China's Anxiety About US Missile Defence: A Solution

Wu Riqiang

On 26 March 2012, the United States announced its ballistic-missile-defence (BMD) plan in the Asia-Pacific and the Middle East.[1] The following August, it was reported that Washington was planning to deploy two forward-based X-band (FBX) radars in southern Japan and Southeast Asia (perhaps the Philippines) to supplement the one already positioned in Aomori Prefecture in northern Japan.[2] During his visit to Japan in September 2012, then US Secretary of Defense Leon Panetta reached an agreement with his Japanese counterpart on the deployment of a second FBX radar.[3] In February 2013, Japan and the United States declared that this new radar would be deployed in the Kyogamisaki base in Kyotango, Kyoto Prefecture.[4] As expected, Beijing expressed its strong opposition, despite Washington's insistence that it was not directed against China or Russia.[5]

Washington's disagreements with Beijing and Moscow regarding missile defence have lasted for many years, and there is no sign that they will be resolved in the near future. The United States has consistently argued that it will not accept any limit on the capabilities, numbers or locations of its BMD systems. Despite their differences on the issue, Washington and Moscow have gone to great lengths in exploring potential BMD cooperation through initiatives such as joint threat evaluation, joint BMD exercises, early-warning data sharing and even a joint BMD system. However, the United States has made no similar efforts to cooperate with China, and appears content to simply ignore Beijing's concerns.[6] Scholarship on Russia–US relations rarely

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addresses the impact of BMD on Chinese security. Some academics have argued that the United States should try to reach an understanding with China about Sino-American strategic stability and regional arms-control issues, but no one has put forward a specific solution.[7]

It is important to understand the technical and political basis of China's concerns about the United States' BMD systems, and to discuss the measures by which a solution might be found.

Technical basis of China's concerns

The four key aspects of the United States' BMD capability for intercepting Chinese strategic missiles are: ground-based mid-course defence (GMD) systems; the Obama administration's Phased Adaptive Approach (PAA); Asia-Pacific BMD assets; and the BMD structure recommended by the US National Research Council. All of my calculations are based on publicly available data. For the sake of argument, I have assumed that the earth is round and non-rotating. I have also assumed that China's intercontinental ballistic missiles (ICBMs) and submarine-launched ballistic missiles (SLBMs) are three-stage solid-propellant DF-31A-type missiles, with a burnout time of 160 seconds and a range of 11,200 kilometres.

BMD effectiveness is determined by two factors: kinematic footprint and intercept probability. As US physicist Dean A. Wilkening has stated, 'a missile aimed at any point inside the kinematic footprint can, in principle, be intercepted by the defence.'[8] Intercept probability is calculated using two factors: the probability that real warheads can be discriminated from decoys and the conditional probability that an identified warhead can be destroyed.[9]

The current GMD system

Generally speaking, the United States' current GMD system is composed of 30 ground-based interceptors (GBIs) deployed in Fort Greely, Alaska, and at Vandenberg Air Force Base, California; one sea-based X-band radar (SBX) home-ported in Adak, Alaska, for fire control; three PAVE PAWS radars in Clear, Alaska, Cape Cod, Massachusetts, and Beale Air Force Base, California; two ballistic-missile early-warning-system radars in Thule, Greenland, and Fylingdales, United Kingdom; one *Cobra Dane* radar in Shemya, Alaska, for early warning; and Defense Support Program early-warning satellites, which provide cueing for ground-based radars.[10]

The declared purpose of the GMD system is to counter North Korean ICBMs. Naturally, it also has the capability to engage China's strategic missiles, as shown in Figure 1. GBIs are launched after the target missile burns out. The earliest intercept time is 774 seconds. The system has many opportunities to engage the target missile before it descends to an altitude of 100km (which takes about 1,672 seconds).

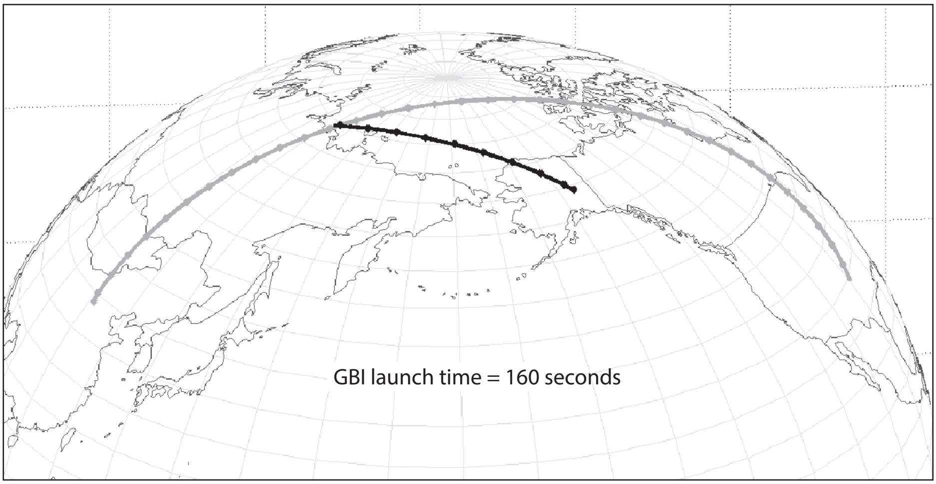

Figure 1. **A GBI engages a Chinese ICBM; 1-minute intervals are shown along both trajectories**

The Phased Adaptive Approach

In September 2009, the Obama administration announced its European PAA missile-defence plan, which focused on the sea- and land-based *Aegis* and Standard Missile-3 (SM-3) systems. The original European PAA was a four-phase deployment plan. In Phase I, which took place in March 2011, the first Europe-based PAA BMD asset, USS *Monterey*, was deployed in Spain. In Phase II, which will probably occur in 2015, the sea- and land-based SM-3 Block IB interceptors will be fielded. In Phase III, scheduled to take place in 2018, the sea- and land-based SM-3 Block IIA – which is jointly developed by the Unites States and Japan – will be deployed to protect NATO allies in Europe from medium- and intermediate-range ballistic-missile threats. And finally, during Phase IV, which was scheduled to occur in 2020, the SM-3

Block IIB would have been deployed to protect the United States against ICBMs launched from the Middle East. However, Phase IV was cancelled on 15 March 2013.[11] The focus of the plan is Europe, but its mobile assets could also pose a threat to China if they are deployed in East Asia.

