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Deploying Missile Defense: Major Operational Challenges

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Key Points

By October 2004, the United States will have begun initial deployment of a missile defense capability—albeit a modest, limited, and not completely proven one—to defend the homeland against a limited ballistic missile attack.

The gradual phase-in of ballistic missile defense deployments will mark an important change in the policy context of the missile defense issue. Past debate focused on whether missile defenses should be deployed and whether they would work. These issues will now share the limelight with another pressing question: how would missile defenses actually be used? Operating a missile defense system presents seven challenges:

- **to whom weapons release authority should be delegated**
- **how limited missile defense assets should be allocated**
- **what roles the President and Secretary of Defense should play during intercept operations**
- **how strike options should be coordinated with defenses**
- **which U.S. command should be responsible for conducting missile defense operations**
- **how testing and operational requirements should best be balanced**
- **what arrangements are needed to notify Russia when the United States launches missile defense interceptors, to reduce possible miscalculation by Moscow.**

To manage the transition to defense, policy guidance to address these challenges will have to be somewhat flexible; it will likely evolve over time, based on the evolution of the system as well as operational experience and future testing using varied assumptions and scenarios.

If all goes according to plan, by the end of 2004, the United States will deploy eight ground-based midcourse defense (GMD) interceptors[1] in Alaska and California, along with land-, sea-, and space-based sensors and the command and control systems to support the interceptors. By the end of 2005, 12 more GMD interceptors will be added, along with additional sensors and interceptor missiles on Navy ships.

The initial deployments of 2004–2005 are only the first step on the path to the Bush administration goal of an integrated, global missile defense[2] to protect the United States, its friends and allies, and deployed forces against limited attacks by ballistic missiles of all ranges (short-, medium-, intermediate-, and long-range) in all phases of flight (boost, midcourse, and terminal).[3]

The main concern driving this goal is not the ballistic missiles of major powers such as Russia but the proliferation of weapons of mass destruction (WMD) and ballistic missiles—particularly for rogue states such as North Korea and Iran. The program, however, is not tied to country-specific threats; instead, it takes a capabilities-based approach that "focuses more on how an adversary might fight than who the adversary might be and where a war might occur."[4] This means, as the director of the Missile Defense Agency (MDA) observed:

We have to consider a wide range of missile threats posed by a long list of potential adversaries. And those threats are constantly changing and unpredictable. . . . A capability-based approach relies on continuing and comprehensive assessments of the threat, available technology, and what can be built to do an acceptable job, and does not accommodate a hard requirement that may not be appropriate.[5]

Thus, there is no final architecture. Under the current plan, the missile defense program will proceed in 2-year block increments of spiral development.[6]

For the most part, the Bush administration has been careful not to oversell the initial defensive capabilities so that expectations do not exceed reality. Officials have characterized the first deployments as "very basic" and a "nascent defensive system."[7] Secretary of Defense Donald Rumsfeld called it a "capability with a small 'c'" (to distinguish it from a formal initial operational capability) that "will probably, one would hope, improve as you go along."[8] The director of MDA said in March 2004:

I must emphasize that what we do in 2004 and 2005 is only the starting point—the beginning—and it involves very basic capability. Our strategy is to build on this beginning to make the BMD [ballistic missile defense] system increasingly more effective and reliable against current threats and hedge against changing future threats.[9]

During a program that spans 4 administrations and 11 Congresses, there has been much public debate about the rationale, geopolitical ramifications, technological maturity, priority, and costs of missile defense.

Echoing earlier debates, critics of the Bush administration plan have questioned the justification of the deployment. They note that terrorists and rogue states are unlikely to use ballistic missiles as the delivery means for WMD and argue that money is better spent combating more immediate threats, such as covert delivery of WMD or safeguarding

Russian nuclear materials. They also have questioned the maturity of the technology, its ability to deal with countermeasures, and the adequacy of testing[10]—and charge that the timing is driven by political considerations to deploy before the 2004 Presidential elections.

