NATIONAL MISSILE DEFENSE OPTIONS AND THE BUSH ADMINISTRATION

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INTRODUCTION

In the last few years of the Clinton administration, the United States appeared to be moving towards the deployment of a limited National Missile Defense (NMD) system, intended to protect the entire country from small-scale attacks by long-range ballistic missiles armed with chemical, biological, or nuclear weapons. Under pressure from the Republican Congress, it seemed quite possible that by the end of his administration, President Clinton would begin NMD deployment, and a formal deployment decision was scheduled for the summer of 2000. However, in a September 1, 2000 speech, Clinton announced that he would not begin deployment – in effect passing the deployment decision onto the next president. This decision appeared to be influenced by a number of factors, including two recent test failures, continued Russian opposition to NMD and Russian unwillingness to modify the ABM Treaty to permit NMD deployment, lack of support from key allies, and technical criticisms of the NMD system's likely effectiveness.

With the election of George W. Bush as president, the probability of a near-term NMD deployment has greatly increased. Bush and his key advisors appear to be strong NMD supporters and as a presidential candidate Bush made it clear that he favored a rapid deployment of NMD. Moreover, the Republican-controlled Congress, long frustrated by what it saw as endless delaying tactics on NMD by the Clinton administration, will continue to push hard for a rapid NMD deployment, emphasizing that existing legislation requires NMD deployment as soon as technologically feasible. While President Bush will probably spend some time reviewing NMD options and attempting to persuade Russia and key allies to accept an NMD deployment, it seems quite likely that by or before the end of the first year of his administration Bush will decide to begin NMD deployment.

This paper will not focus on whether or not deploying NMD is a good idea. (Its author believes that the NMD system proposed by Clinton is not needed, is unlikely to work, and will have serious and adverse international consequences that far outweigh any benefits it can provide, and that a Bush NMD system is unlikely to be much better.1)

[1] See, for example, George Lewis, Lisbeth Gronlund, and David Wright, "National Missile Defense: An Indefensible System," *Foreign Policy*, Winter 1999-2000, pp. 120-137.

Instead, it will focus on the technical options for NMD deployment in the Bush Administration.

This paper will first review the status of NMD and its key technologies at the end of the Clinton administration. It will then consider in more detail four key technical issues relevant to a potential NMD deployment: (1) the real-world effectiveness of Clinton's proposed NMD system; (2) the NMD testing program; (3) the relationship between NMD and theater missile defenses (TMDs); and (4) potential boost-phase approaches for NMD. Finally, it will discuss what is known about President Bush's views on NMD, and review the range of NMD options open to him. Although Bush's plans cannot be predicted with any certainty, it is speculated here that his most likely approach would be to deploy a reconfigured and expanded version of Clinton's ground–based NMD system, which would be eventually supplemented by sea-based interceptors and possibly also by a boost-phase system.

THE CLINTON ADMINISTRATION PLAN

In 1996, under intense pressure from the Republican-controlled Congress, the Clinton administration announced its so-called "3+3" plan for NMD. Under this plan, NMD technology would be developed for three years, at the end of which (in 2000), a deployment decision could be made. If the decision was then made to deploy, an initial NMD capability could then be operational in another three years (by 2003). Otherwise, development would continue, so that the NMD system would remain deployable in three years. Prior to President Clinton's decision not to begin NMD deployment, it was already clear that the earliest possible deployment date had slipped to 2005. In his September 1 speech, Clinton stated that the earliest realistic operational date for the first phase of his proposed system was actually 2007.

The primary official justification for the Clinton NMD program was the possible emergence of a missile threat from countries such as North Korea, Iran or Iraq. An important, but secondary justification, was the possibility an accidental or unauthorized launch of missiles from Russia. Although China's nuclear missile force is not part of the Clinton administration's justification for a potential NMD deployment, these missiles are prominently cited as a threat by many NMD supporters outside of the administration.

As is discussed below, if President Bush wants to rapidly deploy an NMD system, then his system will almost certainly have to be built up out of the same basic components (interceptors, radars, etc.) as Clinton's proposed system. Unless Bush entirely abandons the Clinton approach in favor of a technologically different approach (such as a boost phase system), which would involve a substantial delay in initial operational capability, his NMD system will share not only the same components, but also many of the strengths and weaknesses of the Clinton Administration's proposed system. Thus it is useful to review how Clinton's proposed system would have worked.

In the Clinton administration plan, the NMD system would have been built up out of a small number of components, including:

- Ground-based interceptors (GBIs) equipped with infrared-homing Exo-atmospheric Kill Vehicles (EKVs);

- X-band missile defense radars;
- Upgraded early warning radars;
- Space-based Infrared System—Low Earth Orbit (SBIRS-Low) missile tracking satellites;
- Early warning satellites;
- Command and control facilities and communication relays.

These components, most of which are well along in development and testing, could be could be assembled in various configurations to produce the NMD system.

The "weapon" of the NMD system is the GBI, which would use its high-speed booster rocket to propel its EKV payload towards incoming missile targets. The EKV, which can operate only above the atmosphere, would use infrared and possibly visible light sensors to home in on its target. It would then attempt to destroy the incoming missile's warhead in a direct, high-speed collision.

