite different from that which is widely discussed for other nuclear states. In current stage, the Chinese minimum nuclear deterrence comes from a quantitative ambiguity of its nuclear force. As long as the uncertainty is larger than a few ICBMs, the deterrence is stable. Now, the Chinese nuclear development is going to enter the third stage, in which China will have creditable and visible minimum nuclear deterrence. The Chinese long-range nuclear force would saturate a U.S. preemptive strike, i.e., at least a few Chinese ICBMs or Submarine-Launched Ballistic Missiles (SLBMs) would be able to survive a U.S. preemptive strike and to be used in a retaliation strike no matter how well the U.S. measures the total number of the Chinese nuclear weapons. China has two options to acquire a creditable nuclear deterrence: to increase the quantity or to raise the survivability of its nuclear force. Table 1 that gives the number of nuclear weapons China needs to maintain creditable minimum nuclear deterrence in different Chinese deployment modes and at different levels of U.S. nuclear arsenals.

Table 1, Nuclear Weapons Needed by China for Creditable Minimum Nuclear Deterrence under Various Assumptions

Warheads in the U.S. at different level	Numbers of Chinese weapons and hypothetical deployment			
	Silo-based	One-dimensionally mobile	Two-dimensionally mobile	Submarine-based
START II: Operational and hedge ICBM: 1400 SLBM: 2130	1200	167	22	30
START II: Operational only ICBM: 500 SLBM: 1680	800	112	18	30
Total: 1000 ICBM: 230 SLBM: 770	430	57	14	30

[Li Bin, "China's Nuclear Disarmament Policy, in Harold A. Feiveson ed., "The Nuclear Turning Point, A Blueprint for Deep Cuts and De-alerting of Nuclear Weapons", Brookings Institution Press, Washington, D.C., 1999, pp.325-332]

Table 1 shows that China needs to have a big expansion of its long-range nuclear arsenal if it does not raise the survivability. If China successfully develops mobile ICBMs or SLBMs, it needs to increase very little, if any, of its long-range nuclear force. It is reported that the size of

the Chinese long-range nuclear force has been timely stable in the last two decades [note] and that China is working on road-mobile ICBMs [note]. This suggests that China chooses the second option, that is to build creditable minimum deterrence by increasing the survivability rather than the amount of its long-range nuclear weapons. If there is no missile defense, this will present the direction of the Chinese nuclear modernization. Nuclear development in this direction is very predictable and stable. The effort in this direction will increase the Chinese security while without increasing the perception of threats in other countries. The National Missile Defense (NMD), if the U.S. decides to deploy it, would force China to consider incorporating approaches that help defeat the defense and this would make the direction of the Chinese nuclear modernization diverge in a big range.

## IMPACT OF THE NMD ON THE CHINESE NUCLEAR DETERRENCE

The effort of current U.S. missile defense development is focusing on Ballistic Missile Defense (BMD) [note: exception lower tier]. There are five basic ways BMD: (1) pre-launch attack, meaning attacking the missiles before their launch; (2) boost-phase interception, meaning attacking the missiles when they are speeded up; (3) exoatmospheric interception, meaning attacking the missiles or their warheads during midcourse in the upper atmosphere or above it; (4) endo-atmospheric interception, meaning attacking the missiles or their warheads during reentry course in the lower intensive atmosphere; (5) civil defense, meaning reducing the attack effects of the missiles by strengthening constructions on the ground or hiding personnel and facilities at safe locations. The U.S. BMD effort covers almost all the above five approaches, which may have different impacts on the Chinese nuclear deterrence.

In the history, the U.S. tried several times in acquiring its capability of countering the attacks of ICBMs. The U.S. first developed nuclear-armed anti-ballistic missiles (ABMs) in the 1960s and abandoned them later. In the 1980s, the U.S. attempted to develop layered missile defenses with directed energy and kinetic energy weapons under the project of Strategic Defensive Initiative (SDI), which was believed later as too ambitious. Because the technology was too far from ready and the east-west relation was improved in the later 1980s and the early 1990s, the SDI program shrank once and again. In the Bush Administration, it was changed to be a more limited program referred as Global Protection Against Limited Strike (GPALS). In the first Clinton Administration, the SDI program officially died and then it was revived in the BMD programs.