Advocates, on the other hand, have praised the administration decision to deploy, calling it a prudent step in addressing a growing missile threat. As Senator Joseph Lieberman (D–CT) argued:

Our first priority must be fighting terrorism, but the threat we face from ballistic missiles—whether from rogue states or accidental launches—is real and current. For that reason, I support the administration's decision, because some kind of missile defense system—even a rudimentary one—is better than no system at all. But the administration's plan is so limited at this point that it should not lull anyone into a false sense of security.[11]

Looming Challenges

The gradual phase-in of the first increment of BMD deployments over the next 18 months will mark an important change in the policy context surrounding the missile defense issue. In prior years, the questions that tended to drive debates about missile defense were generally (though not wholly) focused on whether missile defenses should be deployed and on technology and resources—that is, are missile defenses technically feasible? Could they be spoofed or overcome with countervailing responses?

While by no means passé, these concerns will now share the limelight with another pressing question: how would missile defenses actually be used? Looking ahead, one can see a number of challenges associated with operating a BMD system in both day-to-day settings and in moments of crisis when the system would be employed to intercept incoming attacks.[12]

The majority of operational issues surrounding missile defense deployments can be clustered under seven categories of questions. Although each of these questions will be relevant from the day that missile defenses achieve an initial deployed capability, fully satisfactory answers are still some time away. Just as there will be spiral development of the technical capabilities, so there is likely to be spiral development of the guidance related to the operational concerns outlined below. The challenge facing defense planners is to ensure that as missile defense capabilities evolve, both senior decisionmakers and military commanders can become more familiar with the system and its various operational challenges through exercises and wargames, so that all potential players would know what to expect in a crisis, when actual use looms as a potential outcome.[13]

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Release Authority

Who will have weapons release authority? Flight time for ballistic missiles is short—from a few minutes for short-range missiles, to 20 to 30 minutes for missiles of intercontinental range. The timeline for decisions on launching interceptors to destroy incoming missiles is significantly shorter than the time of flight of the missile, given fly-out times for interceptors. Because timelines are short, the authority to release (launch) defensive weapons likely will need to be delegated to the military combatant commander, at least, if not to lower levels of command.

In principle, such predelegation should not be an insurmountable problem. Weapons release for BMD is a different situation from nuclear weapons release, which only the President can decide to employ. Planned missile defenses are nonnuclear and use no sort of explosion to destroy missiles. The destruction is carried out by a kinetic kill vehicle, which rams into the missile/warhead and destroys it with the force of impact ("hit to kill"); in the future, lasers might be used. While defenses are a strategic capability, the consequences of using nonnuclear, kinetic hit-to-kill missile defense interceptors by mistake are not nearly as great as for nuclear weapons. Operator regrets have more to do with having wasted a valuable asset in limited supply.

Allocating Defense Assets

How should limited defense assets be allocated? The President has made clear that the goal is to defend the entire United States, its deployed forces, and friends and allies. But given limited defense, at least in the initial stages of deployments, what criteria would be employed for allocating a limited number of interceptors? The most obvious criterion would be maximizing population saved, but it is not the only one imaginable. Other possible priorities include defending missile defense assets (to maintain the capability to save population);[14] protecting the ability of Government to continue functioning; or protecting other essential military capabilities. While it is reasonable to assume that the President's highest priority for limited defensive assets would be to save as many people as possible, that priority needs to be communicated to those operating the system and deciding which enemy missiles to target and how many interceptors to allocate to them.

For the next several years, at least, there will be a limited number of interceptors deployed. There may be intelligence uncertainty about the number of long-range missiles an adversary has (for example, the number of North Korean Taepo Dong 2 missiles). To have a high defensive probability of kill, U.S. defenders would like to put multiple interceptors against each threat object. If the sensors deployed at that time are not yet capable to allow operators to assess results in between shots—so-called shoot, look, shoot tactics—our defenders may calculate that they will have to salvo multiple interceptors. Under such circumstances, having 20 interceptors is unlikely to translate into being able to defend against 20 missiles; it may mean high confidence of defense against only a handful.