The NMD command and control system would use information from a number of sensors to track and discriminate potential targets, and to guide the interceptors to these targets. The primary NMD sensor is the X-band radar ("X-band" refers to the radar's 10 GHz operating frequency). The X-band radar (which is very similar to, albeit much larger, than the radar for the THAAD TMD system) is a large, phased-array radar that has been specifically designed for NMD use, and is optimized for precision tracking and discrimination.

The X-band radars would be supplemented by a number of Upgraded Early Warning Radars (UEWRs). These radars are upgraded versions of the United States' five existing large phased-array early warning radars. Relatively minor improvements in these radars' processing hardware and software would give them the ability to track missile targets accurately enough to guide to interceptors, a capability they do not have now. However, although the UEWRs are large and powerful radars, both their range and azimuth resolution are far inferior to that of the X-band radars, and they thus have little ability to discriminate missile warheads from decoys or other false targets.

The other primary NMD sensor system is the SBIRS-Low space-based missile tracking system. The system, expected to use a constellation of as many as 24 satellites, would use infrared and visible light sensors to track missiles and their warheads. The tracking accuracy would be high enough to guide interceptors in the absence of radar data. SBIRS-Low is also expected to play a role in discriminating warheads from decoys, since its infrared and visible sensors provide very different information about target characteristics than do the X-band radars. SBIRS-Low is unlikely to be ready in time to be part of an initial NMD deployment. However, once operational it will provide almost complete global coverage of missiles through their entire flight trajectories. SBIRS-Low is also intended to support upper tier theater missile defense systems such as Navy Theater Wide and the Theater High-Altitude Area Defense (THAAD) system.

Under the Clinton administration's plan, the NMD system would have been deployed in phases. The initial system, the C-1 system, would deploy 20 interceptor missiles (this number would be increased to 100 soon thereafter) in central Alaska and a single

X-band radar at Shemya, at the western end of the Alaskan Aleutian island chain. These locations are ideally suited for defense against missiles from North Korea or China. However, the X-band radar at Shemya cannot see missiles approaching U.S. territory from other directions, such as from the Middle East. In the initial phase of Clinton's system, this problem would be solved by using Upgraded Early Warning Radars in Alaska, California, Massachusetts, Greenland and Britain to provide sensor coverage for missiles approaching from other directions.

The stated goal of this C-1 system is to defend the entire United States from a few tens of warheads equipped with "simple" countermeasures from North Korea, or a smaller number of warheads from the Middle East (the number is smaller due to the limited discrimination and tracking limited capabilities of the UEWRs).

Under the Clinton administration's plan, the full NMD system, the C-3 system, would not be operational until sometime after 2010.[2] According to a notional architecture released by the Ballistic Missile Defense Organization (BMDO) in the spring of 1999, the C-3 system would add a second interceptor site at the former Safeguard site in North Dakota, with a total of 200-250 interceptors up divided between the two launch sites. The C-3 system would also deploy up to eight more X-band missile radars and the SBIRS-Low space-based missile tracking system. An April 2000 estimate by the Congressional Budget Office was that this C-3 system would cost about $60 billion.[3]

Some Technical Issues Relevant To NMD Deployment

Will the NMD system work?

If the United States deploys an NMD system, it is important that that system work, and work very well. Moreover, it is also important that US political and military leaders have a clear and accurate understanding of how effective the defense will be if it is ever actually used.

Supporters of Clinton's proposed NMD system claim that it will be highly effective against small-scale missile attacks. Indeed, until perhaps a year ago, it seemed to be widely assumed, even by many NMD opponents, that the system would work. However, test failures and increased scrutiny of the ability of the NMD system to deal with steps taken by an adversary to defeat it have revived the question of whether the system will actually work.

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2 Recent press reports have indicated that BMDO has moved to a deployment approach involving five phases or "blocks." The first block (likely similar to the C1 system) would be operational five to six years after a presidential deployment decision, with full operational capability reached two to five years later. See Michael C. Sirak, "Pentagon Eyes Block-Upgrade Approach in NMD Restructure," *Inside Missile Defense*, November 15, 2000, pp. 1, 13-15, and Chris Strohm, "Pentagon Adjusts NMD Program Due To Capability, Testing Concerns," *Inside Missile Defense*, December 13, 2000, pp. 8-9.

3 Congressional Budget Office, "Budgetary and Technical Implications of the Administration's Plan for National Missile Defense, April 2000.

The key issue here is the operational effectiveness of the NMD system. That is, how well it will work in the real world, where an attacker would likely attempt to defeat the system. The issue is NOT whether it is possible to "hit a bullet with a bullet" or whether it is possible to hit warhead targets on a test range. There is little doubt that, with enough time and money, the U.S. could build a system that could reliably hit an ICBM warhead under controlled circumstances on a test range. However, the problem of achieving effective defense against an adversary that attempts to defeat the system is a qualitatively different and much more difficult problem.

