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Missile Defense, Deterrence and Arms Control:

Contradictory Aims or Compatible Goals

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Contradictory Aims or Compatible Goals?

Wilton Park/UNIDIR

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CONTENTS

Page

PREFACE

At the end of February 2001 the United Nations Institute for Disarmament Research (UNIDIR) and Wilton Park held a meeting to discuss the issues of missile defence, deterrence and arms control at the Wilton Park Conference Centre in the United Kingdom. Forty-six governmental and non-governmental experts from seventeen countries, including officials from international organizations, participated in the meeting.

This was sponsored through generous contributions from the Carnegie Corporation of New York, the Government of France, the Government of Italy and the Cooperative Monitoring Centre at Sandia National Laboratory, United States.

The meeting was structured into eight sessions looking at political, technical, national and regional perspectives on missile defences. Specific attention was paid to the implications of the latter for arms control and international security. A wide range of views was presented and this report attempts to outline the breadth of discussion and highlight the main points and proposals arising from the discussion. The meeting took place under “Chatham House Rules” (i.e. off the record); as such, none of the views expressed herein are attributed to any one participant or organization.

Given the events that followed the meeting in 2001: the attacks on the United States on 11 September; the military action in Afghanistan; the United States announcement of withdrawal from the Anti-Ballistic Missile (ABM) Treaty; and the collapse of the Review Conference for the Biological and Toxin Weapons Convention (BTWC), UNIDIR and Wilton Park are anxious that the debate on missile defence, deterrence and arms control should continue in the public domain. This report is an attempt to reflect the discussion that took place during the meeting and may be cited and used in reference.

We are very grateful to our sponsors for this meeting and to all the experts who participated in it. Heather Ingrey of Wilton Park deserves a special mention for the superb organization of the meeting. Our thanks

go to UNIDIR researchers Vipin Narang and Fanny de Swarte who spent a significant amount of time and effort deciphering notes and summaries of the discussions to produce this report. Thanks also to Steve Tulliu for editing the report and to Anita Blétry for bringing the report to publication.

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THREAT ASSESSMENT

While the 1991 Gulf War demonstrated the capacity of small States such as Iraq to acquire short-range ballistic missile capabilities for use in tactical settings, it is the growing propensity of such nations to acquire longer-range capabilities to be used in non-theatre scenarios that the United States of America cites as one of its most pressing international security threats. Currently, 38 States possess some functional form of ballistic missile capability. Of these, however, only 11 have medium range (>1,000 km range) capacity, and only the five permanent members of the Security Council have intercontinental ballistic missile (ICBM) capability.[1] The 1998 Commission to Assess the Ballistic Missile Threat to the United States, chaired by current Secretary of Defense Donald Rumsfeld, was charged with examining the likelihood of hostile States to progress from short-range or intermediate-range capabilities to long-range technology. Specifically, the Rumsfeld Commission highlighted the growing ballistic missile capabilities of so-called "rogue States" such as the Democratic People's Republic of Korea (DPRK), Iran and Iraq. The timeline for such nations to acquire ICBM capabilities was posited as early as five years for some States, and in the order of a decade for others. Iran, for example, has successfully tested the 1,500 km range Shahab-3 missile[2] of which it is now developing longer-range versions.

Of greatest concern to Washington, however, is the DPRK's acquisition of indigenous ICBM and nuclear capabilities. Pyongyang has already successfully flight-tested its 1,500 km range No-Dong missile and proceeded to transfer that technology to Iran and Pakistan. Six weeks after the Rumsfeld Commission report was released, the DPRK flight-tested a Taepo-Dong 1 missile over the Sea of Japan which, contrary to

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1 A short-range ballistic missile (SRBM) has a range of less than 1,000 km. A medium-range ballistic missile (MRBM) has a range of between 1,000 km and 3,000 km. An intermediate-range ballistic missile (IRBM) has a range of between 3,000 km and 5,500 km. An ICBM has a range of more than 5,500 km.

2 A derivative of the DPRK's No-Dong missile.

Central Intelligence Agency (CIA) expectations, possessed a solid fuel third stage.[3] The test only lent credence to the Rumsfeld Commission's conclusion that the DPRK would imminently be capable of targeting United States territory. In July 2001, the CIA reported that the DPRK had conducted engine tests for its Taepo-Dong 2 missile, which would be capable of targeting mainland the United States. It is this emerging threat, along with the activities of other potentially hostile nations—reconfirmed by the 1999 National Intelligence Estimate Report—that the United States cites as the primary warrant for a ballistic missile defence.

Cited as less likely threats are accidental or unauthorized launches by existing or future ballistic missile States. The probability of such a strike is low, especially given efforts to stabilize and upgrade command and control infrastructure in States where this may be likely—for example the Russian Federation. The Cooperative Threat Reduction programme, has done much to alleviate concerns that the Russian Federation's nuclear and ICBM arsenal is unsafe. Still, the potential for accidental or unauthorized launches clearly exists and is used as a further justification for building missile defences to protect the United States and its forces. Needless to say, a missile defence system provides no protection against sub-State or State-sponsored terrorists who can infiltrate the United States of America's porous borders with relative ease and covertly detonate a weapon of mass destruction (WMD)—a threat that some consider much greater than a limited ballistic missile attack.

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3 The test was ostensibly aimed at placing a satellite, mounted on the third stage, into orbit. It failed when the third stage failed to release properly.

RESPONSE

To address the threat of emerging hostile ballistic missile threats, the United States takes a three-pronged approach: diplomacy, deterrence and defence. The first element, diplomacy, centres on arms control regimes designed to prevent the spread of missile and WMD technology. In practice though, for the United States this often means utilizing its diplomatic and economic leverage to dissuade States like the DPRK from pursuing potentially menacing capabilities. The 1994 Agreed Framework represents what some in Washington consider an example of a successful diplomatic effort to stymie weapons of mass destruction capabilities. High-level exchanges, engagement, and integrating a given State into accepted international norms of conduct are Washington's primary diplomatic tools used to prevent the proliferation of ballistic missile capabilities.