Thus, defenders might run into some tough choices, driven in part by the size of the U.S. defensive magazine versus the adversary's offensive magazine. For example, if we have fewer interceptors than would be needed to be confident of intercepting everything in the adversary's magazine, the decision might be not to engage missiles headed to open ocean areas. In an even more excruciating choice, if there were several missiles bound for U.S. territory and not enough interceptors to defend against all of them, operators might have to choose to defend one area of the United States and not another—presumably a choice based on population saved.

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Another nettlesome question for the defender is this: do you shoot against what has been launched or hold some interceptors in reserve for what may be coming later? The dilemma is that the defender would want neither for the rogue state adversary to have missiles remaining when the United States has used all its interceptors nor to have a nuclear detonation on U.S. soil and still have unused interceptor missiles in the ground. The latter consideration would argue for shooting at what is in the air and allocating sufficient interceptors to have high confidence of destroying them, without holding back interceptors for what may be coming later. Of course, BMD is not the only capability the United States would have in such a messy strategic situation. Attack operations against an adversary that is launching ballistic missiles are another option.

There may be agonizing trade-offs about what to defend when there are limited defense interceptors. The difficulty of the issue, and the question of whether it is an issue at all, will vary over time as the United States moves from a nascent operational capability to a more robust missile defense system. The answer to the allocation question depends on the U.S. interceptor magazine versus a rogue state adversary's ballistic missile magazine; both will presumably grow in the future, but it is unclear at what rate either will grow. Additional defensive inventory solves a lot of these dilemmas but raises the question of how much is enough.

Even more complex prioritization issues will arise when there are systems (such as Aegis interceptors, or later, boost-phase intercept systems) that can defend either the U.S. homeland or the territory of allies and friends. If there is not enough defense capability to go around, does the U.S. homeland take priority? What role will allied leaders have in deciding what is to be defended and how? Their roles may depend upon what contribution these allies can make—that is, whether they have U.S. defensive interceptors or radars deployed on their territory or have their own defensive systems to contribute to layered defense. In any event, these issues will need to be discussed with allies in peacetime, before a crisis develops in which BMD might be employed.

Roles for the President

What are appropriate roles for the President and Secretary of Defense regarding missile defense use? As Commander in Chief, the President always calls the shots but is not necessarily the trigger puller. Under the stress of battle, when the defenders are calculating what shots they have left and how best to use them, there will not be time for Presidential second-guessing. One can assume that our BMD operators will carry out the Commander's intent—the President's guidance—to defend populations as best they can. Ideally, the President will have given or approved guidance during peacetime planning and reviewed and revised it in the buildup to crisis.

What, then, does the President need? In a word: *information*. It is natural to expect that any President would want to have accurate, real-time information about the ongoing missile defense battle as and when defenses are actually employed. The Commander in Chief may also want to have the opportunity to change previous guidance at any time in light of changing circumstances (for example, as interceptor stocks get low, about what risk to take, or what does not get defended)—because in the U.S. system, the buck stops with the President, no matter whose finger is on the trigger. While there probably would not be time to implement a change in guidance in the midst of an engagement (without losing shot opportunities and reducing the likelihood of successfully intercepting enemy missiles), there would be time in some scenarios (where launches are spread over hours or days) to be responsive to revisions in guidance.

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Finally, in any scenario involving ballistic missiles being shot at the United States, the President would be concerned about much more than just the missile defense battle and would need real-time information for other decisions. These could include authorizing offensive strikes—either nuclear strikes, which only the President can authorize, or nonnuclear strikes against strategic targets. Other decisions might be required on ensuring that consequence management and mitigation efforts are under way in case there are missile impacts on U.S. territory[15] (or forces and allies); informing the American public (post- or even mid-crisis); and communicating with international leaders—allied and other—during the crisis. The President (and other senior leaders) will need an information display to provide situational awareness, including the missile defense battle, for these non-BMD purposes. An information display that characterizes the adversary's capabilities and actions, as well as ongoing U.S actions and future options, should always be at hand for the President and advisers, such as the Secretary of Defense and combatant commanders, to provide a common strategic picture.