The current U.S. BMD effort is being made in two major projects. The first is the project to develop Theater Missile Defense (TMD), of which the declared goal is to defend the U.S. military base abroad or its allies against the attack of missiles with range less than 3500 kilometers. The second is the project to develop National Missile Defense (NMD), of which the declared goal is to defend the whole U.S. territory against the attack of ICBMs. For the purpose of defending the whole U.S. territory, the U.S. would have to acquire the technology of

exoatmospheric interception or boost-phase interception. Exoatmospheric defense is the emphasis of the current U.S. NMD project designed by the Clinton Administration while boost phase defense has also been proposed for discussion [note]. The current TMD project includes lower-tier, upper-tier and boost phase systems. The lower-tier systems, e.g., the Patriot antimissiles, are endo-atmospheric defense systems that can defend only small areas. The upper-tier systems, e.g., the Theater High Altitude Area Defense (THAAD) system and the Navy Theater Wide (NTW) system, could defend a big area in principle, so they could be used to supplement the U.S. NMD when needed.

Before President Clinton decided to leave the decision on NMD deployment for the next president, the Ballistic Missile Defense Organization (BMDO) had designed the structure of NMD for the Clinton Administration. But this NMD structure does not satisfy some Americans. The Republicans are pushing for a more robust NMD system while some others oppose the idea of NMD based on mid-course interception. Now the US-DPRK relations is being improved and the perceived DPRK missile threat is declining. All these factors may fundamentally change the structure of NMD. This paper will only check the NMD project designed for the Clinton Administration and analyze its impact on China's nuclear deterrence. This analysis will also be valid if the main technology and structure of the NMD remains the same in the next administration.

According to the NMD project designed for the Clinton Administration, the U.S. would deploy ground-based launchers and interceptors at two locations. The interceptors would be topped with Exoatmospheric Kill Vehicles (EKVs) that kill incoming warheads by hitting them at high speed (hit-to-kill). The designed interception process of the NMD is as follows. The early-warning satellites of the NMD systems capture the launched missile by detecting its hot and bright ejection and engine. Once the missile is detected, the control center tells different sensors to track the missile or the warhead and decoys it released and recognize them. These sensors include five early-warning radars, that would be upgraded to have tracking capability, some new tracking radars and satellite-based infrared sensors in the later deployment phases. The trajectory information obtained by these sensors would send to launch and guide the interceptors toward the target warhead. After the EKV is released by the interceptor at a short distance to the target, the infrared sensors on EKV would guide it to approach the target. To increase the killing probability, several interceptors may be launched toward one target.

According to the current plan, the U.S. would deploy NMD in three phases. In the first phase, referred as capability 1 (C1), the U.S. would deploy one hundred interceptors in Alaska, upgrade some existing early warning radars as tracking radars and deploy a new one. The goal of C1 is declared to defend against the attack of a few tens missiles. It is noticeable that C1 was designed to have twenty interceptors and to deal with a few ICBMs. The proposed size and capability was then enlarged to current level. [note here] In the second phase, referred as capability 2 (C2), the U.S. would deploy more radars, low-orbit missile-tracking satellites and maybe more interceptors. The goal of this phase is declared to defend against a few tens of missiles with complicated countermeasures. In the third phase, referred as

capability 3 (C3), the U.S. would add a new launch site in Great Forks with one hundred and more interceptors and deploy more sensors including high-orbit missile tracking satellites. The goal of this phase is to defend against more missiles with complicated countermeasures.