If diplomacy fails, Washington can rely on its formidable military means to prevent and deter States from threatening the United States or its interests. One possible option, almost exercised in 1994 against the DPRK, is strategic air strikes against key WMD or ballistic missile facilities as a means of preventive defence. While this response is risky, it can largely stymie a State's ability to develop threatening capabilities—Israel's strike against Iraq's Osirak nuclear reactor in 1981 is believed to have set back Iraq's nuclear programme by a number of years. In the event that a State is nevertheless able to acquire significant WMD and ballistic missile capabilities, the United States counts on its powerful conventional and nuclear forces as a deterrent. The threat of overwhelming retaliation in the event of a strike against United States, its allies or interests aims to deter a State from using ballistic missiles and WMDs. This policy of deterrence is quite credible both from a capability and resolve point of view.

Nevertheless, to hedge against the possibility of deterrence failure, the United States is intent on pursuing a third response to emerging ballistic missile threats, and against accidental and unauthorized launches, namely the development of ballistic missile defences (BMD). The United States desires an added layer of security against emerging ballistic missile threats in the unlikely event that deterrence fails to prevent attack. Specifically, United States leaders have cited the "act of desperation" scenario as a probable scenario during a possible war with so-called rogue States. Some contend that an unseated implication is that the United States does not want to be deterred itself by ballistic missile capable States. Missile defences would preclude the United States from being held hostage to coercive diplomacy or blackmail by rogue States. If diplomacy and deterrence break down—and there are circumstances under which this is conceivable—the United States currently feels that it must have the means to defend itself.

Accordingly, the last five years especially have witnessed growing calls in the United States Congress for a national missile defence (NMD) system that would protect the United States homeland from incoming ballistic missiles, regardless of their origin. While President Clinton was not particularly enthusiastic about NMD, he nevertheless placated a hawkish Republican Congress by pursuing research on ground-based "midcourse systems". A decision on deployment was deferred to September 2000, however, on the grounds that the technology was unproven. The Bush Administration has pledged to pursue defensive deployments more vigorously to address the new breed of emerging threats. President Bush has made it explicitly clear that he considers the ABM Treaty to be a relic of the Cold War and wants to "move beyond it" to address today's pressing threats. No longer regarding itself constrained by the ABM restrictions, the Bush Administration is pursuing more elaborate defensive measures that will serve as a comprehensive missile defence architecture, both for national and theatre purposes (theatre missile defence—TMD). Although plans have been vague, they ostensibly include not only ground-based midcourse systems, but also air- and sea-based boost phase options, terminal defence systems and possibly even space-based defence systems.

TECHNICAL ASPECTS OF MISSILE DEFENCE

Missile defence systems are comprised of a broad array of technical measures designed to target incoming missiles—either ballistic or cruise—at some point along their flight trajectory. Short-range theatre ballistic missile defences, such as the Patriot Advanced Capability (PAC-3) system which the United States employed to protect its forces and allies vulnerable to Iraq's Al-Hussayn Scud-derivative missiles, were the subject of much attention during the Gulf War. Since a short-range ballistic missile is powered for most of its flight, and thus has a plume of hot gases trailing it, missile interceptors have a relatively well-differentiated target to hit. In addition, short-range ballistic missile flight trajectories are entirely endoatmospheric, which affords tracking, sensory, and targeting advantages. As such, the United States has been able to develop rather sophisticated, albeit debatably effective, short-range theatre missile defences for tactical wartime scenarios where its troops or allies are at risk.

A natural technical extension of short-range ballistic missile defences such as the Patriot system is intermediate and long-range ballistic missile defence systems which, instead of targeting missiles in tactical situations, aim to defend against an entirely different class of missiles that target a State's homeland. Lately, this class of ballistic missiles has received the most attention, with the United States pledging to deploy some version of ballistic missile defence by the end of this decade, if not sooner. Unlike cruise missiles, which are powered for the entirety of their flight, ballistic missiles are powered only for part of theirs—thereafter they move under the influence of their own momentum and gravity. Employed as the primary delivery vehicle of strategic nuclear weapons, the flight path of a ballistic missile is divided into three distinct stages.

Boost Phase

The first stage is termed the boost phase, where the warhead—which can be conventional, nuclear, chemical or biological—is mounted on a single or multistage booster. Various types of rocket boosters have been developed across the world, with more advanced boosters employing solid fuel or cryogenic systems as opposed to simple liquid fuel. Depending on the range of the missile, the boost phase of a ballistic missile is designed to accelerate the warhead to velocities upwards of 6-8 km/s in order to reach high endo-atmospheric or low exoatmospheric orbit, which is the second phase of ballistic missile flight. The crucial note about the boost phase is that it is the only stage during which the ballistic missile's rocket motors are burning, leaving a distinct signature plume that allows detection and tracking. However, since the booster rockets only have to place the warhead in orbit in the exoatmosphere (no more than 200 km above the earth), the duration of the boost phase is only between two to five minutes depending on the range of the missile.[4]

Midcourse Phase

The second phase of the missile flight, also known as the midcourse of the ballistic missile trajectory, is where the warhead separates from the rocket booster and moves under its own momentum and under the force of gravity. For ballistic missiles with a greater range than 600 km, the midcourse of the missile trajectory is in the exoatmosphere—in the low exoatmosphere (approximately 250 km high) for IRBMs and in the high exoatmosphere (approximately 1,300 km high) for ICBMs. In both cases, the warhead cools to sub-zero temperatures as it arcs through lower outer space, reaching the apex of its parabolic path before beginning its descent in the third phase of the flight path: atmospheric re-entry. For defensive considerations, it is essential to note that the midcourse of the ballistic missile flight path unfolds in a cold zero-gravity, zero-air resistance environment, where a feather moves at the same rate as a warhead. This affords the offence enormous advantages for it can deploy decoys, e.g. mylar balloons, that look like and act like warheads in such an environment, thus placing enormous—perhaps insurmountable—sensory burdens on the intercepting vehicle. However, this phase of the missile trajectory is by far the longest, ranging from about 10 minutes for IRBMs to over 20 minutes for ICBMs.