With a burnout speed of 3.0–3.5km/sec, the SM-3 Block IA and Block IB have no strategic capability, so I will not discuss them here.[12] Wilkening has argued that the burnout speed of the SM-3 Block IIA should be in the order of 4.5km/sec.[13] The SM-3 Block IIB was still on the drawing board when it was cancelled, and its specifications remain unknown. It can be calculated that a 21-inch interceptor can reach a burnout velocity of 5.5km/sec using more powerful solid propellants and lighter cases. So it can be assumed that the burnout speed of the SM-3 Block IIA and Block IIB is 4.5km/sec and 5.5km/sec respectively. Because the SM-3 Block IIB was cancelled, I will focus on the intercept capability of the SM-3 Block IIA.

My calculations show that the SM-3 Block IIA is capable of engaging China's strategic missiles. Deployed off the US coast, one SM-3 Block IIA system can protect most of the continental United States from China's strategic missiles, as shown in Figure 2. To protect all of the continental United States would require two or three SM-3 Block IIA systems. If deployed close to Japan – for example, off the coast of Hokkaido – and launched after the offensive missiles' burnout (at 160 seconds), one SM-3 Block IIA

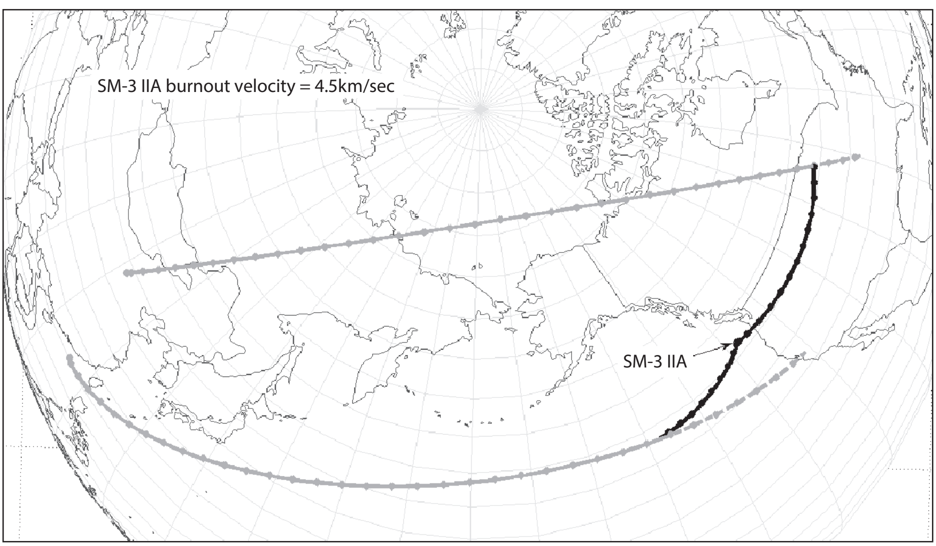

Figure 2. **Capability of one SM-3 Block IIA deployed off the coast of the United States**

system can protect all of the continental United States from Chinese SLBMs launched from the South China Sea, as shown in Figure 3. But it cannot engage Chinese SLBMs launched from the Yellow Sea. To intercept such missiles, SM-3 Block IIAs have to be launched before the offensive missiles' burnout – at around 130 seconds.[14] Even if they launch earlier, SM-3 Block IIAs deployed off the coast of Hokkaido have a limited capability to intercept Chinese SLBMs launched from the Yellow Sea, as shown in Figure 4.