The number of missiles C1 intends to defend against is comparable to the reported size of the whole Chinese long range nuclear force and is obviously larger than the number of the Chinese retaliatory ICBMs. As discussed in the last section, only a few Chinese ICBMs would survive the first U.S. strike and constitute a retaliatory capability if China does not expand the size of its long range nuclear force. So, a very thin NMD system with very few interceptors would pose a serious threat to the Chinese retaliatory capability. No matter how the U.S. government clarifies its intention in deploying NMD, many Americans still believe that a NMD designed for "rogue states" would have inherent capability in defending against the Chinese ICBMs. [note 1 and 2: Stanford and RAND papers] The Chinese nuclear deterrence replies directly on the American perception about the Chinese nuclear retaliatory capability. The deployment of NMD would change the perception and therefore significantly undermine the Chinese deterrence. Without the backup of NMD, the Americans would always worry about the Chinese retaliation with a few Chinese nuclear weapons that are missed out in the U.S. first nuclear strike against China. The deployment of a NMD system would provide the American public an illusion that the several retaliatory Chinese ICBMs would be intercepted by the NMD as declared and designed. If the Americans tend to believe that its first nuclear strike plus a NMD is able to disarm Chinese nuclear retaliatory capability, the U.S. would become incautious in risking nuclear exchanges with China in crisis. It would therefore disturb the strategic stability between China and the U.S and put more dangers of war over the Chinese and American peoples.

China has realized the dangers and its arms control representative, Ambassador Sha Zukang stated that "it is evident that the U.S. NMD will seriously undermine the effectiveness of China's limited nuclear capability from the first day of its (NMD) deployment. This can not but cause grave concerns to China. " [Note, Sha Zukang, "The Impact of the U.S. Missile Defense Programme on the Global Security Structure", CPAPD/ORG Joint Seminar on Missile Defense and the Future of the ABM Treaty, March 13-15, 2000, Beijing.]

The structure of NMD designed for the Clinton Administration is obviously East-Asia-emphasized, especially in its first deployment phase, C1. In C1, the only one new missile tracking radar will be deployed in Shermia, an outpost to watch missiles from East Asia, including Siberia of Russia, Korea, and China. The only one NMD launch site in C1 and C2 would be in Central Alaska, which is much closer to East Asia than to Middle East and the European part of Russia. This geographical structure provides more time and less required defense range for the interceptors in defending against missiles from East Asia than from other places in the world. This may help the U.S. take a strategy of "shoot-look-shoot" in fighting against missiles from East Asia. This strategy could raise the killing probability of the NMD system in a more efficient way. The East-Asia-emphasized structure of the NMD system could leave the Americans a strong impression that missiles from East Asia would have little chance to penetrate the U.S. defense.

The above analyses show that the U.S. NMD system proposed by the Clinton Administration, considering its number of interceptors and geographical structure, would have inherent potential capability in capturing the Chinese retaliatory nuclear force. This would reduce the American perceived Chinese nuclear retaliatory capability and undermine the Chinese nuclear deterrence. Besides the problem of the designed capability of NMD, the intention behind NMD in the U.S. is also worrying. As the relation of the North and South Korea is being improved, the voice in the U.S. to aim NMD at China is getting stronger [note]. This will cause serious concerns in China and the Chinese will have to explore possible responses in its nuclear development if the U.S. makes a decision of NMD deployment.

## REQUIREMENTS FOR THE CHINESE RESPONSES

China is now using its diplomatic resources to influence the U.S. on the NMD matters. The hope is that the U.S. would take China's security concern into account when it considers the NMD deployment. But there is a danger that the U.S. would ignore China's concern when making the deployment decision. If this happens, China will certainly seek possible approaches that help maintain the effectiveness of its nuclear deterrence. As Ambassador Sha Zukang stated, "China has not and will not participate in an arms race with anybody. But neither will we sit on our hands and allow our legitimate security interests to be compromised by any one." [note] When China considers the approaches to protect the effectiveness of its nuclear deterrence, some requirements are necessary to apply to these approaches. Our research indicates that four of them are fundamental.