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4 For example, an SRBM with a range of 600 km has a boost phase lasting 90 seconds, an IRBM with a range of 3,000 km has a boost phase of 120 seconds, and an ICBM with a range of 10,000 km has a boost phase of 300 seconds.

Terminal Phase

The third and final phase of a ballistic missile trajectory is warhead re-entry, also termed the terminal phase of the ballistic missile flight path. As the warhead descends back towards Earth, atmospheric gases heat it as it falls towards the target. Once a warhead begins atmospheric re-entry, it is less than two minutes away from detonation at the target. Old ballistic missile defence designs, such as the Sentinel system of the late 1960s and later the Safeguard system, targeted ballistic missiles in their terminal phase. The latter deployed 20 Spartan rockets and 80 Sprint interceptors around American Minutemen silos in North Dakota. Owing to the short duration of the terminal phase, defences that target the warhead in this phase usually get only one shot at the incoming warhead and must therefore be highly accurate and effective, with attrition rates approaching 100 per cent. The PAC-3 theatre short-range ballistic missile defence targets incoming missiles in the terminal phase of their flight path.

Interception

Because there are three distinct phases in a ballistic missile's flight path, one could theoretically devise systems designed to engage the missile along any or all of these stages, each with its own advantages and disadvantages. The majority of United States efforts have been aimed at targeting the warhead in the midcourse phase in the exoatmosphere for two reasons. First, the warhead is in this phase the longest—for an ICBM aimed at the United States, the midcourse phase will last roughly 20-25 minutes—giving decision makers and interceptor vehicles, also known as the hit-to-kill vehicles (HKVs), more time to track and intercept the incoming warhead. Second, the architecture required for an American midcourse defensive system can be mostly ground-based and employ many existing components (with upgrades) such as its X-band radars and space-based infrared system (SBIRS) satellites.[5]

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[5] SBIRS-high and SBIRS-low satellites would be used to detect and track a missile launch.

Former President Clinton's midcourse NMD proposal called for this midcourse targeting strategy to be implemented in three phases: progressing from a Capability 1 (C1) to Capability 3 (C3) architecture. The C1 architecture called for 100 interceptors deployed in Alaska, with five upgraded early-warning radars including ones in Thule, Greenland and Flyingdales, United Kingdom, one X-band radar in Shemya, Alaska, and 10 SBIRS detection and tracking satellites. The final C3 architecture called for 125 interceptors in both Alaska and North Dakota, six upgraded early-warning radars, nine X-band radars, and 29 SBIRS satellites. This "3+3" plan[6] enunciated in 1996, mandated three years of research before making a deployment decision. After postponing decision for a year, in September 2000, President Clinton decided to defer deployment in the light of two failed integrated flight tests out of three.[7] The crucial component in the midcourse defensive architecture—the HKV—which primarily employs on-board infrared and thermal sensors to detect, differentiate, and intercept the warhead in the exoatmosphere, did not demonstrate a capacity to effectively perform its assigned function.

As a result, the missile defence decision has now been passed to the Bush Administration which, led by Secretary of Defense Donald Rumsfeld, pledges to pursue and deploy a missile defence system. The Administration has dropped the "national" nomenclature for a more general approach, ostensibly aimed at protecting America's allies and forces abroad. Details about the Bush proposal are scant, but official testimony before the United States Senate Armed Forces Committee on 12 July 2001 by Deputy Secretary of Defense Paul Wolfowitz noted that the Bush Administration "intends to develop defences, capable of defending against limited missile attacks from a rogue state or from an

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6 Three years of research followed by a deployment decision with a three-year deployment time frame.

7 Integrated Flight Test 1 (IFT 1) occurred on 2 October 1999 using a Boeing exoatmospheric HKV and was deemed successful, but it was later revealed that the HKV actually homed in on the decoy. IFT 2 was conducted on 18 January 2000 and failed due to a malfunctioning infrared sensor on the HKV. IFT 3 was conducted on 7 July 2000 and failed when the HKV failed to separate from the booster rocket.

accidental or unauthorized launch. [They] intend to develop layered defences, capable of intercepting missiles of any range at every stage of flight—boost, mid-course, and terminal". No specific architecture has been presented, but Paul Wolfowitz has agreed that the Clinton Administration architecture was not designed for maximum effectiveness, but rather to remain within the constraints of the ABM Treaty. The Bush Administration, having already pledged to modify, if not scrap, the ABM Treaty, is instead pursuing technologies with greater potential effectiveness—sea-, air- and space-based. Consequently, the Bush missile defence plans to counter limited ballistic missile strikes appear to be much more expansive, with redundancy and layered systems, than anything the Clinton Administration envisaged. Some missile defence experts question whether the threat of limited strikes from a so-called rogue State—whose likelihood of being deterred by the United States nuclear and conventional forces is considered high—warrant such an elaborate, expensive and diplomatically challenging system. Nonetheless, the Bush Administration appears set to pursue and eventually deploy some form of missile defence.

Multilayering

As already noted, however, there are clear advantages and disadvantages in attempting to intercept a ballistic missile at each stage along its flight trajectory. In planning to build intercepting systems for each stage, the Bush Administration is clearly trying to use multilayering as a means of mitigating each individual system's shortfalls. For midcourse ground-based systems as pursued by the Clinton Administration, and likely to be mostly continued by the Bush Administration, the advantages are threefold. First, the midcourse phase is the longest stage of the ballistic missile's flight path, affording decision makers and the component systems more time to detect, track and intercept the incoming missile. For the United States, any incoming ICBM would have a midcourse phase lasting approximately 20 minutes, allowing the defensive system to intercept the warhead at a time and range that is more feasible and convenient for Washington. Second, a ground-based midcourse system employing the architecture proposed by the Clinton Administration, once technologically feasible, would be in relative terms more efficient than other types of BMD systems. Once the HKV is capable of tracking and distinguishing the warhead in the exoatmosphere, it is more likely to be able to do so effectively and with the necessary attrition rates from a fixed ground-based system as opposed to a mobile system at sea which would require component adjustment and realignment prior to each interception. Finally, the interception would occur in the exoatmosphere, with the resulting payload being released there as opposed to over any populated regions on Earth. For nuclear, biological and chemical warheads, this is a tremendous advantage, for the risk posed to civilian populations is thus minimized.