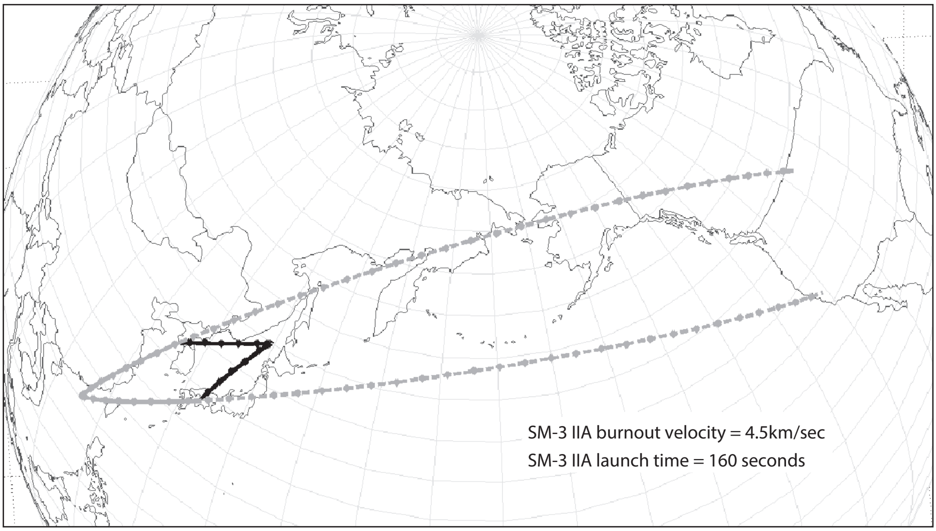

Figure 3. **Capability of one SM-3 Block IIA deployed off the cost of Japan**

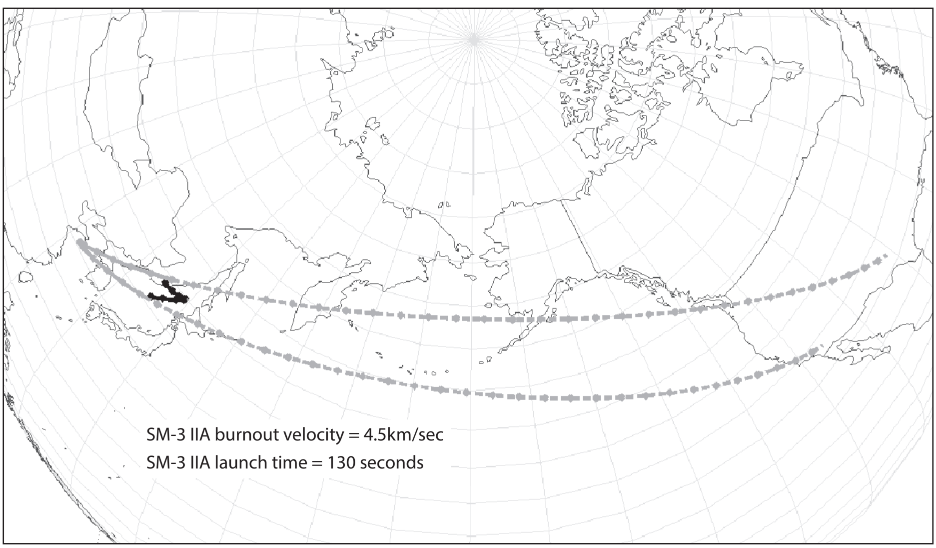

Figure 4. **Limited capability of SM-3 Block IIAs deployed off the coast of Hokkaido against SLBMs from the Yellow Sea**

Asia-Pacific BMD assets

The United States has yet to clearly delineate its Asia-Pacific BMD system. It has been suggested that such an initiative would be based on trilateral cooperation between the United States, Japan and Australia; and the United States, Japan and South Korea. The system would probably utilise the FBX radar deployed in Aomori, Japan; the SBX radar in Adak, Alaska, which is used for fire control; the PAVE PAWS early-warning radar in Taiwan; and two *Green Pine* radars in South Korea. The United States is also planning to deploy two more FBX radars in Japan and Southeast Asia respectively. These radars' capabilities for tracking Chinese strategic missiles have significant security implications.

The detection range of FBX radars is classified, but can be estimated from the job they are designed for. In Japan, such radars are deployed to track North Korean missiles, and it can be calculated that the minimum detection range required for this is 1,200km. Another way to calculate their detection range is using publicly available information. George Lewis and Theodore Postol contend that against cone-shaped warheads with a radar cross-section of 0.01m^2, FBX radars have a range of 866km.[15] According to their work, if the target's radar cross-section is 1m^2 – for example, ICBMs during the boost phase – an FBX radar can detect them at a range of 2,739km. For the sake of argument, I will assume that FBX radars have full tracking and discrimination capability at a range of 1,200km, and a limited capability at a range of 2,000km.

At a range of 1,200km, the three FBX radars in Japan and Southeast Asia, and the SBX radar, can provide a very good capability for tracking China's SLBMs from early boost phase to late mid-course, as shown in Figure 5. Chinese ICBMs targeted at the continental United States are out of this range. At a range of 2,000km, FBX radars in Japan can detect China's ICBMs, as shown in Figure 6. FBX radars in Southeast Asia cannot detect China's ICBMs, even with a range of 2,000km. These FBX radars in Japan are supposed to be directed at North Korea in peacetime, but the United States could redirect and re-calibrate them to detect Chinese strategic missiles during a crisis.

Taiwan's PAVE PAWS radar, whose performance far exceeds Taiwan's defence requirements, could also pose a threat to Chinese strategic missiles.