Strike Options

How should offensive strike options be coordinated with defenses? Missile defense is only one of a number of strategic capabilities. Missile defense affects, and is affected by, decisions on offensive strikes, both nuclear (which is always a Presidential decision) and nonnuclear strikes against strategic targets. So it is important to think through the relationship between offenses and defenses and integrate planning for both.

In a crisis involving the threat or fact of ballistic missile attack, offensive actions could well affect the missile defense battle. If offensive strikes eliminate part of an adversary's ballistic missile inventory (either before or during conflict) and there is sufficient battle damage assessment capability to determine that they have been destroyed, then the defender can dynamically change the number of interceptors allocated to the remaining missiles to have a higher confidence of intercepting them.

Missile defenses could also affect decisions on offensive options. For instance, a U.S. counteroffensive action could vary, depending on whether the intercept is successful or the enemy missile actually reaches its target. If a WMD-armed missile actually hit the United States and many Americans were killed, the U.S. offensive response would no doubt be overwhelming and devastating. Some would argue that if a rogue state even attempted to hit the United States with a WMD-armed missile, the response must be overwhelming both to assure allies and to deter the next rogue state that might consider attacking the United States. However, if BMD successfully intercepted the enemy attack, the President may

have greater latitude in choosing a response that does not threaten large numbers of casualties (for instance, regime change in but not extensive destruction of the rogue state and its population, which might be seen as unwitting hostages of an authoritarian regime).

Missile defense could also affect decisions regarding preemptive strikes in a building crisis. Some argue that having missile defenses may allow a preemptive strike against a rogue state's missiles, even if the United States were not sure it could get them all, if there is confidence that BMD can intercept the remainder—the use of which may be prompted by the preemptive strike. On the other hand, if the United States is confident that it could handle the first enemy missile launches with defenses, there is less need to make what may be tough decisions about preemptive strikes on the adversary's missiles, with the potential for attendant collateral damage and international opprobrium.

Many of the offense-defense issues above will vary over time, as the United States goes from the initial deployment of rudimentary missile defenses to more capable ones and as strike capabilities (nuclear and nonnuclear) evolve. Continuing exercises/wargames, analysis, and planning will be required to think through a variety of scenarios and how offenses and defenses interact in each.

Military Command

Which military command will be responsible for BMD operations? The issue of which Department of Defense (DOD) organization is in charge of missile defense will change as the program transitions from research, development, test, and evaluation (RDT&E) only to an operational capability with continuing RDT&E. For two decades, the MDA and its predecessors, the Ballistic Missile Defense Organization and the Strategic Defense Initiative Organization, have been the focal point for all things related to BMD. While other organizations had roles, MDA was the primary office of responsibility and the public face of missile defense. But MDA is a research, development, and acquisition organization, not an operational one. The transition to a deployed capability dictated the need for an operational military organization—a combatant command—to be in charge.

While our unified command structure divides the world into well-defined regional areas of responsibility, long-range missiles do not necessarily remain within those boundaries—nor do the sensors, interceptors, and communications infrastructure of a multilayered missile defense system. Because the BMD program is a global system of layered defenses, with defensive assets not confined to a single region of the world, the task of planning, integrating, and coordinating global missile defenses was assigned to a global commander—the new U.S. Strategic Command (STRATCOM).[16] Because the STRATCOM portfolio also includes global strike (both nuclear and nonnuclear), it is in an ideal position to address the offense-defense integration issues discussed above.

STRATCOM is responsible for defining the concept of operations for global missile defense, developing rules of engagement to be approved by senior civilian decisionmakers, and working with regional combatant commands as well as the Army, Navy, and Air Force to develop and refine tactics, techniques, and procedures to counter a ballistic missile attack.