(1) The approaches China takes should be **FEASIBLE** in helping defeat the U.S. NMD. This is a requirement prior to all others. The judgment of the feasibility is sometimes difficult because of the following three reasons. (a) The BMDO is declared that the NMD would be able to defeat simple and complicated countermeasures in its development. It is not clear how the NMD would do this based on all possible technology [note]. (b) Although the technology of the NMD plan proposed by the Clinton Administration is clear, the plan itself is streaky. For example, the republicans are pushing for stronger missile defenses. (c) China needs to worry about any scientific surprises in the NMD development. (d) Different organizations in the Chinese defense industry may have different assessments on the feasibility of different approaches. Due to the uncertainty of the feasibility, the Chinese government may want to take more than one set of approaches in case one cannot work.

(2) Some of the approaches should be **VISIBLE** to the U.S. It is necessary but not sufficient if the Chinese approaches can defeat the U.S. NMD. The reason is that the Chinese deterrence relies on the American perception about the Chinese retaliatory capability rather than the real capability. Some of the Chinese approaches should be visible to the Americans so that they know that their NMD system will not be able to capture the Chinese retaliatory capability.

(3) The approaches do not add too much financial burden to China. China is now concentrating on economic development. It does not want a sharp expansion of military expenditure that would disturb its economic construction. The Chinese government's policy is taking the economical development as the priority [note] and the policy has strong support from the Chinese people. The policy is unlikely to be changed. So, it will be a central consideration of the Chinese government whether the approaches are AFFORDABLE.

(4) The approaches do not increase the perception of "China threat" in other countries. China is now in the process of fully participating in the international community and it needs a peaceful environment for its economical development. It wants its peaceful profile would help serve for these purposes. China would prefer the MODERATE approaches while avoiding others that would have much negative consequences in arms control or pose any new tension.

Besides the above four key requirements, there are some additional factors that can also influence the decision-making in selecting possible approaches. These factors are not as critical as the above four, but sometimes they can be important when the options of the approaches are assessed in different Chinese organizations. These factors are as the follows.

(5) The decision makers will prefer the approaches that are COMPATIBLE to each other. All approaches applied to the same missile must be compatible to each other. But the decision makers may want to see the competition among some incompatible approaches in the early development. So, we may not see that incompatible approaches are exclusive to each others in the early Chinese plan.

(6) Some PRECAUTIONARY approaches are needed. The U.S. BMDO declares that NMD will defeat simple and complicated countermeasures in different development phases. It is not clear how the current NMD technology will do this. So the Chinese would have to worry about some possible scientific surprises. On the other hand, some people in the U.S. are pushing for stronger missile defense or even revive part of the SDI program. The Chinese may want to have some technical preparation for the approaches that can also deal with stronger missile defense.

(7) The approaches based on CHALLENGING technology could obtain more support. China worries that an intention behind the U.S. NMD is to acquire preemption in military technology in the new century. [note] The Chinese scientists would hope that their work can narrow the technical gap between China and the U.S.

The above list is not an exhausted one. There may be some other factors, which could sometimes play some roles in choosing the Chinese responsive approaches. For example, if an approach has traditional bases in the Chinese defense industry or dual-use industry, it would have more chance to be recognized and recommended by the scientists. Therefore, it would have more chances to be taken by the government. However, these factors may not be as important as previous listed seven ones.

The U.S. development on missile defense is forcing China to consider taking approaches to protect its nuclear deterrence. This poses some new requirements and challenges to the Chinese nuclear developments. As discussed in the first section, China needs to worry only the survivability, reliability and safety in its further nuclear development if there is no missile defense. The appearance of missile defenses would disturb the process and put a lot of uncertainties in it. The next section will comment on different Chinese approaches based on the above listed seven factors.

