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The ABM Treaty and Missile Defense Testing: Does the United States Need to Withdraw Now?

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Introduction

President Bush is apparently poised to announce that the United States will withdraw from the 1972 Anti-Ballistic Missile (ABM) Treaty—the first time in history that the United States has withdrawn from a major international arms control agreement.

The key question is: Why now? What is driving the Bush administration's urgency to pull out of the treaty now despite continuing objections from Russia, China, and US allies?

Bush administration officials argue that the ABM Treaty is standing in the way of US efforts to develop and test a system to defend against long-range missiles. However, our technical analysis shows that this testing rationale is specious. There is no compelling reason for the United States to withdraw from the treaty now.

The Bush administration has said it plans several activities in the near term that would violate the treaty. First, the Pentagon plans to use the SPY-1 radar on Aegis ships to observe an intercept test of the ground-based defense system that is currently under development. We find that there is no sound reason to conduct such tracking tests in the near future. By the Pentagon's own assessment, the SPY-1 radar is not capable enough to be used for a midcourse defense against long-range missiles. While a modified version of the radar may eventually play a role in a boost-phase defense, such a system is only in the early R&D stage and the modified radar is not available for testing.

The administration also plans to build five interceptor silos at Fort Greely, Alaska beginning in the summer of 2002, and to deploy interceptor missiles there by 2004. However, because safety considerations prevent the test launch of the interceptor missiles from Fort Greely, these silos would not be useful for testing. Administration attempts to justify Fort Greely as an "emergency defense" are also not compelling because the technology that could be deployed there by 2004 would not provide an effective defense. The 2004 date seems instead to be driven by domestic political factors, such as a desire to begin deployment before the next Presidential election.

What about the longer term?

We find that there is no compelling reason for the United States to withdraw from the ABM treaty for at least the next several years.

First, the ground-based defense system that is the centerpiece of the Bush program can be fully tested under the ABM Treaty. The many limitations and artificialities of that test program have nothing to do with the treaty.[1]

[1] For a detailed discussion of this point, see Lisbeth Gronlund, David Wright, and Stephen Young, "An Assessment of the Intercept Test Program of the Ground-Based Midcourse National Missile Defense System," Union of Concerned Scientists Working Paper, 30 November 2001 (available at www.ucsusa.org/security/ift7.html).

Second, while the treaty restricts the testing of sea-based, air-based, space-based, or mobile ground-based defenses against long-range missiles, it does not prevent research and development on these technologies. The United States could conduct a robust development and testing program on the various defense systems it is pursuing for at least several years without bumping into ABM Treaty restrictions. In particular, the other defenses the Pentagon is developing against long-range missiles—the space-based systems and the sea-based boost phase system—are in the very early stages of research and development, and will not be ready to test in ways that violate the treaty for at least several years.

Finally, Russia was reportedly willing to give the United States extensive freedom to conduct missile defense tests, but wanted to proceed within the framework of the ABM treaty and retain some limits on systems that could eventually be deployed. Thus, had the United States been willing to proceed cooperatively with Russia, it appears that the treaty would not have become a barrier to future testing.

If the testing rationale were the real justification behind withdrawal from the treaty, there would be no reason to withdraw from the treaty now, or in the foreseeable future.

Instead, the real reason for the timing of the US withdrawal appears to be political. The Bush administration has made clear its desire to pull out of the treaty, and a near-term withdrawal appears designed to take advantage of muted domestic and international criticism in the wake of the war in Afghanistan.

Taking the unprecedented step of withdrawing from a major international treaty should not be done in haste or without solid strategic reasons. Withdrawal at this time is simply not justified.

We examine these issues in more detail below.

Aegis SPY-1 Radar Tracking Tests

As evidence that the ABM Treaty limits the US missile defense testing program, missile defense proponents have pointed to the postponement of three "tracking tests" in which a SPY-1 radar based on an Aegis ship would track a long-range ballistic missile. On October 25, Secretary of Defense Donald Rumsfeld announced that the Bush administration was postponing these tests to avoid violating the ABM Treaty. The Aegis SPY radar is currently part of the air defense system intended to protect the Aegis ship from attacks by aircraft, and will also be used as part of the Navy Area and Navy Theater-Wide missile defense systems currently under development for use against short- and medium-range missiles.