The operational effectiveness of the NMD system will be determined primarily by its ability to deal with steps – "countermeasures" – that an attacker takes to defeat the system. Countermeasures have been the fundamental problem for ballistic missile defenses from the beginning, and still are. Every country that has developed and deployed intercontinental-range ballistic missiles has had a parallel (and highly classified) program to develop missile defense countermeasures. President Clinton specifically cited the problem of countermeasures in his September 1 announcement deferring the deployment decision.

There are many possible countermeasures and to be reliable and effective, a defense must be effective against all plausible countermeasures. However, Clinton's proposed NMD system – which now has a relatively well defined overall design comprised of specific components – appears to be vulnerable to a number of specific countermeasures. The recent report *Countermeasures: A Technical Evaluation of the Operational Effectiveness of the Planned US National Missile Defense System* sponsored by Union of Concerned Scientists and the MIT Security Studies Program surveyed a range of countermeasures and analyzed three in detail:[4]

- Biological submunitions. A missile attacker using biological weapons could package them in numerous small submunitions that would be released shortly after the end of the missile's boost phase. This tactic would overwhelm the defense with too many targets to fire at.
- Anti-simulation decoys. If the appearance of the warhead is disguised, then almost any object with a volume larger than a warhead can be a credible decoy, since both heavy and light objects move on identical trajectories in outer space, where the defense interceptor operates. In particular, the warhead could be put inside a light-weight balloon covered with a thin layer of metal and released along with numerous similar, but empty, balloons.
- Cooled shroud. Covering the warhead with a thin shroud cooled with liquid nitrogen would make it effectively invisible to the heat-seeking interceptors the defense uses.

The *Countermeasures* report found that each of these countermeasures appeared to be able to defeat the planned NMD system and were within the means of countries able to develop nuclear-armed intercontinental-range ballistic missiles (ICBMs). It therefore argued that it did not make sense to deploy the system unless it could be

[4] Andrew M. Sessler, John M. Cornwall, Bob Dietz, Steve Fetter, Sherman Frankel, Richard L. Garwin, Kurt Gottfried, Lisbeth Gronlund, George N. Lewis, Theodore A. Postol, and David C. Wright, *Countermeasures: A Technical Evaluation of the Operational Effectiveness of the Planned US National Missile Defense System* (Cambridge, Mass.: Union of Concerned Scientists and M.I.T. Security Studies Program, April 2000).

demonstrated through testing that the system could in fact defeat such countermeasures.

The primary response to the *Countermeasures* report made by NMD supporters is that it underestimates the difficulty of actually implementing the countermeasures it discusses. They argue that these countermeasures are too difficult for emerging missiles states such as North Korea to deploy, at least for many years.

However, the best way to judge if an emerging missile state such as North Korea could build such countermeasures is by comparison to the problems they would have already had to solve in order to pose a missile threat to the United States. An emerging missile state able to attack the US with nuclear-armed ICBMs would have already solved much harder problems – building ICBMs, building nuclear weapons small enough to be delivered by such missiles, solving reentry heating problems, etc. – than are involved with putting a warhead inside a balloon or putting a cooled shroud around a warhead. Any country capable of building long-range nuclear-armed ballistic missiles is clearly capable of building such countermeasures. Moreover, the September 1999 National Intelligence Estimate (NIE) on the Ballistic Missile Threat to the United States through 2015 stated that emerging missile states could have countermeasures technologies such as reentry vehicle (RV) separation, RV reorientation, simple (balloon) decoys, RV spin-stabilization, chaff, low-power jammers, booster fragmentation, and radar absorbing materials available by the time they test-flight their missiles. [5]

NMD supporters have also argued that the *Countermeasures* report assumes a static defense configuration, but that the NMD system will evolve and adapt to observed countermeasure developments.

However, the *Countermeasures* report analyzed the complete NMD system planned by the Clinton administration, which it has stated can defeat even complex countermeasures, and showed that this claim is not correct. Moreover, the NMD system cannot adapt to changes it cannot observe. Countermeasures can be tested on the ground, and since emerging missile states have no facilities with which to observe flight tests, they have no reason to test fly their countermeasures. For example, the US didn't even know that North Korea's Taepodong missile had a third stage until it was flown over Japan on its only flight. Moreover, the changes required to defeat proposed countermeasures are not minor and will require extensive development and testing, and potential attackers will also be able to respond to these changes.

The NMD Testing Program

How will it be known if an NMD system will be effective in the real world? Although simulation will necessarily play a vital role, the only way to determine whether the planned NMD system will work in the real world is through a program of tests against realistic threats. However, a testing program against only cooperative targets (no effective countermeasures, complete advance knowledge) may tell you very little about how the defense will work in the real world.

[5] National Intelligence Council, "National Intelligence Estimate (NIE): Foreign Missile Development and the Ballistic Missile Threat to the United States through 2015," unclassified summary, September 16, 1999, p. 16.

This situation is illustrated by the only actual use of a ballistic missile defense – the Patriot in the 1991 Gulf War. Prior to the Gulf War, Patriot had 17 tests against ballistic missile targets, and every one was successful. But against the Iraqi missiles it failed completely, although it was a political success. Unlike the test range targets, which flew on smooth, predictable trajectories, the Iraqi missiles broke apart and maneuvered vigorously, and Patriot had almost no chance of destroying such targets. This example illustrates that it is essential the defense be tested against realistic targets if a correct understanding of its real-world effectiveness is to be obtained.