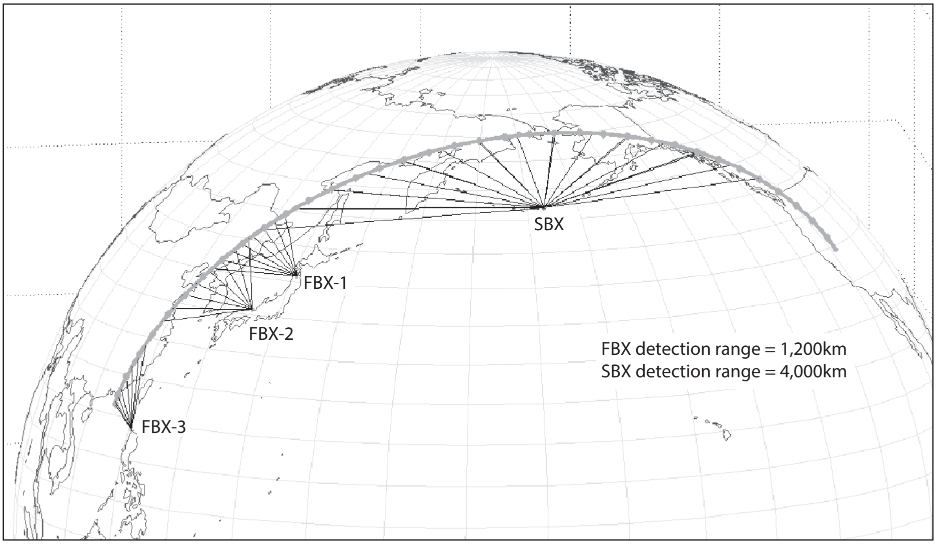

Figure 5. **FBX and SBX radars' coverage of Chinese SLBMs**

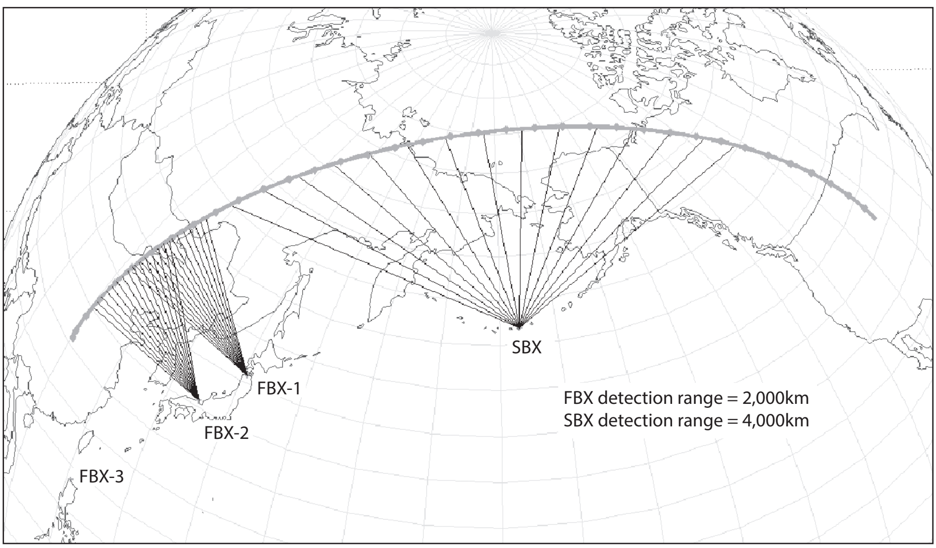

Figure 6. **FBX and SBX radars' coverage of Chinese ICBMs**

This radar, which Raytheon began construction of in 2005, achieved operational status in 2012. The original radars of this type in the United States have a detection range of 5,000km, but the detection range of Taiwan's version is reported to be 2,000km.[16] Using Apple Maps, it can be clearly seen that this radar has at least two antenna faces, with an azimuth of 240 degrees. The radar can detect Chinese ICBMs launched from central-southern China and SLBMs launched from the South China Sea (as shown in Figure 7) but cannot detect ICBMs launched from northern China. The Taiwan PAVE PAWS is not currently part of the US missile-defence system. But from Beijing's perspective, because the United States could covertly connect the radar to the system with ease, it must be regarded as such.

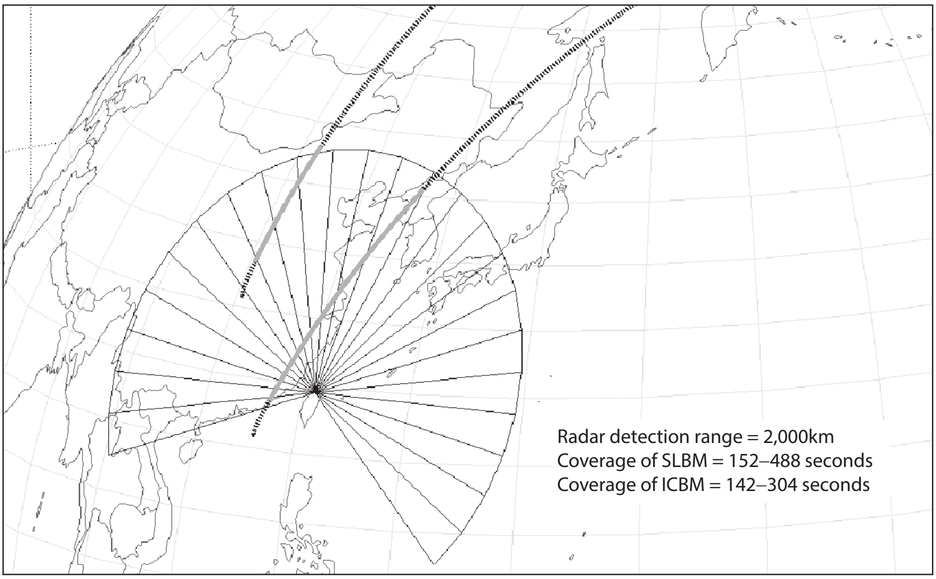

Figure 7. **Taiwan PAVE PAWS' coverage of Chinese strategic missiles**

South Korean missile-defence radars have a limited capability to track Chinese strategic missiles. During a meeting between US and South Korean foreign and defence ministers on 14 June 2012, both sides decided to strengthen 'comprehensive and combined defenses' against the North Korean missile threat, implying that their BMD systems would be integrated in some way.[17] Seoul later denied that it would join the US global missile-defence system, but admitted that it would share surveillance and early-warning information with Washington.[18] Since 2012, South Korea has deployed two *Green Pine* radars bought from Israel.[19] These early-warning fire-control radars form part of the Israeli *Arrow* anti-missile system, use L-band and have a detection range of 500km.[20] South Korea's radars can detect Chinese SLBMs launched at the continental United States from the Yellow Sea, covering the deployment of warhead and decoys, as shown in Figure 8.

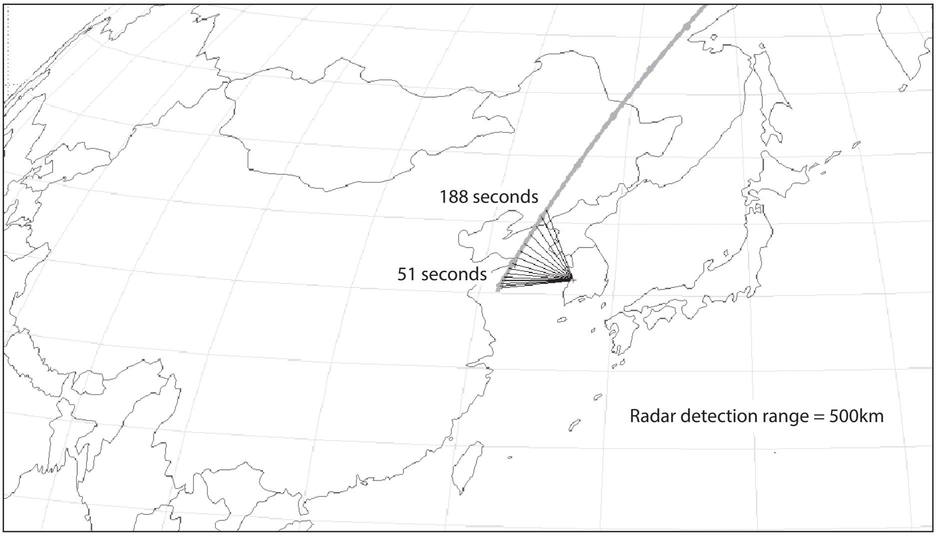

Figure 8. **South Korea's radars track a Chinese SLBM launched at the continental United States from the Yellow Sea**

That US forward-based BMD radars can detect China's strategic missiles is important for several reasons. Firstly, early detection can give the defensive side more warning. This provides the United States with a greater number of opportunities to intercept the missile, and may allow it to apply a shoot-look-shoot firing doctrine to greatly increase BMD potency. Secondly, longer-term radar tracking can contribute to more effective decoy identification. Discriminating warheads from decoys or other countermeasures during mid-course flight is the most challenging aspect of missile defence. The more information that is collected, the more likely missile-defence systems are to distinguish between warheads and decoys. Thirdly, if BMD radars, especially X-band radars, can detect the decoy-deployment process of the offensive missile – which occurs shortly after its burnout, at 160 seconds – the defensive side will be able to easily identify the real warhead because the decoys are much lighter.[21] In such circumstances, missile-defence systems are no longer susceptible to mid-course countermeasures.