## COMMENTS ON POSSIBLE CHINESE RESPONSES

Overwhelming the defense

(A) building more ICBMs

(B) MIRVing the Chinese ICBMs

(C) decoys

Stealth technology during flights

(D) chaffs

(E) radar stealth

(F) infrared stealth

Rivalry between warheads and interceptors

(G) Maneuvering warheads

Raising the ICBM survivability

(H) Mobile ICBMs

(I) Missile defense

(J) On-alerting

Many approaches that could help defeat the NMD have been discussed. [note] These approaches may be divided into four groups. The first group is to overwhelm the defense. This could be done by (A) building more ICBMs, (B) MIRVing the Chinese ICBMs to multiply the number of warheads; and (C) carrying and releasing decoys by the missiles. The second group is to lower the observability of the warheads by applying stealth technology during flights. This group includes (D) dispersing chaffs to fool the sensors of the defense; (E) radar stealth, meaning that the radar reflection from the warhead is reduced; and (F) infrared stealth meaning that the infrared radiation of the warheads is reduced. The third group is to launch a rivalry between the warheads and the interceptors during the flight, for example (G) make the warheads maneuver. The fourth group is to raise the survivability of the Chinese ICBMs by (H) deploying mobile ICBMs and/or SLBMs; (I) building missile defense; and (J) putting the Chinese nuclear weapons on hair-trigger alert. [note]

There are two very different scenarios in which more ICBMs are built to overwhelm the defense. In the first scenario, China builds more silo-based ICBMs; and in the second scenario, China builds more survivable ICBMs or SLBMs. These two scenarios gives very different results.

As discussed in the first section, the current Chinese nuclear deterrence is based on quantitative uncertainty in the minds of its rivals. The NMD would help the U.S. build the confidence in capturing the Chinese retaliatory capability. If China wants to overwhelm the defense by developing more warheads, the size of the its retaliatory force should be the larger than the sum of the number of warheads intercepted by the defense and the number of warheads that can produce "intolerable damage". Assume that two interceptors are used to kill one warheads. C1 with 100 interceptors are intended to kill 50 warheads. Table 2 gives the number of warheads China needs to overwhelm C1, C2.

Table 2, Nuclear Weapons Needed by China to Maintain Creditable Minimum Nuclear Deterrence in Case of C1

Warheads in the U.S. at different level	Numbers of Chinese weapons and hypothetical deployment			
	Silo-based	One-dimensionally mobile	Two-dimensionally mobile	Submarine-based
START II: Operational and hedge ICBM: 1400 SLBM: 2130	1250	217	72	80
START II: Operational only ICBM: 500 SLBM: 1680	850	162	68	80
Total: 1000 ICBM: 230 SLBM: 770	480	107	64	80

All the numbers in Table 2 are 50 larger than that given in the same positions of Table 1. However, China could maintain its nuclear deterrence by keeping some quantitative ambiguity about its silo-based nuclear force if there is no missile defense. If there is a missile defense, the effect of the quantitative uncertainty would be ruled out by the defense. China would have to seek a creditable deterrence. The conclusion is that if China chooses to enlarge its silo-based nuclear force in responding to the U.S. NMD, it is not economic or efficient. If China wants to overwhelm the defense with fully mobile ICBMs or very survivable SLBMs when the technology are ready, it would be a more reasonable option. A key problem here is the timing: If China wants to overwhelm the defense with an enlarging nuclear force, China needs to raise the survivability of its nuclear force before the U.S. finishes the deployment of NMD. If the

Chinese technology cannot be ready in time, or if China chooses to deploy combined modes of its long range nuclear force, the number of nuclear warheads China needs to overwhelm the defense varies from one hundred to several thousands. This would give a big uncertainty of the future of the Chinese nuclear forces.

Enlarging the Chinese nuclear forces to overwhelm the defense may have some significant costs for China. (1) It may not be good for China's peaceful profile; (2) It may require a big financial support if China chooses to enlarge the silo-based nuclear force; (3) China may need to produce additional fissile materials for the new warheads, especially when China chooses to add silo-based ICBMs. It would make China reluctant to join a Fissile Materials Cut-off Treaty (FMCT) if China keeps the option of buildup open. Although the costs could be big, the option of buildup cannot be simply ruled out. The reason is that it is so mathematically simple to understand and so certain to work. So, in the Chinese debate this idea would easily win some support from non-technical people. Another advantage is that the buildup would be visible to the outside and therefore helps discourage any first strike against China.