However, there has NEVER been an intercept test of a missile defense such as the planned US NMD system against targets employing credible countermeasures. And under current plans, by the time the initial US NMD system could be deployed and operational, no such realistic tests will have occurred.

The NMD program has had three intercept tests so far. In the first test, held in October 1999, the kill vehicle hit its target, however, the second and third intercept tests, in January and July 2000 respectively, failed. These three intercept tests all used the same target set: a conical warhead and a larger, spherical balloon (the final stage of the missile used to boost these targets was also in the field of view). The infrared signal from the balloon was about seven times larger than that of the warhead, and the defense had complete advance knowledge of the characteristics of both the target and decoy. Tests against such targets do not demonstrate discrimination, much less real world effectiveness, they only establish basic functioning in a very controlled environment.

NMD supporters argue that it is appropriate to start with such simple targets, because you must "walk before you run." This is true. But these tests in no way demonstrate that the system can work against a real-world attack – one that actually attempts to defeat it. This might not be a concern if subsequent tests used realistic target sets and if a deployment decision was not made until after these realistic tests. However, this is far from being the actual situation. Under current plans, realistic tests would not occur until AFTER the defense is deployed and operational, if ever.

As of mid-2000, plans called for a series of 19 intercept tests to be carried out through the end of 2005. However, this testing program is already well behind schedule, and is unlikely to be completed before the 2007 date by which the NMD system could be operational.

Each of these 19 tests will be against targets representing the "defined C-1 threat.[6] (Recall that the initial phase of NMD deployment is known as the C-1 system.) The C-1 system is only intended and required to counter threats that use no countermeasures or have only "simple" countermeasures (the C-1 threat). Administration and contractor statements make it clear the C-1 threat includes no credible countermeasures.

For example, according to Major General William Nance, the NMD Program Manager, the mock warhead and large balloon target set used in the first three intercept tests was "more than representative" of the decoys and countermeasures an emerging missile state might use.[7] Similarly, John Peller (then the NMD program

6 Director, Operational Test and Evaluation, FY99 Annual Report, submitted to the U.S. Congress in February 2000, page VI-8. (available online at www.dote.osd.mil/pubs.html).

7 Michael C. Sirak, "BMDO: Only Three NMD Tests 'likely' Before Next Year's NMD Review,"

manager at Boeing, the NMD Lead System Integrator) stated that "the target suite was equal to, if not more challenging than, the current projected rogue threat."[8] In June 2000 Congressional testimony, BMDO Director Lt. General Kadish said that the defined C-1 threat does not include "many" of the countermeasure technologies that the September 1999 National Intelligence Estimate says will be available to emerging missile states by the time they flight test their missiles.[9] This situation does not change qualitatively throughout the entire projected series of 19 flight tests, all of which feature an undisguised warhead and spherical balloon decoys.

By requiring the C-1 system only to be effective against attackers using no countermeasures (or completely ineffective ones), BMDO has in effect defined away the countermeasures problem until *after* the initial deployment has occurred. However, even a few successful intercepts against such unrealistic targets are taken as demonstrating the technical feasibility of the NMD system.

The next phase of deployment is then supposed to be able to deal with "complex" countermeasures. But the apparent availability of effective countermeasures against this system indicates that while the planned NMD system may be able to "walk" on the test range it will not be able to "run" in the real world.

The combination of a rush to deployment with an unrealistic testing program raise the likelihood that the US will incur the worst possible NMD outcome: suffering substantial international diplomatic and security costs for the deployment of an NMD system that does not work.

To avoid such an outcome, the NMD system should be tested realistically against a range of plausible countermeasures. This could be done by establishing an independent countermeasures "red team," with expertise and resources equivalent to that believed to be held by emerging missile states, to develop, construct, and test countermeasures. Once this red team determined which countermeasures were feasible, they should be tested against the planned NMD system. These tests should be conducted without the defense having complete advance information on the nature of the threat it will face. Ideally, this testing should be done before committing to deployment. At a minimum, analysis should demonstrate that the planned defense could defeat such plausible countermeasures before beginning deployment.

In response to criticisms of the NMD testing program, BMDO has reportedly modified the test program. According to Major General Nance, the NMD Program Manager, future tests will now include multiple threats ands targets with multiple interceptors and that the NMD program will work with the test community to create a task force that combines developmental and operational testers for planning and execution of the NMD test base.[10] Although General Nance has stated that these changes will greatly improve the realism of the NMD test program, the limited

Inside Missile Defense, August 25, 1999, pp. 13-14.

8 Michael C. Sirak, "NMD Kill Vehicle Performed 'Very Well' in Flight Test, Officials Say," *Inside Missile Defense*, October 20, 1999, pp. 1, 19-21.

9 Lt. General Ronald T. Kadish, verbal response to a question from Senator Jack Reed, Hearing before the Senate Armed Services Committee, June 29, 2000.