BMD structure recommended by the National Research Council

In 2009 the US National Academy of Sciences set up a congressionally mandated committee to conduct an independent study of concepts and systems for boost-phase missile defence. The committee's declassified report was published on 11 September 2012.[22] Its main recommendations are: replace current GBIs with a new type of two-stage interceptor based on technology developed under the Kinetic Energy Interceptor programme; introduce a new kind of ground-based X-band radar, which is built by doubling existing FBX radars by stacking one on top of the other; improve mid-course discrimination capability by synergising X-band radar data, concurrent kill-vehicle observation and a shoot-look-shoot firing doctrine; and construct a new BMD site in the northeast of the United States.

The new GBIs will provide the United States with a much larger defence footprint and make a shoot-look-shoot firing doctrine viable. The National Research Council report states that the burnout speed of the notional new GBI would be approximately 6km/sec. It also recommends the interceptor be deployed at three sites: Fort Greely, Vandenberg Air Force Base and a new location in the northeast of the United States. In China's worst-case scenario, the new GBIs might also be deployed in Japan. I will assume that Hokkaido will be the location of such an additional site. As shown in Figure 9, one system deployed in Hokkaido can protect all of the continental

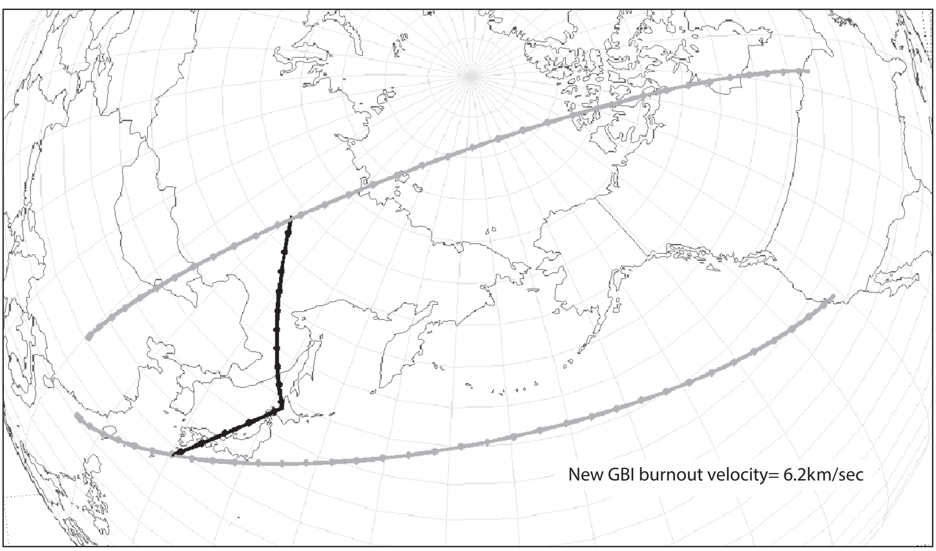

Figure 9. **New GBIs in Japan protecting all of the continental United States**

United States from China's strategic missiles. Interceptors launched from Hokkaido, Fort Greely and Vandenberg Air Force Base could implement a shoot-look-shoot firing doctrine, providing a total of five chances to intercept an offensive missile, as shown in Figure 10.

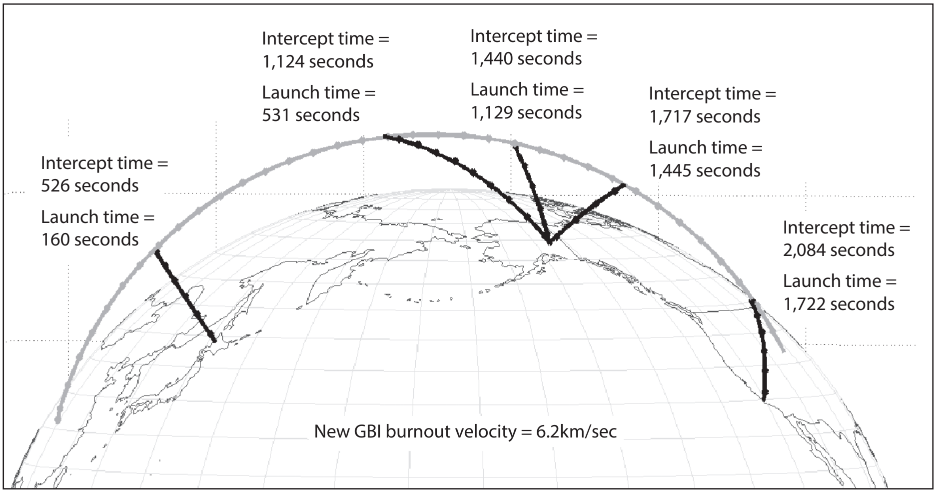

Figure 10. **Shoot-look-shoot firing against a Chinese ICBM**

The political basis of China's concern

Western academics often hold that China's nuclear strategy is similar to that of the minimum-deterrence approach adopted by the United Kingdom and France, but there are significant differences between the two postures. The backbone of both British and French nuclear forces is very quiet ballistic-missile nuclear submarines, one of which remains at sea every hour of every day. Therefore, both countries have absolute confidence in their nuclear-retaliation capability, even in the extreme worst-case scenario: a bolt-from-the-blue disarming attack with no early warning, while on regular alert status. But this strategy does not apply to China. The state's small and relatively vulnerable nuclear arsenal cannot give Beijing the same level of confidence in its nuclear-retaliation capability. This is compounded by the fact that Chinese nuclear weapons are kept off alert in peacetime, so in the worst-case scenario China might not have enough time to re-alert its nuclear weapons (although this is unlikely). China's nuclear posture is therefore unique, and requires explanation using a new model.