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While STRATCOM has been given the responsibility for planning, integrating, and coordinating global missile defense, it has emphasized that it does not seek to replace regional combatant commanders or usurp their authority. For example, defensive assets located in North America would be under the operational control of U.S. Northern Command (NORTHCOM), and those in the Pacific region would be under the operational control of Pacific Command (PACOM). Former STRATCOM commander Admiral James Ellis has said, "We don't view ourselves as the trigger puller in this process."[17]

Thus, in the near term at least, the execution of defense engagements will remain largely decentralized. For the immediate future, when there will be only Patriot short-range interceptors (deployed in forward theaters) and GMD interceptors in the United States—each located in the theater that the system would protect—having the regional combatant command as the execution authority will work well. However, a layered missile defense system—which is intended to engage threat missiles of various ranges in various phases of its flight, using different types of interceptors that operate across many time zones and many geographic regions—may require even greater operational integration.

Regional combatant commands often cite the need for unity of command when it comes to having the trigger for assets in their theaters. However, that time-honored principle could cut a different way with regard to missile defense: it might suggest having one command responsible for defending against a missile during its entire flight, sometimes with defensive assets in different regions, with multiple shot opportunities at different points in the flight of the missile. When there are multiple types of defensive elements, including those that could engage the threat missile in boost or ascent phase, a single global commander might execute more effectively all the types of defenses that could defend the United States or another theater.

Testing and Operations

How should test bed and operational capability requirements be balanced? In 2001, DOD planned to deploy a test bed (facilities to allow for the more complete and stressing BMD testing) in the 2004 timeframe for development purposes, which would also have some incidental operational capability. The President's December 2002 deployment decision changed the focus to an initial operational capability that could also be used as a test bed. Critics argue that there has been inadequate testing and that what has been done is not operationally realistic. Administration officials maintain that given the geographic scope of the defensive system, realistic testing will be impossible until the initial deployment is in place (initial deployment will also serve as a test bed for continuing tests and evaluation). As the MDA director put it, "How do you realistically test an enormous and complex system, one that covers eight time zones and engages enemy warheads in space? The answer is that we have to build it as we would configure it for operations in order to test it."[18]

A number of elements deployed in the coming months will serve both operational and testing purposes. The deployed assets will serve two masters: the research and development community—represented by MDA and

its contractors, who are trying to improve the capability through spiral development—and the operational user community—Strategic Command, regional combatant commands such as NORTHCOM and PACOM, and their service components—who will be expected to maintain a 365-day-a-year, 24-hour-a-day capability to defend the country. When and under whose authority would deployed BMD assets be allowed to be used in research, development, and testing so that the initial capabilities could be improved, and when would those assets be manned by scientists and contractors? When would they be under the control of the military (for example, the Army National Guard, which would man the GMD interceptor system, the Navy for Aegis, or the Air Force for some sensors)?

Varying the readiness levels depending on an assessment of the world situation may allow for using some elements for testing when it is judged that readiness can be at a lower level, and returning to a focus on maximum operational readiness at times of greater potential threat. However, this approach would require strategic warning to put the system on maximum readiness. Another approach is to have sufficient redundancy in components, software, and procedures to allow concurrent testing and operational status, but such redundancy comes at a financial cost. Some combination of these two approaches is likely to be required to allow for maximum operational readiness and the simultaneous testing needed to improve the system through spiral development.

Confidence-Building

Is there a necessary role for confidence-building measures? With deployment comes the possibility of using missile defense interceptors against rogue state attacks. If the United States uses its GMD interceptors or sea-based Aegis interceptors, Russia's early warning satellites and radars may detect the launch (if the deteriorating Russian early warning system is working at the time). The booster for a GMD interceptor may appear to Russian early warning systems as an intercontinental ballistic missile (ICBM). Might Russia see missiles (albeit defensive missiles) being fired, misinterpret it as an attack—and respond in kind?