10 Chris Strohm, "NMD Program Office Seeks More Input on Capabilities, Testing," *Inside Missile Defense*, December 13, 2000, pp. 9-10.

publicly available information about these changes suggest that they are minor ones that do not change the fundamental problems with the testing program. In particular, they do not appear to involve either credible countermeasures or an independent countermeasures red team.

The Relationship Between NMD and TMD

In addition to its NMD program, the United States is also developing a number of TMD systems. These systems can be divided into three groups: low-altitude systems capable of covering relatively small areas, high-altitude systems capable of covering much larger areas, and boost-phase systems.

The United States is currently developing three low-altitude TMD systems. These are the U.S Army's Patriot PAC-3 system, the Navy Area Defense system, and the Medium Extended Air Defense System (MEADS) being developed jointly with Italy and Germany. The U.S. is also supporting Israel in the development of its Arrow system. All of these systems are intended to cover relatively small areas from relatively short-range (perhaps 1,500 km or less) missiles, and all of them use interceptors that rely on atmospheric forces for maneuvering. None of these systems are regarded as having any significant capabilities against long-range strategic ballistic missiles or as being violations of the ABM Treaty. However, these systems could also be deployed independently of the NMD system to defend US allies or overseas forces from short and medium range missiles. In this restricted way, at least for countries for which the missile threat is seen as being due to shorter-range missiles, such TMD systems could be viewed as supplementing an NMD system.

The U.S. is also developing two high-altitude systems, the U.S. Army's Theater High Altitude Area Defense (THAAD) system and the Navy Theater Wide system, intended to protect large areas from missiles with ranges of up to 3,500 km. Both of these systems operate in the same general way as the NMD system, and, if supported by the NMD sensor network may have significant capabilities against strategic missiles.

Over the past few years, there has been significant Congressional Republican support for deploying the Navy Theater Wide system as a sea-based mid-course NMD system, either in place of or as a supplement to a land-based NMD system. Such a sea-based system could provide earlier and additional intercept attempts, and could be used to expand the coverage of the NMD system to anywhere in the world.

The Navy Theater Wide system would use existing or modified launchers and radars on some or all of the many U.S. Navy cruisers and destroyers equipped with the Aegis weapons system. The interceptor for a sea-based NMD system could be a variant of the Navy Theater Wide SM-3 interceptor that is currently under development, or it could be a larger and faster missile (which might require modifying the launchers on the ships). An infrared homing kill vehicle, likely a modification of either the Light-weight Exo-Atmospheric Projectile (LEAP) developed by SDI or the land-based system's EKV, would attempt to destroy the missile warhead in a direct high-speed collision.

Advocates of naval NMD argue that such a system could be deployed more rapidly and more inexpensively than the currently planned land-based system, since it would be based on the already existing AEGIS infrastructure.[11] Critics of sea-based NMD argue that it will take much longer and be much more difficult and expensive to build than its supporters argue.[12] The Ballistic Missile Defense Organization recently reported that such a sea-based system would both cost more and take longer to deploy than the currently planned land-based system.[13]

More importantly, a sea-based NMD system would operate in essentially the same way as the land-based system (i.e., it would use infrared homing, above-the atmosphere, hit-to-kill interceptors, supported by radars and space-based infrared sensors), and thus would have all of the same vulnerabilities. In fact, the sea-based system would likely be even less effective because of the smaller size and more limited capabilities of its individual components.

However, the same BMDO report that concluded that a sea-based system would take longer and cost more than a land-based system also concluded that sea-based mid-course interceptors, such as the planned Block-II interceptors for the Navy Theater Wide TMD system (currently scheduled for deployment sometime after 2010) could usefully supplement a land-based NMD system. As noted above, such interceptors could be used to make earlier intercept attempts and to expand the coverage of the NMD system overseas. In this approach, the sensors for the land-based system (including SBIRS-low) could be used to overcome one of the key weaknesses of the Navy Theater Wide system -- the relatively limited capabilities of its ship-borne radars.

The Army's THAAD system could similarly use information from the NMD sensor system to attempt to intercept strategic missile targets. However, because of its relatively slower interceptor speed (2.7 km/second compared to 4.5 km/second for NTW Block II), the size of the area it could attempt to defend is not as large, and there seems to be little interest in incorporating THAAD into the NMD program.

The final group of U.S. TMD programs consists of those that attempt to intercept theater missiles during their boost phase. The U.S. has one boost-phase TMD system, the Airborne Laser (ABL), under development and has studied (with Israel) boost-phase TMD systems using interceptor missiles on aircraft.

The primary program in this category is the Airborne Laser, which would put a megawatt-class laser aboard a Boeing 747 aircraft. Current plans call for the first test against a missile target in 2003 and for deployment of 7 ABL aircraft to begin in 2007. The technical feasibility of the ABL is not yet firmly established, and probably cannot be until it is actually tested. Even if it is feasible, there are significant engineering problems that could substantially delay its deployment.

If it works as expected, the ABL could have a range of about 300 to 500 km against short-range theater missiles. However, it would likely have greater range against intercontinental-range missiles, because these have longer boost phases, burn out

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11 See, for example, Heritage Foundation Commission on National Missile Defense, "Defending America: A Plan to Meet the Urgent Missile Threat," March 1999.