A reasonable model for China's nuclear posture is the concept of first-strike uncertainty. As Devin Hagerty, professor at the University of Maryland, Baltimore County, has said, this posture relies on creating uncertainty 'in the minds of the potential attacker's leaders about whether it is possible to destroy all of the victim's nuclear weapons before it can retaliate'.[23] US strategist Avery Goldstein was the first to use this concept in analysing China's nuclear strategy.[24] The idea of first-strike uncertainty has been reflected in Beijing's planning of the Chinese nuclear arsenal; the earliest reference to it was Mao Zedong's argument that nuclear weapons are 'paper tigers'.[25] Marshal Nie Rongzhen, who oversaw the Chinese nuclear-weapons and missile programmes, said that the purpose of China's nuclear weapons was to have 'the rudimentary means of a counterstrike' ('*qima de huanji shouduan*') when China sustained a nuclear attack.[26] Nie's use of the word 'rudimentary' indicates that he expected China's nuclear retaliation to be possible, rather than assured. But it is not immediately clear what degree of first-strike uncertainty is necessary to deter a nuclear attack.

The threshold of effective deterrence can be identified by studying China's nuclear history.[27] It is surprisingly low. Although it was a system with very poor survivability and a limited range, the land-based, mobile DF-3 intermediate-range ballistic missiles China deployed in the mid-1970s convinced Washington and Moscow that Beijing had a nuclear-retaliatory capability. By contrast, Beijing had no such confidence until Chinese nuclear forces acquired an independent launch capability (without technical support from the Chinese missile industry and Chinese missile-test bases) in the mid-1980s. A symbol of this newfound confidence was the 1984 entrance of China's nuclear missile force (the Second Artillery) into combat duty. Prior to this, China's leaders had not mentioned the country's nuclear-retaliatory capability. Instead, they had relied on the people's war strategy and the ability to endure long-term conflict to deter aggression. It was not until the mid-1980s that Chinese leaders began to talk about nuclear retaliation. It can therefore be concluded that for a nation to deter a nuclear attack and gain confidence, assured nuclear retaliation is not necessary and only the uncertain threat of such a response is required.

Missile defence and uncertainty

As previously mentioned, BMD effectiveness is determined by two factors: kinematic footprint and intercept probability. An easy way to analyse BMD's influence is to assume that the intercept probability is 100%; in such circumstances, the balance between offence and defence will be determined by the footprint of the BMD and the relative size of the offensive and defensive capabilities. If the offensive missile is aimed at a point outside the footprint, then it is certain to hit its target.[28] But if the missile is aimed at a point inside the footprint, then the outcome depends on the relative size of the offence and the defence. In this scenario, if the offence can overwhelm the defence, the remaining missiles will hit their targets. If not, all offensive missiles will be successfully intercepted. Using this assumption, the security consequences of missile defence are clear, and there is no room for uncertainty.

In reality, however, BMD intercept probability is imperfect, so the situation is more complicated. As previously mentioned, intercept probability is calculated using two factors: the probability that real warheads can be discriminated from decoys and the conditional probability that a discriminated warhead can be destroyed. The aspect of intercept probability I will focus on is discrimination probability, which has been key to the BMD debate for decades.

Regarding mid-course discrimination, there are two main points of view among US experts. The first school argues that 'exo-atmospheric missile defenses will never be reliable if confronted with countermeasures. The countermeasures could be very simple, like balloons, which could readily be deployed by *any* country capable of building long-range ballistic missiles'.[29] Scholars from the second school admit that mid-course discrimination is very difficult, but they believe that it is not impossible. They argue that:

> The following two statements are *both* true: 1) There is no missile defense architecture against which an effective countermeasure cannot be developed to defeat; and 2) There is no offensive countermeasure against which a defensive counter-countermeasure cannot be developed to defeat.[30]

Therefore, 'the outcome of the measure-countermeasure competition depends on the capability of opponents and on the exact BMD architecture deployed.'[31]

I will not try to judge which school is correct here. Despite their disagreement on the issue, there is a consensus among the sides that mid-course discrimination is very difficult, and that current BMD systems have not solved this problem. For example, the National Research Council committee report stated that 'the midcourse discrimination problem must be addressed far more seriously if reasonable confidence is to be achieved'.[32] A 2011 US Defense Science Board report also made this point, contending that 'discrimination in the exo-atmosphere is still not a completely solved problem'.[33] This suggests that the difficulty of mid-course discrimination might be a source of uncertainty in missile defence that provides a window of opportunity for maintaining strategic stability at low numbers.

Using the concept of first-strike uncertainty, it is therefore possible to build a model of Sino-American strategic stability that could form the basis of bilateral dialogue between Washington and Beijing. If first-strike uncertainty is great enough, then the system is stable. As previously mentioned, the strategic relationship between China and the United States in the mid-1980s can be seen as a threshold. This relationship provides a useful starting point for analysing the evolution of first-strike uncertainty.

First-strike uncertainty is the product of two factors: disarming uncertainty (which relates to whether a disarming strike can destroy all of the opponent's nuclear weapons) and penetration uncertainty (which relates to whether surviving retaliatory warheads can penetrate missile defences). Figure 11 shows the relationship between disarming uncertainty and penetration uncertainty. The area enclosed by a point and the two axes denotes first-strike uncertainty. In the mid-1980s, the United States had no missile defences, so the penetration uncertainty equalled one. The country is currently building a BMD system, but its low level of effectiveness means that the penetration uncertainty decreases only slightly. At the same time, China has continued to modernise its nuclear forces and the survivability of its nuclear weapons has been improved, so the disarming uncertainty is much greater than it was in the mid-1980s. Taken together, current first-strike uncertainty is greater than it was in the mid-1980s, so the Sino-American strategic relationship is stable.