Decoys and Countermeasures

However, the disadvantages of the ground-based midcourse architecture are quite substantial, perhaps even insurmountable. Primarily, there is unequivocal concern that decoy measures could easily and fairly cheaply defeat any proposed midcourse system. Because the midcourse defence targets an incoming warhead in the cold zero-gravity, zero-air resistance environment of the exoatmosphere, where a balloon and a WMD warhead would register at roughly the same temperature and move at the same rate, the differentiation capabilities of the HKV must be extremely sensitive and accurate. Further, the primary sensors on the HKV would be infrared, which detect signatures along the optical spectrum, and thermal, which detect temperature differentials. Consequently, the offence could simply deploy a multitude of mylar balloon decoys, each heated by a one-pound lithium battery to mimic the warhead temperature, and wrap the actual warhead in the same mylar covering, forcing the HKV to differentiate between the decoys and the actual warhead—currently a prohibitively difficult task.

Decoy technology is not entirely trivial, for the decoys must be released and deployed properly and embark on the correct trajectories, requiring extensive range tests. Still, decoys designed to defeat an exoatmospheric system would be easier to develop since they are not forced to operate with air and gravity resistance. The general sense is that any State capable of developing ICBM technology would have more than sufficient technical capacity to develop effective countermeasures to defeat a midcourse system, since sophistication in devising decoys is not a stringent requirement. Of course, the United States could respond with counter-countermeasures such as spatial sensory technology that allows real-time visualization and tracking of the warhead or simply more sophisticated thermal and optical sensors. Nonetheless, the current general sense is that the offence has the advantage over missile-missile defence systems since, for every defensive advance, a large number of defeating countermeasures can be devised and deployed. The qualification on the two successful integrated flight intercepts, the most recent of which was on 14 July 2001 is that the tests are unrealistically choreographed for success—since "chaff is simple and cheap",[8] the offence has a tremendous advantage if the defensive scheme targets the ballistic missile in the midcourse.

The prospect of countermeasure deployment is further complicated by the second major drawback to midcourse systems—the so-called "hitting-a-bullet-with-a-bullet" problem. That is, the speed at which the warhead and HKV close on each other approaches 8 km/s (28,800 km/hr), meaning that the HKV has nary a fraction of a second to distinguish the actual warhead in a potential sea of decoys and align itself on an intercept trajectory. And, for any midcourse defence to be effective, it would have to do so with unprecedented reliability. Given that no integrated flight tests have been conducted with more than one decoy, there is no technological evidence that the United States has the capacity to develop HKVs that can quickly distinguish warheads from decoys and intercept them at the tremendous speeds reached in the exoatmosphere.

A third major complication to midcourse defences is oversaturation, which can be achieved in multiple ways. In principle, biological bomblet warheads and multiple independently-targeted re-entry vehicles (MIRVs) pose the same problem for a limited midcourse defence system that uses an HKV. It would be very difficult to defend against the simultaneous release of multiple warheads, whose technology is within perhaps a decade's reach for would be proliferators. It would require the launch of multiple HKVs which would each correctly differentiate and intercept different warheads, again most likely among a plethora of decoys. While the midcourse defence is not designed to defend against large strikes, the

[8] Joe Cirincione in "Missile Interception Test was Hit-and-Miss", *The New York Times*, 19 July 2001.

threshold strike for which a midcourse system could be effective is estimated to be in the order of tens of missiles, or roughly China's current ICBM arsenal. But even with an 80 per cent attrition rate—generous according to former Defense Secretary William Perry—a midcourse defence could become oversaturated at even lower thresholds.

Fourth, a fixed ground-based midcourse system would leave key components such as the X-band radars vulnerable to attack. A ballistic missile attack from any potential aggressor would most likely be preceded by some form of conventional strike against the system's key detection and tracking components, rendering it impotent against the impending ballistic missile launch. Anecdotally, America's early warning for an impending missile attack would be when a rain of missiles fell at Thule and Flyingdales.

Finally, a midcourse ground-based system would only suffice to protect the United States homeland. The architecture for such a system would be a poor defence in theatres beyond the United States homeland since ballistic missile flight times in those theatres would be short and the interceptors quite distant from the point of attack. Although a midcourse system would only protect the United States homeland, it could do so regardless of where the missile strike originated—it is not threat specific. Hence Russian and Chinese concern that any "limited" midcourse national missile defence, once the technology had been mastered, could easily be upgraded to defend against their existing arsenals. Clearly, once the United States is capable of deploying 100 interceptors to effectively intercept ballistic missiles in the midcourse phase, there is little to stop Washington from deploying 1,000 interceptors to defend against a Russian strike.

Boost Phase Interception

Because of the technical hurdles to targeting a ballistic missile in the midcourse of its trajectory, many experts are moving towards the consensus that pursuing a ballistic missile defence for the boost phase is the most feasible option. Two types of boost phase defences have been suggested: sea-based platforms, most likely on Aegis cruisers, and airborne laser systems either on manned or unmanned aerial vehicles.

In both cases, the range of defence around the platform is no more than 1,000 km, meaning that the United States would have to deploy its boost phase platforms off the coasts of the given threat. The crucial implication is that such systems would only be effective against small States such as the DPRK, Iran and Iraq[9]—they are, therefore, threat specific. Such systems would be entirely ineffective against ballistic missile launches from large States such as China and Russia that could launch from deep within their own territory and thus place an ICBM warhead in orbit before any boost phase system could target it.[10] Thus, Moscow is somewhat more amenable to boost phase options if the proposed platform is land-, sea- or air-based (it vehemently opposes space-based options for obvious reasons).[11] In addition, a key tactical advantage for the United States is that a boost phase system is mobile and threat specific, serving simultaneously as a theatre missile defence for United States forces and allies as well as a defence against missiles launched against the United States homeland.