One might argue that because the launch sites for GMD interceptors in Alaska and California are different from those in Wyoming, Montana, and North Dakota (where U.S. intercontinental ballistic missiles are deployed), the Russian early warning system could surely distinguish the launch point and know that missile defense interceptors were not from ICBM silos. Another assumption might be that the Russian early warning system would see the rogue state launch and therefore recognize the U.S. launch as an attempt to intercept it. However, this line of reasoning places unwarranted confidence in the Russian early warning system of radars and satellites, which has deteriorated drastically over the last decade. One expert assesses that the "system appears to be capable of detecting a massive attack, but cannot be relied upon to detect individual launches" and cannot cover all possible launch areas.[19]

The argument could also be made that the Russian system would be able to identify the missile (by comparing it to system characteristics in its database) and determine it was not an ICBM or a submarine-launched ballistic missile. However, in 1995, the Russian early warning system mistook a Norwegian sounding rocket for a missile attack by U.S. submarines in the Barents Sea and activated President Boris Yeltsin's nuclear briefcase to authorize the launch of a nuclear strike.[20] In this case, the command and control system worked; Russians realized they were not under attack, and no response was initiated. (An investigation found that a prelaunch notification message issued by the Norwegians was not properly delivered to Russian early warning forces.)

Given the possibility for Russian misidentification of a GMD or Aegis interceptor launch, it is worth considering how the United States might handle notifying Russia of its launches of interceptor missiles in a crisis involving rogue states. Mechanisms exist that might be used, if a decision is made to do so.[21] There is a hotline between Washington and Moscow for use by Presidents in a crisis; however, notification may need to be more routine, automatic, and at a lower level than the President. There is a 1971 U.S.-Russian agreement for advance notification of test launches of offensive missiles and space launches to be made by the Nuclear Risk Reduction Center at the U.S. Department of State and Russian Ministry of Defense. In December 2000, U.S. and Russian officials signed a memorandum of understanding establishing a Pre- and Post-Launch Notification System (PLNS) for launches of ballistic missiles and space launch vehicles. It also contains a provision that may be particularly applicable to BMD launches: "Once the PLNS is in full operation, the Parties shall consider the possibility of, and need for, exchanging information on missiles that intercept objects not located on the Earth's surface." PLNS notifications are to be made under the 1998 U.S.-Russian agreement for a Joint Data Exchange Center in Moscow, in which the United States and Russia would share information from their early warning systems; however, progress toward standing up the center has been slow, primarily because of Russian red tape.

One of these mechanisms might handle notification of emergency launches of missile defense interceptors, but no decision to do so has been made. The U.S. Government should assess existing procedures and possibilities and identify the right mechanism (or package of measures) for notifying Russia that missile defenses are being used. In the future, if China gets an early warning system that could detect the launches, it might also be included in notifications in rogue state crises. For Russia currently and China in the future, the likelihood is low that either country would mistake a missile defense interceptor launch for an attack and respond with its own strike. Since the consequences would be high if they did so, finding a mechanism or package of measures to reduce that risk is worthwhile. Such notification of major powers who might miscalculate does not have to be a hard problem to solve; it just needs to be addressed and sorted out in advance.

The autumn of 2004 marks a historic transition point in the evolution of the U.S. missile defense program. The operational and employment policy issues raised by the new defense system are complex in their detail and potentially significant in their impact, especially in crisis situations. All of these issues will attract greater public and congressional attention in the months ahead as the country adjusts to the reality of defenses. Policy guidance on most of these issues will be needed and should be finalized quickly if it has not been already, recognizing that the guidance will evolve over time. Ideally, it would include:

- delegation of weapons release authority to combatant commanders or below, given the short timelines involved
- criteria for allocating limited defensive assets, with maximizing population saved as the highest priority
- information and displays needed by the President and other senior leaders about the missile

defense battle to have the opportunity to give further guidance if time allows, as well as for other decisions they must make

- integrated planning and coordination of offensive strike options and defenses
- designation of combatant command responsibilities related to integrated missile defense
- a means for balancing operational capability requirements with the testing needed to improve the system, whether by establishing varying readiness levels, by having redundant assets for testing, or some combination of both
- a mechanism (below the Presidential level of the hotline) for notifying Russia when the United States launches missile defense interceptors in a crisis to prevent an unlikely but highly consequential miscalculation by Russia.