In the future, the situation will be more complicated. Firstly, China will continue to modernise its nuclear forces over the next 10–15 years, so the disarming uncertainty will increase. At the same time, the effectiveness of missile defence is unlikely to greatly improve. As a result, a probable outcome is that first-strike uncertainty will continue to increase, and the Sino-American strategic relationship will remain stable. But paradoxically, China might overestimate the effectiveness of the United States' BMD systems, especially if Washington insists on developing and deploying them unilaterally, regardless of other countries' concerns. Beijing might therefore see its first-strike uncertainty as being greatly lowered by these systems and lose confidence in its nuclear-deterrence capability. In the long term, China will continue to modernise its nuclear forces and might be able to build quiet ballistic-missile nuclear submarines, raising the disarming uncertainty to almost 100%. The effectiveness of the United States' BMD might be greatly improved by combining advanced missile-defence structures, forward-deployed sensors and highly capable and relocatable interceptors. Such a development would result in strategic instability.

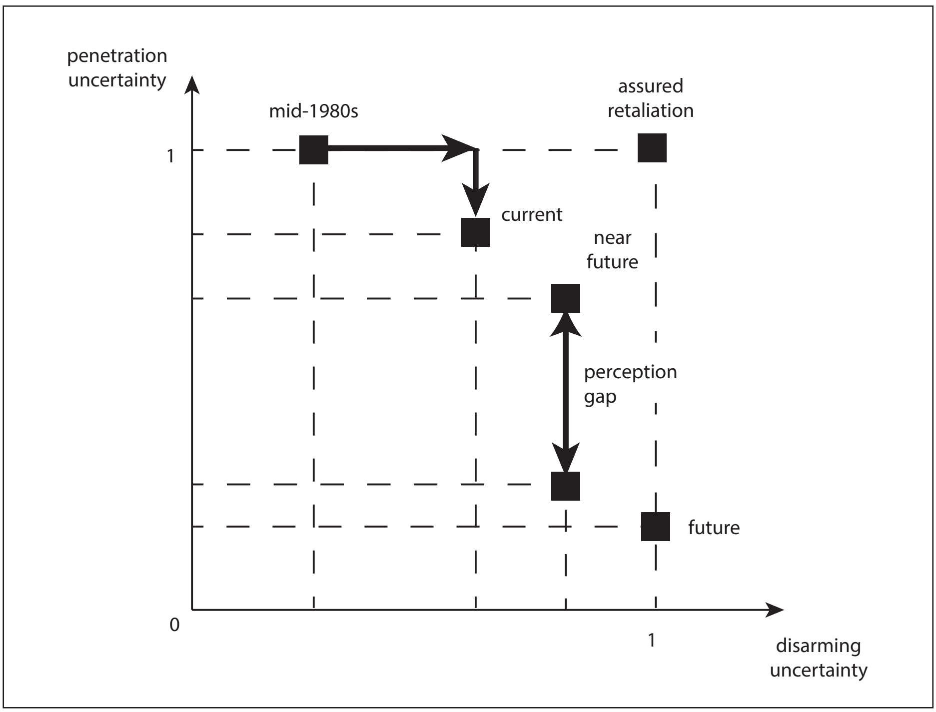

Figure 11. **Model of Sino-American strategic stability**

A delicate balance of defence and offence

To avoid a defence–offence arms race, it is very important for China and the United States to resolve the BMD dilemma. China's unique strategic situation makes finding a solution both extremely difficult and urgent. Firstly, China's nuclear force is small and relatively vulnerable. A small BMD system may be able to absorb China's low numbers of retaliatory nuclear warheads. Secondly, China operates both nuclear and conventional ballistic missiles. The latter capability gives the United States a reasonable motivation to develop tactical BMD systems. But certain tactical BMD assets can be used for strategic purposes, thereby undermining Sino-American strategic stability. Finally, China might become involved in conflicts with the United States over islands in the South and East China Sea, or over the Taiwan issue. Without an agreement at the strategic level, the risk of nuclear escalation will be very high. My suggestions for solving the problem reflect my personal views – with which other Chinese scholars and officials might disagree – and can be considered as a starting point for future discussions.

A possible solution to the dilemma is that the United States commits to maintaining a low level of BMD effectiveness – enough to counter North Korea's unsophisticated ICBMs without threatening China's more advanced strategic missiles. In return, Beijing will agree to refrain from expanding its nuclear arsenal. Recall former US Senator Sam Nunn's statement that 'national missile defense has become a theology in the United States, not a technology'.[34] We can therefore label this response to the dilemma the 'theology solution', with reference to the fact that missile defence would become partially symbolic and only capable of dealing with relatively weak threats.

Given that North Korea is the declared target of the United States' BMD and US officials have repeatedly said that the current defence structure can deal with this threat in the near future – as Pyongyang is still far from acquiring an operational ICBM – this solution is in Washington's interest.[35] This assumes that the United States' declaration that its BMD systems are not directed at China is sincere. Beijing has maintained a small nuclear arsenal for several decades, and the only reason it would have to increase its stockpile of weapons is to compensate for its nuclear deterrence being undermined by the United States improving its BMD systems. So this solution is also in Beijing's interest.

Towards the theology solution

China should make it very clear that its purpose is to maintain first-strike uncertainty rather than to achieve nuclear parity. In the United States, opponents of arms control often argue that self-constraint of US strategic capability will probably induce China to sprint to parity. An explicit statement from Beijing and some sort of transparency measures would help to remove Washington's domestic obstacles to potential compromise on BMD issues. This kind of declaration is also in Beijing's interest. In the absence of BMD, China believed that uncertain retaliation was enough to deter nuclear attack. Facing the potential threat of BMD, there is no reason for Beijing to pursue 'assured' or 'credible' retaliation, let alone nuclear parity. All China needs to do is restore the uncertainty that might have been removed by the United States' BMD systems.