It is an efficient way to enlarge a nuclear force by deploying Multiple Independently-targeting Re-entry Vehicles (MIRVs) if the technology is allowed. In the U.S. efforts to persuade Russia into revising the ABM treaty, one bait is to allow Russia to keep their MIRVs [note]. This could encourage China to think about this option. However, for China, MIRVing the silo-based ICBMs is not a good idea because its nuclear force has a much smaller size than Russia's. MIRVing the survivable ICBMs could be better. But it depends on whether the technology is mature.

Many Chinese articles mentioned multiple-warheads as countermeasures [note], but they do not always refer to real warheads. So, multiple warheads in these articles could mean one real warhead plus many decoys. As discussed in a report made by a group of American scientists (UCS/MIT) [note], the proposed NMD sensors cannot differentiate real warhead from anti-simulation decoys during the midcourse of the flight. This technology is not too complicated for China. This means that the deployment of decoys is much more efficient and simple than MIRVs in defeating the NMD for China.

Some stealth technology can make the warheads less observable during the flights. For example, the radar reflection of a warhead can be reduced by putting the warhead in a shroud with pointed cone-sphere shape and painting the shroud with radar absorption materials. If some metal chaffs are dispersed around the warheads, they can fool the radars of the defense. These two countermeasures are based on not too complicated technology and can reduce the effectiveness of the defense. Another stealth technology is discussed in UCS/MIT report, that is to reduce the infrared radiation of the warhead by cooling the skin of the warhead. This countermeasure is also based on not-too-complicated technology and can completely defeat the defense.

The only one countermeasure mentioned by the Chinese defense industry is maneuvering

warhead. To win its rivalry with the interceptor, the maneuver capability of the warhead should be comparable to that of the interceptor. [note] So, the warhead needs to detect the approaching interceptor and to start its maneuver at a good time; or the warhead needs to bring a lot of fuel to keep maneuvering continuously. Either option is a challenge to the designers of the warhead. The first option needs very capable sensors on the warhead that can search approaching interceptors from all possible directions while the later needs to reduce much weight of the nuclear device so that the re-entry vehicle can carry additional fuel and engine. To match the maneuver capability of the interceptor, the warhead may need new design to tolerate off-axis overweight during maneuver. This may require new nuclear tests and therefore put difficulties for the entry into force of the Comprehensive Test Ban Treaty (CTBT). The result of the chasing game between the warhead and interceptor are dependent on the competition of technologies of the defensive and offensive sides.

Raising the survivability of the Chinese nuclear weapons cannot directly defeat the U.S. NMD, however, it can make some other approaches much more effective and efficient. For example, China would need much fewer nuclear warheads to overwhelm the defense if China can deploy survivable ICBMs rather than silo-based ICBMs. It is the main goal of the Chinese nuclear modernization to build a survivable mobile or/and a sea-based nuclear force if there is no missile defense. This goal is still important for China even if the factor of missile defense is added.

Some point missile defenses protecting missile silos may help raise the survivability of the ICBMs. However, the technology is very challenging and the cost is very high.

Another approaches to raise nuclear weapon survivability is to put the Chinese nuclear weapons on hair-trigger alert. It means that China needs to launch its nuclear weapons after it detects a nuclear attack and before the incoming nuclear weapons arrive. This strategy is called "launch on warning" and was suggested by the American negotiators to their Russian counterparts in their consultations on the ABM Treaty. This approach requires advanced and reliable early-warning systems, which China may not have had now. The approach is inconsistent with the Chinese nuclear thought, in which nuclear weapons are not for war-fighting. [note]

## POSSIBLE RESPONSES IN ARMS CONTROL

China is making its diplomatic effort in dissuading the U.S. from deploying NMD at both bilateral and multilateral occasions. In bilateral exchanges, the Chinese expressed its concerns over NMD through official visits and "tract two" meetings that include both governmental and non-governmental officials. These bilateral dialogues have helped the two countries understand the positions and concerns of each other and are laying a base for possible resolutions of the dispute of the two countries over the NMD issue [note].