One thing is certain: the debate over missile defense will not end in 2004. Just as the beginning of deployments will end deliberations over whether to deploy missile defense, it will likely stir a new debate over how much to deploy. The capabilities-based, evolutionary approach to the current missile defense program, and the resulting lack of a final architecture, means that major decisions remain for the future about how many more interceptors, how many more types of systems, in what locations—in short, about how much defense is enough. While the answer to that question depends on how adversary capabilities evolve, it also depends on judgment calls about how effective missile defenses—one of a number of strategic capabilities—need to be, and where defenses rank as a priority. Beyond the operational challenges of initial deployed capability, these are the key issues that loom just over the horizon.

Notes

[1] Ronald T. Kadish, testimony before the Senate Appropriations Committee, Defense Subcommittee Hearing on the Fiscal Year 2005 Missile Defense Budget, April 21, 2004; accessed at <http://appropriations.senate.gov/hearmarkups/record.cfm?id=220637>. The exact numbers of what is to be deployed and when have changed over the last several years and may change again, so this article cites the latest numbers available at the time of publication.

[2] In previous administrations, separate efforts focused on intercept of short- and medium-range ballistic missiles (under the rubric of theater missile defense, or TMD) and on intercept of intercontinental ballistic missiles (known as national missile defense, or NMD). That distinction has been abolished by the current administration. The TMD/NMD distinctions were important under the 1972 Anti-Ballistic Missile (ABM) Treaty, which placed limits on NMD but not TMD. Thus, there were efforts in the 1990s to delineate the distinction between NMD and TMD programs in negotiations with the Russians. The initial deployments in 2004 and 2005 integrate both land- and sea-based sensors and interceptors—something that was prohibited by the ABM Treaty. (The ABM Treaty included a provision for withdrawal after a 6-month notification period; the Bush administration announced its intention to withdraw on December 13, 2001, and the United States was no longer bound by the treaty as of June 13, 2002.) Prior to withdrawal from the ABM Treaty, there had been no work to solve the technological problems of passing radar data from Navy ships to the ground-based mid-course system, since TMD systems such as Aegis were firewalled from national missile defense.

[3] For a primer on ballistic missile defenses, see the Missile Defense Agency missile defense system booklet; accessed at <http://www.acq.osd.mil/bmdo/bmdolink/pdf/bmdsbook.pdf>. For the Bush administration missile defense policy, see the prepared statement of J.D. Crouch II, Assistant Secretary of Defense (International Security Policy), before the Senate Armed Services Committee, March 18, 2003; accessed at <http://armed-services.senate.gov/statemnt/2003/March/Crouch.pdf>.

[4] *Quadrennial Defense Review Report* (Washington, DC: Department of Defense, September 30, 2001), 13–14; accessed at <http://www.defenselink.mil/pubs/qdr2001.pdf>.

[5] Ronald T. Kadish, prepared statement, "Missile Defense Program and Fiscal Year 2005 Budget," Senate Armed Services Committee, March 11, 2004; accessed at <http://armed-services.senate.gov/statemnt/2004/March/Kadish.pdf>.

[6] *Spiral development* is an evolutionary process for developing and acquiring systems with constant interaction among users, testers, and developers to improve fielded capabilities.

[7] James O. Ellis, statement before the House Armed Services Committee, March 13, 2003; accessed at <http://www.defenselink.mil/dodgc/lrs/docs/test03-03-13Ellis.doc>.

[8] Donald H. Rumsfeld, news briefing, December 17, 2002; accessed at <http://www.defenselink.mil/transcripts/2002/t12172002_t1217sd.html>.