Unlike homeland missile defence, US tactical BMD systems are not destabilising. Beijing should acknowledge Washington's concerns about theatre ballistic missiles, including China's conventional ballistic missiles. Sino-American offensive and defensive competition at the tactical level is different from that at the strategic level. At the strategic level, no matter how bad their overall relationship, both sides have a common interest in avoiding nuclear war and are therefore motivated to cooperate. By contrast, at the tactical level, if a conventional conflict seems unavoidable, competition between the states is zero-sum, so there is little room for cooperation. Of course, both countries can also work together to decrease the likelihood of a conventional conflict by improving their overall relationship.

However, certain aspects of tactical BMD systems may enhance a state's strategic capability. During the presidency of Bill Clinton, theatre missile defence and national missile defence were separated under an agreement between the United States and Russia. The George W. Bush administration began the deployment of an integrated, layered BMD system, which eliminated the distinction between the two. The Obama administration's PAA plans include upgrading tactical BMD systems (SM-3 Block IA/B) to strategic systems (SM-3 Block IIA/B).[36] Beijing will only accept the United States' use of tactical BMD if there is a clear distinction between tactical and strategic systems.

Equipment such as the forward-deployed radars that can greatly increase the effectiveness of BMD systems are unacceptable to China. Beijing's biggest concern is that such radars will be deployed close enough to China to register the decoy-deployment processes of strategic missiles, which requires them to detect target missiles before booster burnout, tracking them through this phase and the deployment of the re-entry vehicle and countermeasures. Taiwan's PAVE PAWS, and FBX radars in southern Japan and Southeast Asia, have that capability. Decoys and other countermeasures are much lighter than the re-entry vehicle, so the BMD system can identify the real warhead by detecting changes in velocity caused by the deployment of each object. This prevents missile-defence systems from being susceptible to mid-course countermeasures, and should be seen as China's red line, which the United States should not cross.

There is no smoking gun

North Korea has launched a space rocket that could be modified for use as a ballistic missile on several occasions. Former US Secretary of Defense Robert Gates said in 2011 that Pyongyang could have ICBMs within five years, but this is not the first time that the United States has rung the alarm.[37] For example, a 1998 report on ballistic-missile threats presented to Congress concluded that 'a new strategic environment now gives emerging ballistic missile powers the capacity, through a combination of domestic development and foreign assistance, to acquire the means to strike the U.S. within about five years of a decision to acquire such a capability.'[38] Yet it is questionable that North Korean ICBMs pose an imminent threat.

Due to North Korea's territorial limits, it is extremely unlikely that the state will be able to build an operational ICBM in the foreseeable future. Washington's argument is that because North Korea has demonstrated a delivery capability in space launches, it should be seen as able to build a missile with such a capability. This contention, which is based on worst-case assumptions, ignores the difficulty of developing a re-entry vehicle, and therefore exaggerates the threat. Re-entry heat-protection technology for long-range missiles is very challenging to develop and cannot be tested in space launches. Gaining reasonable confidence in such a capability requires carrying out a flight test of an ICBM to evaluate its re-entry vehicle. It is not necessary to test an ICBM's intercontinental range because it can be directed on a depressed trajectory at a relatively short range, thereby recreating the re-entry conditions of a normal launch. However, North Korea is too small a country to carry out this kind of test in its own territory. An alternative is to launch the missile from land into the sea, but Pyongyang would have to protect the impact area and recover the re-entry vehicle. It seems unlikely that the North Korean navy can accomplish this task.

China's experience of developing ICBM technology shows how difficult it is to design a working re-entry vehicle. Beijing conducted three depressed-trajectory flight tests of its DF-5 ICBM in 1971, 1972 and 1973 – all without success. China then modified the DF-5 into the CZ-2 space-launch vehicle, and successfully sent several satellites into space during 1975–78. Between 1978 and 1979, depressed- and lofted-trajectory flight tests also met with success. Finally, in 1980, China conducted a full-range flight test of the DF-5.[39] After the first series of flight tests proved the heat shield of the re-entry vehicle to be inadequate for a full-range ICBM, Beijing decided that the development of such missiles would be divided into two steps: the first would cover the shorter-range DF-5 and the second the full-range DF-5A. The DF-5A was eventually flight tested in 1993.[40]

Analysts previously thought that the second stage of the North Korean *Unha*-3 rocket was based on the advanced technology of the Soviet SS-N-6, and if transformed into an ICBM could deliver a 1-tonne payload at a range of 10,000km. But following Pyongyang's successful space launch on 12 December 2012, it was discovered that the second stage of the *Unha*-3 was based on *Scud* technology, and that North Korea had never flight-tested an SS-N-6 engine.[41] Without an SS-N-6 engine, the state would need to cluster a greater number of *Scud*/*Nodong* engines to build an ICBM. Theoretically, North Korea could build an ICBM based on *Scud*/*Nodong* technology, but such a missile would be cumbersome and have very low reliability.

Given the technical difficulty of developing an ICBM and the very slow progress of the North Korean missile programme, there are no technical grounds for the United States to develop Asia-Pacific strategic BMD in the near future. Washington's approval of unnecessary BMD will inevitably be cause for concern in Beijing.

* * *

China's small nuclear arsenal makes it much more difficult for Washington to reach a solution on BMD issues with Beijing than with Moscow. Fortunately, China's unique nuclear philosophy provides a window of opportunity. Beijing has no desire to achieve either nuclear parity or assured retaliation, but simply wishes to maintain a degree of first-strike uncertainty in the presence of BMD. It is therefore possible for the United States and China to find a solution that addresses US concerns about North Korean missile threats without weakening Chinese nuclear deterrence. An analysis of the technical and political effects of the United States' BMD on China's nuclear deterrence suggests such a solution: in return for Washington maintaining a low level of BMD effectiveness, Beijing will promise to refrain from expanding its nuclear arsenal. To achieve this result, both China and the United States will need to restrain their offensive and defensive capabilities, increase transparency and enhance bilateral dialogues.

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