12 Rodney W. Jones, "Taking National Missile Defense to Sea: A Critique of Sea-Based and Boost-Phase Proposals," Council for a Livable World Education Fund, October 2000.

13 Ballistic Missile Defense Organization, "Summary of Report to Congress on Utility of Sea-Based Assets to National Missile Defense," June 1, 1999.

higher in the atmosphere (so the laser beam has to pass through less atmosphere), and usually have thinner walls. Thus the ABL could potentially be deployed against strategic missiles either as a free-standing system or as an add-on to a land-based or sea-based NMD system.

Potential Boost-Phase Approaches for NMD

The inability of mid-course defenses, such as Clinton's proposed NMD system, to defeat submunitions and the vulnerability of midcourse systems to countermeasures has increased interest in boost-phase defenses, and a number of boost-phase approaches for NMD have been proposed. Boost-phase systems can destroy submunition-armed missiles before they can release their submunitions. In addition, boost-phase systems appear to be more resistant to countermeasures than mid-course systems, and thus could be more effective in the real world.

Although boost-phase systems are likely to be more effective than midcourse systems, a number of concerns remain. Most boost-phase systems have relatively short ranges and thus must be deployed close to the missile launch site if they are to be effective. This means both that the general location of the missile threat must be known in advance and that the boost-phase system may be vulnerable to attack. Most of the proposed boost-phase systems destroy the rocket booster and not the warhead, thus the question of where the warhead comes down and what happens when it does must be considered. Some types of boost-phase systems could also be overwhelmed if a number of missiles are launched within a short time interval. Most of the proposed types of boost phase systems cannot counter one of the NMD system's principal justifications – the possibility of an accidental or inadvertent Russian missile launch. Finally, all boost-phase systems involve short decision time lines.

A potentially significant advantage of boost-phase systems that use interceptor missiles is that these systems are inherently limited in range because the interceptors have only a few minutes to fly out to reach a missile target before its boost-phase ends. This raises the possibility that such a boost-phase system could be configured so it can cover a small country such as North Korea, but not a larger country such as Russia or China. Such an approach may therefore be less threatening and more acceptable to Russia and/or China. However, although Russian President Putin's proposal for a European missile defense system is sometimes, and apparently incorrectly, said to involve a boost-phase approach, neither Russia nor China has given any indication it would find a U.S. boost-phase NMD system to be acceptable.

The U.S. Ballistic Missile Defense Organization is reportedly carrying out a preliminary study of boost-phase options for NMD. However, other than the Space-Based Laser, a holdover from the SDI Program that is two decades or more away from deployment, there are no NMD boost-phase programs underway.

Nevertheless, a number of potential approaches for boost-phase NMD have been proposed. Some have suggested adapting near-term or future planned missile defense interceptors and deploying these on ships near suspected launch points.[14] However, the use of near-term terminal-phase interceptors such as Patriot PAC-3 or the Navy

[14] John Deutch, Harold Brown, and John P. White, National Missile Defense: "Is There Another Way?," *Foreign Policy*, Summer 2000.

Area Defense does not appear to be feasible. These interceptors are too slow and cannot operate above the atmosphere, and could only hope to make an intercept under extremely favorable conditions -- for example, against a missile launched from a site on a coast.

Longer-term, exo-atmospheric midcourse interceptors, such as those for the THAAD, Navy Theater Wide and NMD systems, may have some capabilities if used as boost-phase systems. However, the kill vehicles used in these systems have not been designed to intercept accelerating targets such as missile boosters. This requires greater maneuvering capabilities than for midcourse targets, which travel on predictable trajectories. Thus it is at present unclear if any of these approaches could work.

A boost-phase system could instead use interceptors specifically built for boost-phase use. Theodore Postol and Richard Garwin have developed proposals that would use large (ICBM-sized) interceptor missiles equipped with homing kill vehicles deployed on ships, submarines, or fixed sea platforms, or on land in cooperation with Russia.[15] A system using such interceptors specifically designed for boost-phase use would almost certainly be more effective than a system that tried to adapt interceptors designed for mid-course or terminal intercepts. However no such mid-course interceptor is currently under development.

The use of small, high-speed interceptor missiles on unpiloted aircraft has also been suggested as a way of obtaining an NMD boost-phase capability. However, among other issues, it is unclear if the kill vehicle and missile can be made small enough to make this approach practical.

Finally, a boost-phase system could use lasers. As discussed above, the Airborne Laser, if it works as anticipated, would have a greater range against strategic missiles than against theater missiles, and thus could potentially be used for NMD boost-phase purposes, since it could cover a launch area comparable to or larger than that of interceptor-based systems.

George W. Bush on National Missile Defense

As a presidential candidate, George W. Bush has made a number of statements that indicate what his general approach to NMD would be. In a May 2000, op-ed, Bush said:

> "First, America must build effective missile defenses, based on the best available options, at the earliest possible date. Our missile defense must be designed to protect all 50 states - and our friends and allies and deployed forces overseas - from missile attacks by rogue nations or accidental launches."