Two of these tracking tests are intended to take place during an intercept test of the land-based midcourse defense system. During the test, the Aegis SPY radar would track both the target missile and the interceptor missile. The third tracking test that the Pentagon postponed would have used a SPY radar to track a scheduled satellite launch using a Titan 2 missile on Nov 14.[2]

The administration has implied that these tests are both important and time urgent for the development of its missile defense system. Some in the Pentagon are apparently now pushing to conduct such tracking tests during the next intercept test, currently scheduled for February 2002.

How useful and urgent are tracking tests of this kind using the Aegis SPY radar?

The administration has not stated clearly how the SPY radar might be used as part of a defense against long-range missiles. In his 17 July 2001 testimony before the Senate Armed Services Committee, Paul Wolfowitz stated that Aegis SPY radar tracking tests "would provide initial data for assessing the basic capability of the Aegis SPY radar to track long-range targets that will assist in formulating Aegis development options." He also stated that the Pentagon expected to eventually integrate a "modified, more capable version of the SPY-1 radar" into tests of boost and ascent phase missile-defense systems.

However, the Pentagon does not need to track objects during an intercept test with the SPY radar to assess basic tracking capability. It has years of experience with this radar and large amounts of data from tracking other objects. Using this data and standard computer programs, the BMDO can calculate with considerable confidence the basic capability of the SPY radar to track various types of long-range missiles and warheads at operationally realistic distances.

In fact, the BMDO itself has concluded that the SPY radar would not be useful as part of a midcourse defense against long-range missiles, presumably on the basis of just such computer calculations. In the unclassified summary of the classified report, "Utility of Sea-Based Assets to National Missile Defense (U)," dated 15 May 1998 and submitted to

[2] This test does not appear to violate the ABM Treaty as long as the missile was not also being observed by an ABM radar (see Common Understanding B ("Tested in an ABM Mode") of the ABM Treaty).

Congress by Lt. General Lyles, BMDO notes, "The AEGIS AN/SPY-1B radar is not capable of supporting NMD type engagements due to limited detection and tracking ranges for strategic (long range) ballistic missiles and their reentry vehicles."

Further evidence that the Pentagon already knows that the SPY radar is not suitable for use in a midcourse defense against long-range missiles is found in the FY2000 Annual Report of the Office of the Director, Operational Test & Evaluation, which similarly states, "The AEGIS AN/SPY-1 B/D radar is not capable of supporting NMD-class engagements due to its limited detection and tracking range for strategic (long-range) ballistic missiles and their reentry vehicles."[3]

It is not surprising that the SPY radar is not capable enough to serve as a useful part of a midcourse defense against long-range missiles. The radar is designed to track large objects—airplanes and entire missile bodies—that are fairly close to the radar, and is not very capable of tracking small objects—such as warheads, decoys and missile debris—at the long ranges needed for such a defense.

Our estimate of the capability of the current SPY radar suggests that its detection range against a warhead is well under 1,000 kilometers and possibly even less than 500 kilometers.[4] In contrast, the X-band radars planned as part of the land-based system could track a warhead at a range of several thousand kilometers. A long-range missile booster on a standard trajectory would typically burn out and release its warhead and countermeasures at an altitude of about 300 kilometers and a distance from the launch site of roughly 500 kilometers. Thus, in order to track such a warhead, the Aegis ship and radar would have to be stationed within a few hundred kilometers of the launch site and track the warhead as it flew nearly directly over the ship. Even in this case, the warhead would fly out of range of the radar within a minute or so after the warhead had been released.

As a result, the SPY radar may not lead to very precise track data since the tracking would take place when the warhead was near the edge of the detection range of the radar, so that the signal-to-noise ratio would be relatively low. Moreover, since such tracking would occur at the beginning of the warhead's flight, the uncertainties in the trajectory would grow throughout the full flight time of the warhead. As a result, it may be difficult to predict accurately the location of the warhead at the time of intercept based on such information.

In addition, since the wavelength of the SPY radar is three times that of the X-band radars planned as part of the defense system and because this radar was not designed for missile defense purposes, the SPY radar's ability to discriminate and track is likely to be very poor relative to the X-band radar.