The technical advantages to a boost phase system centre mostly on the fact that it avoids many of the complications of the midcourse system. While most of the detection and tracking components would be the same as for a midcourse system, the key difference is the technological sophistication required of the kill vehicle. Primarily, the boost phase is the phase during which the missile is under powered flight in the endoatmosphere and thus has a clear signature of hot trailing gases that are easily detectable by existing sensory technology. In addition, the missile is under such high shear stresses in this phase that the kill vehicle does not have to target the warhead directly; it can defeat the missile by hitting any part of the missile—a relatively large target—thus reducing

9 Boost phase defences against Iran are complicated because of its geography and larger land mass—some have suggested a Caspian Sea platform, but the Caspian Sea is landlocked. Different platforms would also have to be used to defend against launches from northern and southern Iran.

10 This is only true for airborne and sea-based boost phase platforms. Space-based boost phase options could potentially target a ballistic missile launch *anywhere* on the globe, including deep into Russian or Chinese territory.

11 The ABM Treaty would nonetheless have to be modified to allow for sea-based boost phase options.

the accuracy burden. Even if the boosters were destroyed but somehow the warhead remained intact, the latter would not have the necessary velocity to reach the intended target, and would most likely crash onto the aggressor's territory. Moreover, because the warheads and any decoys have not yet separated from the booster rockets, boost phase systems would only have to chase and destroy one easily distinguishable vehicle to defend against a strike.

The challenges to a boost phase system, however, are by no means trivial. Unlike a midcourse or terminal defence which intercepts an incoming ballistic missile head-on, a boost phase system would require an interceptor to chase after a ballistic missile after it had already been launched and during its period of highest acceleration. And, because the boost phase lasts less than five minutes, sometimes substantially less, decision-making would have to be devolved to field commanders who would have to fire almost immediately on launch to have any hope of catching the ballistic missile as it accelerated towards the exoatmosphere. The United States is hoping to develop interceptors capable of accelerating to 9 km/s to catch a 7-8 km/s moving ballistic missile—this gives decision makers less than 60 seconds to make a launch decision. Still, technology is not the prohibitive element for boost phase defences. Some potential countermeasures that the offence could employ include shortening burn-times, launching decoy flares, missile rotation during ascent, and utilization of heat shields; all of which attempt to minimize the interceptor's capability to differentiate and track the ascending missile. However, since the ballistic missile is still in the endoatmosphere, distinguishing the correct target is significantly easier than having to do so in the midcourse. No matter what countermeasures the offence employs, it must still launch a large, easily visible missile that is essentially a warhead mounted upon a large gas tank that emits a detectable exhaust plume. Intercepting it is a much simpler task than hitting a small, cold warhead dispersed among a plethora of decoys in lower outer space.

Because the interceptor technology required for a boost phase defence is not as prohibitively demanding as that for the midcourse defence, most notably for the key kill-vehicle component, most scientific experts are strong proponents of abandoning midcourse efforts in favour of boost phase alternatives. If deployed at sea or in the air, the time frame for a fully functional system is predicted to be about a decade—the same time frame as President Clinton's original C1 capability. In addition, because the system is threat specific—designed to put a "lid" on small States thought to have an impending limited ballistic missile launch capability—and serves as both a TMD and an NMD, it is more acceptable to the international community (some modifications of the ABM Treaty would still be required though, since mobile defences are not currently allowed). Hence the recommendation of many BMD experts that if the United States were to pursue any sort of defence, it should be a boost phase option deployed at sea or in the air.

Terminal Defences

Terminal defences have the least technical support as a national missile defence system,[12] but could conceivably be deployed as a redundancy measure to "clean up" any warheads that penetrated a boost phase or midcourse defence. Terminal defences are plagued by the short time between the warhead's re-entry into the atmosphere and detonation (less than two minutes) and must be effective enough to destroy the incoming warheads at an altitude high enough to avoid harming civilian populations below. Although simple decoys would disintegrate upon re-entry, the offence could still oversaturate terminal defences by developing more sophisticated "dud" warheads that survive re-entry and which place added burdens on the defence. The offence could also take stealth measures, such as cooling the warhead upon re-entry to limit its visibility to sensors, or electrical or optical measures to confuse the defence. A terminal defence alone, while it probably conforms most strictly to the ABM Treaty, would probably not be an effective homeland defence (it is, however, the United States of America's primary theatre missile defence system against endoatmospheric short-range missiles as in the PAC-3).

The Bush Administration has pledged to pursue all three types of missile defence—midcourse, for which the architecture has begun and

[12] The PAC-3 theatre missile defence system is a terminal defence system, which can be effective for short-range ballistic missiles.

four integrated flight tests (two successful intercepts) conducted, boost phase and terminal—hoping to introduce redundant defence systems so that the strengths of each type of system compensate for the weaknesses of the others. The boost phase option, if pursued vigorously, could conceivably be deployed the fastest and most inexpensively. It is the most technically feasible and avoids the pitfalls of trying to target a ballistic missile in the midcourse after the warhead (and any decoys, etc.) have separated from the large and relatively slow-moving booster rocket. Uniquely, it is threat specific and serves as both an NMD and potentially a TMD for United States forces and allies. Boost phase defences deployed in the endoatmosphere are capable of defending against only limited strikes from emerging small-State threats and are thus more palatable to the broader international community.