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15 For a description of Garwin's proposed system see, Richard L. Garwin, "Boost-Phase Intercept: A Better Alternative," *Arms Control Today*, September 2000, pp. 8-11. Postol's proposed system differs slightly in using a ground- or sea-based radar for initial interceptor guidance and in emphasizing the need to directly hit the missile warhead.

> "The Clinton administration at first denied the need for a national missile defense system. Then it delayed. Now the approach it proposes is flawed – a system initially based on a single site, when experts say that more is needed."[16]

He has also stated that he would not allow Russian objections to prevent NMD deployment:

> "If elected president, I will offer Russia the necessary amendments to the ABM Treaty so as to make our deployment of effective missile defenses consistent with the treaty." "If Russia refuses the changes we propose, I will give prompt notice, under the provisions of the treaty, that the United States can no longer be a party to it."[17]

Bush reiterated his intention to rapidly deploy NMD following President Clinton's September 1 announcement that he would not deploy NMD:

> "As President, I intend to develop and deploy an effective missile defense system at the earliest possible date to protect American citizens from accidental launches or blackmail by rogue nations." "…I welcome the opportunity to act where they [Clinton and Gore] have failed to lead by developing and deploying effective missile defenses to protect all 50 states and our friends and allies."[18]

These statements, and other statements by Bush advisors, indicate that President Bush's approach to NMD will likely be built around the following propositions:

- NMD should be deployed as soon as possible;
- The NMD system should be larger (and presumably more effective) than the system proposed by Clinton, and should be effective against both emerging missile states and a Russian accidental launch;
- The NMD system should also protect not only U.S. territory but also U.S. allies and U.S. forces deployed overseas;
- Russia agreement to NMD deployment should be sought, but if such agreement is not forthcoming, the U.S. should withdraw from the ABM Treaty in order to deploy NMD.

A Possible Bush Administration Approach to NMD.

Assuming that, as now seems highly likely, the Bush administration decides to proceed with NMD deployment, what form will its NMD system take? It is argued here that a likely approach is a phased deployment of a significantly expanded and reconfigured version of Clinton's land-based system, supplemented with sea-based interceptors and/or a boost phase component.

16 George W. Bush, "Missile Defense Now," *The Washington Times*, May 25, 2000.

17 George W. Bush and Al Gore, "Presidential Election Forum: The Candidates on Arms Control," *Arms Control Today*, September 2000, pp. 3-7.

18 Statement by Governor George W. Bush Regarding President Clinton's Announcement on a National Missile Defense System, Friday, September 1, 2000. (available at www.clw.org/coalition/bmdstategov.htm).

In this approach, the basic NMD components (X-band radars, Upgraded Early Warning Radars, EKVs on Ground-Based Interceptors, SBIRS-Low, etc.) developed for the Clinton system would be used as the basis of Bush's NMD system, but the system would be significantly expanded and restructured.

There are two ways such an expansion could be carried out, both of which seem likely to be adopted. First, more of the land-based system's basic components could be deployed. For example, more interceptors could be deployed at additional launch locations. Second, additional types of components, such as sea-based interceptors or the Airborne Laser could be added to the system.

From President Bush's perspective, such an approach could have a number of advantages. Because the first phase of its deployment would be similar in size, scope, and nature to Clinton's system, this approach could achieve an initial operational capability on about the same time scale as Clinton's system (2005 to 2007), which is probably faster than any other approach. Second, the greater size of Bush's initial and/or complete system could be presented as eliminating some of the vulnerabilities of Clinton's proposed system (although this might not actually be the case). Third, adding new components, such sea-based interceptors, would allow coverage to be extended to U.S. allies and forces overseas, a stated Bush objective. Finally, although the system would be built up from components developed during the Clinton Administration, it would be clearly different than Clinton's system, leaving no doubt that it was a Bush administration system.

This system would be deployed in phases in order to get an early initial operational capability. The first phase would likely be similar in scope to Clinton's first phase, although the component locations could be different, and there might be more than one interceptor site and/or more than one X-band radar deployed. This system might be operational by 2005-2007. It would subsequently be built up into a system with a sensor network resembling that of Clinton's final system (5-6 Upgraded Early Warning Radars, 8-10 X-band radars, and the SBIRS-Low space-based tracking system) but with a greater number of interceptor sites (perhaps 2 to 4) and interceptors (at least several hundred).

This system would be supplemented with one or more additional components that would be developed in parallel to it but which would not be ready in time to be part of the initial deployment.

The most likely such addition to the basic land-based system appears to be sea-based interceptors. As noted above, there is strong Republican support for sea-based NMD and BMDO has already stated that sea-based interceptors could be incorporated into a land-based NMD system. In this situation, naval ships would essentially become remote, mobile launch platforms for the land-based NMD system, extending its coverage over the entire globe.

Bush could additionally decide to formally incorporate the Airborne Laser into the NMD system, giving the system a boost-phase component. Perhaps somewhat less likely, a boost-phase supplement to the NMD system could also be obtained by deploying sea-based boost-phase interceptors.

Alternative NMD Options

President Bush could, of course, decide to scrap entirely the technology developed during the Clinton Administration (and in some cases begun during his father's administration or earlier). However, a brief review of the possible NMD approaches shows why this is unlikely.