[9] Kadish, Senate Appropriations Committee, Defense Subcommittee testimony.

[10] See General Accounting Office, "Missile Defense: Additional Knowledge Needed in Developing System for Intercepting Long Range Weapons" (August 2003); Philip Coyle, "Is Missile Defense on Target?" *Arms Control Today* 33, no. 8 (October 2003); letter to the President signed by 49 retired generals and admirals, April 4, 2004; accessed at <www.wagingpeace.org/articles/2004/03/26_generals_admirals_postponement.htm>; and the Union of Concerned Scientists/Massachusetts Institute of Technology, "Countermeasures: A Technical Evaluation of the Operational Effectiveness of the Planned U.S. National Missile Defense System" (April 2000); accessed at <http://www.ucsusa.org/global_security/missile_defense/page.cfm?pageID=581>.

[11] Quoted in Malina Brown, "Plan to Begin Fielding Missile Defense Shield Sparks Mixed Response," *Inside Missile Defense*, January 8, 2003.

[12] Some of these issues were highlighted in a computer-simulated wargame conducted by the Missile Defense Agency as an exercise for reporters at the Joint National Integration Center in Colorado Springs, CO, on March 16, 2004. See James Glanz, "Missiles Incoming, and You're President," *The New York Times*, March 17, 2004; Bradley Graham, "Simulated Attacks Repelled In Antimissile War Game: U.S. Almost Exhausted Arsenal of Interceptors," *The Washington Post*, March 17, 2004, 3; and Thomas Duffy, "War Game Gives Glimpse of Future National Missile Defense System. Scenario: A Nuclear Attack on America," *Inside Missile Defense*, March 18, 2004; and William B. Scott, "North America's Under Attack," *Aviation Week & Space Technology*, April 5, 2004, 71.

[13] Regarding strategic level guidance, Ellis said before the House Armed Services Committee that a senior military and civilian leadership exercise was completed in November 2003 to help formulate key national policy guidance and that "[i]nterim proposed ground-based mid-course defense employment policy guidelines for Initial Defensive Operations are currently under final review."

[14] A consideration in whether to "defend the defenses" is how many interceptors remain. For example, if it is the first bullet used, one is likely to choose to defend radars and other interceptors, so they can be used to protect populations against further attacks. If it is the last bullet, it would likely be used to defend the maximum population, not the defense system.

[15] The only information on target/impact areas will come from DOD sensors—information that would need to be shared with the Department of Homeland Security, governors, and mayors so that they could take actions to mitigate damage. Given some warning time (even 20 minutes), they might be able to shelter some of the population if there are plans in place to do so; they could at least alert first responders.

[16] The most recent changes to the Unified Command Plan transformed Strategic Command. First, in October 2002, the President directed the merger of U.S. Strategic Command and U.S. Space Command so that Strategic Command had responsibility for both nuclear deterrence and space operations. In January 2003, the President assigned to STRATCOM the responsibility for four previously unassigned mission areas: global strike; global missile defense; DOD information operations; and command, control, computers, communications, intelligence, surveillance, and reconnaissance.

[17] Jeremy Feiler, "Pentagon Integrates Missile Defense Command and Control Systems," *Inside Missile Defense*, March 5, 2003.

[18] Kadish, prepared statement, Senate Armed Services Committee hearing.

[19] Pavel Podvig, "History and the Current Status of the Russian Early Warning System," *Science and Global Security* 10 (2002), 21–60; accessed at <http://www.russianforces.org/podvig/pdf/Podvig-History%20and%20the%20Current%20Status%20of%20the%20Russian%20Early-Warning%20System.pdf>.

[20] David Markov, "The Russians and Their Nukes," *Air Force Magazine Online* 80, no. 2 (February 1997); accessed at <http://www.afa.org/magazine/feb1997/0297russi.asp>.

[21] Agreements and treaties discussed in this paragraph can be found at <http://www.state.gov/www/global/arms/bureau_ac/treaties_ac.html>.

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