NATIONAL AND REGIONAL PERSPECTIVES ON MISSILE DEFENCE, DETERRENCE AND ARMS CONTROL

United States

The current missile defence debate can be seen largely as an offspring of the Strategic Defence Initiative (SDI) launched by the Reagan Administration in 1983. While SDI was (as originally enunciated) meant to protect the United States from a fully-fledged missile strike from the Soviet Union, today's version of missile defence is meant to protect against limited missile strikes. Although SDI was abandoned years ago, in some Republican quarters the idea of a nationwide missile defence has survived. In 1995 this resulted in Congress passing legislation mandating the deployment of a limited national defence system. President Clinton, however, vetoed the legislation, arguing that there was no threat justifying NMD deployment. Nonetheless, under congressional pressure, he did eventually agree to a programme whereby a limited system would be developed followed by a decision on deployment.

In 1998 the NMD debate was radically altered by two events. First, the report of the Rumsfeld Commission asserted that "rogue" States such as the DPRK or Iran could develop ICBMs within five years with little to no warning. Second, later that year the DPRK launched a three-stage Taepo-Dong 1 missile, proving the technological capability of the DPRK and undermining the Clinton Administration's key argument about postponing an immediate decision. The National Missile Defence Act of 1999, which was passed half a year later, mandated that a limited NMD system should be deployed as soon as technologically possible.

The transition from a Democratic to a Republican administration will change the current debate considerably, both nationally as well as internationally. This can easily be discerned from the seemingly opposite priorities between Presidents Clinton and Bush. While the former was openly suspicious about the need and effectiveness of NMD systems, the latter has NMD high on his political agenda. The Bush Administration also hopes for full cooperation on this with the United States' allies. Unlike in the Clinton Administration, there is apparently consensus supporting missile defence deployment in the Bush Administration. Still, various approaches to missile defence have emerged from within the Administration. Secretary of Defense Donald Rumsfeld believes that it is a constitutional responsibility of the Government to protect its population and therefore has argued for a unilateral approach to the matter. Under this approach the United States will notify its allies about its missile defence progress, but will not afford them the ability to "veto" any of its decisions. Secretary of State Colin Powell, however, believes in keeping close ties with the allies as well as that the burden of proof for the need, and therefore the introduction of new weapons and new weapons systems, rests with the United States. His preference is to obtain at least some sort of consensus and hopefully full cooperation on the part of the key international actors.

Three other factors could influence the direction of United States policy on NMD in the near future. First, the position of the United States military could be crucial. The latter is unlikely to look favourably upon any scheme that threatens to jeopardize its traditional functions and status. Second, public opinion will remain a wild card—although in principle the public supports the idea of missile defence, it is unclear whether it will continue to do so in the light of the potential costs, both economically and diplomatically. Finally, the midterm congressional elections in 2002 could also cause delay by altering the composition of the United States Congress.

President Bush's missile defence proposals have put a strain on the United States' relations with the international community, both with its traditional allies and with China and the Russian Federation. The latter two strongly object to NMD, fearing that the deployment of even a limited system could easily be upgraded eventually to mitigate their own strategic weapons. China, in particular, is worried that the NMD system is in fact aimed squarely at itself. After all, why would the United States be prepared to remain vulnerable to China's small nuclear arsenal, but not to those of the DPRK, Iran and Iraq? The North Atlantic Treaty Organisation (NATO) countries have not been terribly enthusiastic about the endeavour either, mostly for fear that deployment will evoke a stronger and more hostile Russian Federation in Europe, encourage United States disengagement on the continent, and possibly leave them exposed to bear the brunt of any surrogate attack against the United States.

With regard to disarmament agreements, the Bush Administration clearly favours a cooperative approach on the ABM Treaty but is clearly equally prepared to go it alone in the absence of Russian acquiescence. President Bush is known to regard the ABM Treaty as a relic of the Cold War and has plainly indicated that the United States will go ahead with NMD come what may. This position is consistent with the Administration's seemingly general aversion to arms control treaties (witness Washington's position on the Comprehensive Test Ban Treaty (CTBT) and the Fissile Material Cut-off Treaty (FMCT), for instance).

Russian Federation

The Russian Federation opposes NMD on the grounds that it will resurrect nuclear arms races and destabilize the arms control framework that has taken decades to erect. Moscow does however make a distinction between TMD and NMD. It believes that one of the cornerstones of international stability is the ABM Treaty. Any missile defence plan that falls inside the boundaries of the ABM Treaty, like some TMD proposals[13] would be acceptable to the Russian Federation. These, however, should not be located close enough to pose any threat to its nuclear arms. But the Russian Federation's first priority is to preserve and strengthen the ABM Treaty. Towards this end, President Putin has expressed a willingness to renegotiate the Treaty to allow for sea- and air-based boost phase options. However, the Russian Federation has noted that a boost phase system supplemented with midcourse or terminal systems would not be acceptable, for the latter would theoretically be capable of interdicting the Russian Federation's strategic force.

[13] The Theatre High Altitude Area Defence (THAAD) and Navy Theatre Wide systems, whose interceptors do not exceed velocities of 3 km/s, have been noted as acceptable under the ABM Treaty and its subsequent demarcations.

In order to achieve a better overview of the threats of missile strikes the Russian Federation proposes a Joint Missile Launch Data Exchange Centre, which would eventually open participation to all interested parties. In 1999 the Russian President proposed the Centre as part of a Global Control System (GCS) at the G8 summit in Germany. This proposal was further elaborated during two international conferences in Moscow in March 2000 and February 2001. At the last conference there were representatives from 71 countries and the United Nations Secretariat. The only major party absent was the United States. GCS would consist of a missile proliferation regime, including the Missile Technology Control Regime (MTCR) and other initiatives in this area, a missile transparency regime, cooperation in non-strategic missile defences and development of scientific knowledge and technologies to be used for the benefit of mankind. The missile transparency regime would comprise the Joint Missile Launch Data Exchange Centre. The Centre would in the future accommodate about 200 users (nations). There are two reasons for nations to develop missiles: the need for technological development and to deal with security threats. The Data Exchange Centre would obviate the first reason, because it would provide the data on scientific and technical progress in the area for the benefit of mankind.