Sea-based NMD

As noted above, there is support in some quarters of the Republican party for the deployment of a free-standing sea-based NMD system. However, taking this approach would significantly delay the date at which an NMD system could be operational. The Navy Theater Wide Block-II interceptors that BMDO assess as having some capabilities against strategic missiles are not currently scheduled to be available until sometime after 2010. The Aegis radars on the ships are vastly inferior to the land-based X-band radars for NMD purposes. Either new ship-based radars would have to be developed and deployed or the sea-based system would have to rely on a network of land-based radars. (Although the SBIRS-Low satellite system could be used for guiding sea-based interceptors, the discrimination capabilities of this system, which uses only passive sensors, are inferior to those of the X-band radars.)

Such a sea-based system would require many years of development and testing before construction could begin. In contrast, construction of a land-based system could begin essentially immediately. A purely sea-based system probably would not be operational even in the second term of a Bush presidency. Such a delay seems likely to be unacceptable both to Bush and to the Republican-controlled Congress.

A stand-alone sea-based NMD system would be also be very expensive, likely considerably more expensive than a ground-based system. It would also place a significant burden on the U.S. Navy unless a considerable number of additional Aegis cruisers or destroyers were purchased (and the Navy's operating budget increased correspondingly). In addition, given the limited sizes of the radars and interceptors that could be placed on a ship, the capabilities of a sea-based system are likely to be inferior to that of a ground-based system.

Boost-phase defenses

As discussed above, boost-phase defenses appear to offer significant advantages over mid-course systems. Moreover, at least one boost-phase system, the Airborne Laser, might be available on a time scale similar to that of a land-based system, by about 2007.

However, the technology of the Airborne Laser is much less mature than those of the radars and interceptors making up the land-based system, and it is quite possible that an initial operational capability could be delayed many years beyond 2007.

No other boost-phase approach is currently under development (except for the Space-Based Laser). Thus any other boost-phase approach would require starting a new development program and would thus almost certainly significantly delay an initial operational capability relative to a land-based system.

All boost-phase systems currently being discussed (except for space-based ones) also share the common problem that they must be deployed near the missile launch site, thus requiring this launch site be known in advance. While it is very unlikely that a missile attack could come from an unexpected country (although it could come from an unexpected location if the missile was launched from a ship), this situation may not appeal to many NMD supporters. Moreover, these systems cannot meet one of President Bush's stated requirements for his NMD system, that it be able to counter a Russian accidental launch, since a Russian ICBM launch could occur far inland, out of range of any of these systems. Similarly, such system could not counter a Chinese missile launch, which while not currently an official requirement, is certainly an important consideration for many NMD supporters. For these reasons, a stand-alone boost-phase system seems unlikely to be adopted by Bush, although a boost-phase system could be adopted as an eventual supplement to his NMD system.

Space-Based Weapons

The only space-based weapon that the U.S. is currently developing is the Space-Based Laser, which is intended to provide a global boost-phase capability. The U.S. is currently spending about $140 million per year on this system, and current plans call for a possible in-orbit technology demonstration in 2012-2015, with deployment possible sometime after 2020. However neither of these dates are likely to be achieved, and recent BMDO cost estimates are as high as $75 billion for a deployed system (and this figure is almost certainly low).

Thus no space-based weapons will be available for well over a decade. A Bush decision to abandon other NMD approaches and proceed with space-based defenses would in effect amount to a decision to indefinitely delay NMD deployment. However, there is still strong support for space weapons among some Republicans in Congress, so there could be a significant increase in spending on the Space-Based Laser, with the objective of accelerating its potential deployment and, less likely, that some development of space-based interceptors could begin.

Theater Missile Defenses

In conjunction with an NMD deployment intended to protect U.S. territory, President Bush could choose to forward deploy TMD systems in order to satisfy his stated requirement of also defending U.S. forces deployed overseas and U.S. allies. Lower-tier defenses, such as Patriot PAC-3 or Navy Area Defense, could be available before a land-based NMD system could be operational. However, such systems cannot be used to defend against intercontinental-range missiles and thus could only supplement, and not replace, an NMD system.

The THAAD upper-tier system, and possibly Navy Theater Wide Block 1, could be available on a time scale comparable to the initial operational capability of a land-based NMD system. Such systems could also be deployed overseas to defend troops and allies. As noted above, such systems could also be used to defend U.S. territory, but only if supported by the NMD system's sensor infrastructure.

SUMMARY

George W. Bush has stated that he intends to deploy a National Missile Defense system and that he intends to so as rapidly as possible. In order to do so, he would almost certainly have to choose an NMD system design that, at least in its initial phases, would be largely based on the components of Clinton's proposed NMD system. To this system, President Bush seems likely to add more interceptors, and also seems likely to add additional components, such as sea-based interceptors or a boost-phase system, that would not be available in time for the initial deployment. Adopting any other approach to NMD deployment would involve significant delays in achieving an initial operational capability, and thus would in effect be a decision to delay deployment at least by several years, which seems unlikely to be acceptable to either President Bush or the Republican-controlled Congress.