[3] "Annual Report FY2000," Office of the Director, Operational Test & Evaluation, The Pentagon, February 2001.
[4] George Lewis, MIT Security Studies Program, personal communication December 2001.

Thus, while a SPY radar deployed near the launch site of a missile, e.g., one launched from North Korea, might be able to provide some early track data on the missile, it appears unlikely that this information would be critical to the operation of the defense. If BMDO argues that it needs to assess the SPY radar capability now because such sensor capability is crucial for the operation of an early defense system in Alaska, this raises the question of why the Pentagon has indefinitely postponed building the X-band radar at Shemya that the Clinton administration had planned for exactly this purpose.

Potential Role in Boost- and Ascent-Phase Defenses

The Aegis SPY radar could potentially be used as part of a boost-phase defense against long-range missiles. The radar should have little problem tracking a large missile booster during powered flight from distances short enough to allow an interceptor to reach from the ship to the missile while the missile was boosting. However, the utility of the Aegis radar for such a defense is not an issue that would naturally arise for at least several years, since a sea-based boost-phase system is not a priority of the Bush administration and is still in early stages of development. Moreover, understanding the phenomenology of observing missile bodies and plumes does not require the SPY radar to observe an intercept test—it could obtain the same information by observing other missile launches.

The SPY radar could also potentially be used as part of an ascent-phase defense system—one that attempts to intercept the warhead early in flight, soon after it is released by the booster at the end of boost phase—if the ship carrying interceptors for this task were located close enough to the launch site of the missile. As noted above, however, the detection range of the radar is likely short enough that it would have marginal capability for this task since the warhead would quickly fly out of range of the radar. More importantly, there is currently no defense system of this type under development. The interceptor for the Navy Theater-Wide Block I system is too slow to be used for such an engagement. If the Aegis ship were located close enough to track the warhead after boost phase, the interceptor would not be able to catch the target missile, since it would be forced to chase the warhead from behind but would be traveling only half as fast.

Fort Greely

The Bush administration plans to begin building a set of facilities for its ground-based midcourse missile defense system at Fort Greely, Alaska in the summer of 2002, arguing that it is needed for testing. If finished, the site will include five silos equipped with interceptor missiles, a battle management command and control node, and two In-Flight Interceptor Communication System (IFICS) data terminals to communicate between the battle management and interceptors while they are in flight.[5]

New test sites are permitted under the ABM Treaty. The ABM Treaty permits each country to add test sites for launching interceptor missiles simply by declaring the site within 30 days of starting construction, as long as the facilities are intended for testing and could not be used as a national defense. Thus, if the planned facilities at Fort Greely constitute a test site and not a deployment site, the United States could simply declare Fort Greely to be a new test site.

However, the Pentagon has stated it intends the site will have an "emergency deployment" capability when construction is completed. That capability is supposed to be fielded in 2004.

Moreover, the planned facilities at Fort Greely will not be useful for testing the ground-based system under development. For safety reasons, the United States does not launch long-range missiles from inland sites. Indeed, BMDO has stated that test launches cannot be conducted from Fort Greely because it is too near populated areas. According to Senate testimony given 31 July 2001 by Patricia Sanders, deputy director of BMDO for test, simulation, and evaluation, "At present, BMDO does not intend to launch any GBI [ground-based interceptors] from Fort Greely during the testing process because these missiles would fly over land in violation of current flight-test safety restrictions."

In response to questions about the testing utility of building silos that could not be used to test launch interceptors, BMDO has argued that building these facilities at Fort Greely would be useful—even without flight testing—because it would allow other kinds of testing. According to Sanders' testimony, "The GBIs [ground-based interceptors] at Fort Greely will allow BMDO to prove out the design and siting of a GBI field that would be required to fire in a salvo without having the GBI interfering with each other GBI, to test the communication between all component parts, and to test for fuels degradation in the arctic environment, as well as to develop and rehearse maintenance and upkeep processes and procedures."

These activities have no place in an R&D testing program for a system about which no deployment decision has yet been made; rather they are the kinds of activities needed in the later stages of making a deployment site operational.