Cooperation on non-strategic ballistic missile[14] defence could result in a European defence system. Intentionally, the proposal includes only non-strategic missile defence so as to stay within the boundaries of the ABM Treaty and the Demarcation agreements of 1997. As noted, the preservation of the ABM Treaty is a key priority for the Russian Federation which would also like to see the draft code of conduct, drawn up in Helsinki in October 2000 by MTCR member States, to be considered and finalized. The non-strategic missile defence would consist of joint combat units of continual preparedness, which are internationally recruited and can be deployed (land-based) in any region under threat in Europe. Although the Russian proposal includes at the moment only the European region, it intentionally delivered its plan to

14 This is rather strange since there is still no clear distinction between strategic and non-strategic missiles. Typically, though, strategic missiles are those that have a range of over 5,500 km.

NATO instead of, for example, the European Union, to avoid accusations of seeking to effect a split between the United States and European countries. Transatlantic cohesion is perceived to be good for international stability. The GCS might also develop beyond Europe. Although the proposal is rather vague at the moment, one could see it as a gesture on the Russian Federation's part to open negotiations. This would be to the advantage of the European countries, because agreement between the United States and the Russian Federation on NMD could lessen the strategic predicament posed by the United States' insistence on deploying missile defences.

China

China opposes the BMD because it believes that it will undermine both international security and its national security.

Foremost China is concerned with international instability. According to China, BMD will not only endanger the preservation[15] of the ABM Treaty and therefore of the international strategic balance, but it will also undermine any effort on the part of the international community to promote non-proliferation and disarmament. By building up a defensive architecture that threatens the deterrent capabilities of States, a new arms race could start. BMD will undermine the missile capabilities of others and will only increase incentives for ballistic missile proliferation. BMD will also have a negative impact on international cooperation, particularly in the Asian region. Unlike the Russian Federation, China does not distinguish between NMD and TMD. This view stems from the fact that a TMD deployed in either Taiwan or Japan (especially as Taiwan is supposedly already cooperating on the TMD project) would present China with strategic implications. Furthermore, even a limited BMD could mitigate China's 20 or so ICBMs, forcing it to

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[15] China is so concerned about the preservation of the ABM Treaty that it co-sponsored (together with Belarus and the Russian Federation) a draft resolution entitled "Preservation of and the compliance with the Anti-Ballistic Missile Treaty" during the 54th session of the General Assembly (United Nations document A/C.1/54/L.1/Rev.1). The latter was adopted with an overwhelming majority.

upgrade and expand its nuclear arsenal to maintain a sufficient nuclear deterrent. An upgrade of Chinese nuclear forces, however, would have serious consequences for the region as Delhi, Seoul and Tokyo could feel compelled to take requisite countermeasures. This could then be followed by tertiary effects in Islamabad, Pyongyang and Teheran, and the spread of insecurity on the Asian continent.

China, thus, opposes any form of BMD (although some analysts contend that China is doing its own BMD research or is buying the S-300 technology from the Russian Federation) and believes it would be more profitable to start focusing on the root causes of proliferation rather than to treat its consequences.

Europe

Most European countries are concerned about NMD and the United States tendency to resort to military means to deal with the proliferation of ballistic missiles. Nevertheless, opposition is softening and will probably continue to do so in the future.

There are four feasible scenarios for a missile defence system: a unilateral deployment by the United States; an allied BMD system; a United States BMD system with some partial cooperation or a Global Protection Against Limited Strikes (GPALS) system. From the European viewpoint, all of these are problematic in some way. The unilateral deployment of NMD by the United States, will lead to the dismantling of the ABM Treaty which could in turn result in the breakdown of arms control. Although more concerned with preserving its principles rather than the entire Treaty, European countries are nevertheless reluctant to see the demise of the ABM Treaty. Moreover, the unilateral deployment of NDMs by the United States could also lead to a strategic decoupling of Europe and the United States leading to unwelcome results. Under such a scenario, the United States would turn its back on European concerns leaving Europe without a crucial element of support, or, conversely, the European States could deliberately distance themselves from the United States with much the same consequences. Finally, the unilateral deployment of NMDs by the United States could very well leave an unprotected Europe to bear the brunt of ballistic missiles attacks should the United States' adversaries decide to use Europe as a proxy for striking at United States interests.

The problem with an allied missile defence system is that the political and military decision of interception cannot be shared owing to time constraints and technical reasons. The decision therefore would need to be centralized. This in turn raises difficult questions regarding the modalities of such a centralization. Another problem with an allied missile defence system is that it threatens to split up Europe into zones of differentiated security. A NATO BMD system, for instance, would be problematic both for France and the non-NATO members of the European Union.

The deployment of NMD by the United States with partial European cooperation would largely share the problems outlined above.

The general impression in Europe is that NMD is unnecessary and unworkable. Nonetheless, European countries could have a significant influence on United States NMD plans. By going along with these, they could influence their shape to their liking. European countries, for instance, could insist that NMD be embedded in a larger non-proliferation effort, which could decrease the risk of a new arms race. Another possibility is that the European States decide to stay on the sideline and distance themselves from NMD. In this case, they could lose the opportunity to influence United States plans, although, it may also very well be that they could exert most influence on the United States by withholding their backing of NMDs. Above all, however, European countries need to decide under what circumstance NMDs would be acceptable.

ARMS CONTROL TREATIES AND ARRANGEMENTS

Missile Technology Control Regime (MTCR)

MTCR was formed by the G-7 countries in 1983. Since then membership in the Regime has grown to include 33 States.[16] The aim of MTCR is to inhibit the proliferation of missiles by restricting exports and transfers of missile equipment and technology. The controlled items are compiled in a list. Members can implement the restrictions according to their own national legal systems. Furthermore, they use diplomacy to discourage missile proliferation. In addition, some members back their policy with the implementation of sanctions.

MTCR has registered some limited success like the discouragement of the missile activities of Argentina, Central Europe, Egypt and South Africa. However the missile developments in the DPRK, India and Pakistan could be construed as failures. The unintended consequence of MTCR is that it has the propensity to strengthen the domestic missile development programmes of those very States that it targets.