China has two major multilateral occasions to speak against the NMD. The first one is the

First Committee of the United Nations (UN). At the UN's first committee, China endorsed the Russian proposal to sustain the ABM treaty, that won an overwhelming support of the UN members [note]. The second occasion is the Conference on Disarmament (CD), where China is trying to initiate a negotiation on the prohibition of weapons targeting outer space [note]. Besides UN and CD, China also addresses its concerns over NMD or TMD that could supplement NMD at some regional forums [notes]. The Chinese diplomats have talked more and more with the western news medium [note] that provides more transparency of the Chinese positions to the common American people.

If the diplomatic effort fails, China would make some responses in the area of arms control in addition to its responses in nuclear development.

The NMD deployment would harm the Chinese confidence in arms control. Before China gradually opened its door to the world in the early 1980s, it was skeptical to the utilities and effectiveness of international efforts in global arms control and it did not believe that the superpowers would be faithful to their commitments when they feel that they have the power to break them. As it has been involved more and more in international arms control regimes and negotiations, China has learned the importance of participation in international cooperation on arms control and has become very active in this area. The U.S. attempt in modifying or withdrawing from the ABM treaty is reviving the old doubts in China about the faith of the U.S. to its arms control commitment and the sustainability of international arms control cooperation. The Chinese would worry that participating in arms control would only reduce China's capability in self-defense rather than help it. In conclusion, China could become less cooperative with the U.S. in the area of arms control and non-proliferation if the U.S. finally revises or abandons the ABM treaty.

As discussed in the last section, some approaches may add difficulties for the Chinese arms control. For example, it may need some new fissile materials for China to saturate the defense by building more nuclear weapons, especially silo-based ICBMs. It will be difficult for China to accept a Fissile Material Cut-off Treaty, that puts a ceiling to the size of the Chinese nuclear force and makes China lose an option to defeat the NMD although China may not take the option immediately. Another difficulty would add to the ratification of the Comprehensive Test Ban Treaty. In China, there has been some voice to argue that China lost too much in signing the CTBT [note]. If some Chinese feel that a few more nuclear tests are required to develop countermeasures like maneuvering warhead as discussed above, the voice to oppose the CTBT would certainly become stronger in China.

In non-proliferation area, China would become less interest in fully accepting the MTCR including its annexes as China's export control law if the U.S. does not echo China's concern over NMD. The U.S. would become less influential in dissuading China from cutting its cooperation with some countries if China believes the cooperation are consistent with existing international law. In the area of nuclear disarmament, the NMD will become a new serious obstacle that blocks China from considering joining global efforts of nuclear reductions.

Assume that the U.S. NMD is not designed for China, or assume that China succeed in dissuading the U.S. from choosing China as the target of the NMD, could the U.S. and China make some compromises in this issue? The answer is possible, but difficult.

To reach the compromise, China could help reduce the threat of missile and weapons of mass destruction to the U.S. China could also make its domestic enforcement of export control over sensitive technology to be more transparent to the world. The main Chinese efforts in reaching a compromise should focus on helping the U.S. reduce its perceived missile threat.

If the U.S. wants a compromise, the compromise would not come from the limitation over the number of the interceptors as discussed above. The compromise would come from the constraints over the capabilities of the NMD system or the change of the structure of the defense. For example, if the U.S. develops some civil defense, China would not be angry with this. The emerging missile states are not able to develop missiles that can reach any part of the U.S. without any warning, so the U.S. does not need to defend the whole U.S. territory. The missiles of the emerging missile states would be very visible to radar and infrared sensors, so the U.S. does not have to deploy very powerful radar and infrared sensors for the defense. Technically, the U.S. could convince China and Russia that its NMD does not aim at them by constraining the speed of the interceptors, location of the NMD detection systems and their capability.

Another thing the U.S. could do to help reach the compromise is to much deeply cut its nuclear force. If China does not feel that the U.S. would have the first strike capability against China, China would not worry that much about the U.S. missile defense capability.