By 1999 it became evident that the control of supply of missile and missile parts and technologies alone was insufficient. Constraints on demand were also very much needed if the proliferation of missiles was to be stemmed. In 2000, MTCR States drafted in Helsinki a code of conduct against the proliferation of ballistic missiles. The code is a set of principles, commitments and confidence-building measures which are set up to create transparency and reduce missile programmes. This code also points to the changing character of MTCR, although more changes are still needed.

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[16] Member States are Argentina, Australia, Austria, Belgium, Brazil, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Russian Federation, South Africa, the Republic of Korea, Spain, Sweden, Switzerland, Turkey, Ukraine, the United Kingdom and the United States.

MTCR has three major drawbacks. First, membership in the Regime is far from universal and the agreement lacks a monitoring body. Although currently MTCR counts some 33 members, there are still countries that oppose the principles of the Regime and some of these actively work against it. Second, MTCR cannot do anything about countries that have an indigenous ballistic missile building capability. Finally, there are leaks from within the Regime by countries that pledged to observe it. For example, the Russian Federation has been accused of proliferating restricted technology to India and Iran.

All of these challenges should be met with the offering of incentives rather than penalties. In the case of the DPRK the genie is already out of the bottle. Through diplomacy MTCR States could offer incentives to other countries not to embark on ballistic missile development programmes.

The United States' NMD plans do not have any direct implications for MTCR. They are compatible with the regime as long as the United States does not export the technology.

ABM Treaty

The ABM Treaty was originally signed by the United States and the Soviet Union in 1972. In 1997, it was agreed that a number of the USSR successor States—the Republic of Belarus, the Republic of Kazakhstan, the Russian Federation and Ukraine—would succeed the Soviet Union as parties to the treaty.

The Treaty limits each party to the deployment of two ABM areas: one to protect the nation's capital and the other to protect an ICBM launch site. It thus prohibits NMD. The treaty also provides for a United States-USSR consultative commission to promote its objectives and implementation.

In 1993 the Clinton Administration reopened negotiations on the ABM Treaty in order to make it compatible with the development of a limited NMD system. In 1997 these resulted in the Demarcation agreements. The agreements distinguished between strategic and theatre missile defences, and deemed the latter to be compatible with the ABM Treaty.[17]

Despite the Demarcation agreements, the ABM Treaty nevertheless faces new challenges in the NMD plans of the new Bush Administration. Many components of the system proposed by the Administration are incompatible with the Treaty meaning that the Treaty will either have to undergo another major modification or it will have to be scrapped. Although cooperation with the Russian Federation in amending the ABM Treaty is clearly preferred, the Bush Administration has already indicated that it is prepared to dispense with the Treaty which it considers to be a relic of the Cold War that is wholly inappropriate for current circumstances.

Other Treaties and Arrangements on Weapons of Mass Destruction

Although NMD does not violate the provisions of treaties such as the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), the Chemical Weapons Convention (CWC) and the Biological and Toxin Weapons Convention (BTWC), it might nevertheless be construed as violating their spirit. Arguably, if the United States decides to abandon the ABM Treaty, the entire non-proliferation and disarmament architecture constructed over the last 30 years could be at risk.

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[17] As a result, the THAAD and Navy Theatre Wide BMD programmes were deemed acceptable whereas previously they would have been incompatible with Article VI of the original agreement.

THE FUTURE

The future of arms control will be profoundly affected by how the NMD issue plays out. Further multilateral treaties dealing with matters such as a ban on land-based surface to surface missiles, missile velocities or BMDs seem out of the question for the near future. Regional-specific agreements on arms control, though, may well fare better because of the move away from global multilateralism coupled with the increasing need for regional security arrangements.

Paradoxically, after the Cold War ballistic missile capabilities seem to be spreading, although the notion of missile attack seems increasingly unacceptable except in certain circumstances. The MTCR countries' attempt to increase support for the aims of missile proliferation control through the proposed International Code of Conduct may well find some resonance over the coming years. However, as the support for multilateralism ebbs away in the United States, so might export controls find fewer and fewer supporters in the developing States.

Pulling out of the AMB Treaty may not turn out to be the death knell for arms control as predicted. However, if this withdrawal is coupled with withdrawals from other treaties and processes, such as the Strategic Arms Reduction Treaty (START I) or the Protocol to strengthen the BTWC, then there could well be severe long-term repercussions for arms control and international stability. In particular there is a great deal of concern over the continued stability of the NPT, the BTWC, the CWC and the viability of the CTBT. The fates of these treaties are inextricably linked to missile proliferation and missile defences and the signs do not augur well for their future.

ACRONYMS

ABM	Anti-Ballistic Missile (Treaty)
BM	ballistic missiles
BMD	ballistic missile defence
BTWC	Biological and Toxin Weapons Convention
CIA	Central Intelligence Agency (USA)
CTBT	Comprehensive Test Ban Treaty
CWC	Chemical Weapons Convention
DPRK	Democratic People's Republic of Korea
FMCT	Fissile Material Cut-off Treaty
GPALS	global protection against limited strikes
GCS	Global Control System
HKV	hit-to-kill vehicle
ICBM	intercontinental ballistic missiles
IFT	integrated Flight Test
IRBM	intermediate-range ballistic missile
MIRV	multiple independently-targetable re-entry vehicle
MRBM	medium-range ballistic missile
MTCR	Missile Technology Control Regime
NATO	North Atlantic Treaty Organisation
NMD	national missile defence
NPT	Nuclear Non-proliferation Treaty
PAC-3	Patriot Advanced Capability
SBIRS	space-based infrared system
SDI	strategic defence initiative
SRBM	short-range ballistic missile
SSM	surface-to-surface missile
START	Strategic Arms Reduction Treaty
THAAD	Theater High Altitude Area Defence (US)
TMD	theatre missile defence
UNIDIR	United Nations Institute for Disarmament Research
USSR	Union of Soviet Socialist Republics
WMD	weapons of mass destruction
WP	Wilton Park