[5] For a detailed analysis of BMDO plans at Fort Greely, see Lisbeth Gronlund and David Wright, "The Alaska Test Bed Fallacy," *Arms Control Today*, Spetember 2001, pp. 3-9.

Even if such assessments were necessary or justified at this stage in the testing program, BMDO would not need to build five interceptor silos to test how fuel degrades in the arctic or to develop maintenance procedures. In fact, if there is a potential problem with fuel degradation at Fort Greely, it would be premature and potentially wasteful to build five silos there before the issue was adequately understood.

Finally, the argument that the United States needs to build five silos at Fort Greely to "prove out" the design and siting of an interceptor site where interceptors fired in a salvo would not interfere with each other makes no sense. BMDO is not proposing to test launch five interceptors in a salvo from Fort Greely to demonstrate that they do not interfere with each other, but rather proposes only to prove that it can build a site with five silos of the proper design. If the United States knows how to design and build silos so missiles can be salvo-launched, there is no need to prove this capability again at Fort Greely as part of an R&D program. If, on the other hand, the United States does not know how to design and build such sites, then building the silos at Fort Greely is not a useful way to demonstrate this capability because the interceptors could not be fired from this site. Moreover, BMDO is already planning to build multiple interceptor silos at Kwajalein and Kodiak Island to test the system with simultaneous interceptor launches.

For all of these reasons, it is clear that the Fort Greely facilities will serve no useful testing purpose and instead will be a deployment site. Withdrawing from the ABM Treaty to permit construction at Fort Greely to proceed legally is not justified by the need to test the ground-based midcourse system.

At the same time, attempts to justify Fort Greely as an "emergency defense" system are not compelling because of the rudimentary state of the technology that could be deployed there by 2004. The booster proposed for the interceptor missiles at the site is a completely untested hybrid because the prototype booster in development is so far behind schedule.

Even if the interceptor and kill vehicle technology worked perfectly by 2004, the system would be limited by its sensors. BMDO has stated that an X-band radar is the key sensor needed to discriminate warheads from other objects, including debris or simple decoys. There are no current US plans, however, to build such a radar that could see trajectories from North Korea fired toward the United States.

The Bush Missile Defense Program and Longer-Term Treaty Issues

We now look at the range of missile defense programs under development and consider when the test programs will be constrained by the ABM Treaty.

While BMDO has restructured its program under the Bush administration to include more research and development on other types of defenses, the core of the Bush missile defense program against long-range missiles remains the ground-based midcourse hit-to-kill system that was under development in the Clinton administration. The extent to which this is true can be seen by looking at the amounts budgeted for the relevant missile defense programs in the FY01 budget under President Clinton and President Bush's proposed FY2002 budget (see Table 1).

Under the proposed FY02 budget, the ground-based midcourse system remains by far the largest program. The budget for this system is 20 to 200 times larger than the budgets for other missile defense systems against long-range missiles. In absolute terms, the midcourse system has also received the lion's share of the budget increase since FY01.

Table 1. Budgets for missile defense programs against long-range missiles
(all numbers given in millions of US dollars)

	FY01 Budget	President Bush's Proposed FY02 Budget
Midcourse:		
Ground-based hit-to-kill	1,916	3,231
Boost-phase:		
Space-based hit-to-kill	0	15
Sea-based hit-to-kill	0	50
Space-based laser	138	175

BMDO is also developing two systems intended to intercept intermediate-range missiles: the Airborne Laser, and the Navy Theater Wide Block I system. Because these systems could potentially have some utility against long-range missiles, we include them in the analysis below.

Finally, the BMDO budget also includes funding for several terminal missile defense programs, but these are all intended to intercept only short-range missiles. Testing and deployment of these systems is clearly permitted under the ABM Treaty. These theater missile defenses include Patriot PAC-3; the Navy Area Missile Defense; Arrow, which is developed and partly funded by Israel; and MEADS (Medium Extended Air Defense System), which is also funded by Italy and Germany. Another terminal defense system,

THAAD (Theater High-Altitude Area Defense), is intended to intercept intermediate-range missiles. Testing and deployment of THAAD is permitted by the 1997 Demarcation agreements to the ABM Treaty, as long as it is not tested against missiles with a speed greater than 5 kilometers per second or a range greater than 3,500 kilometers. These agreements were signed by the United States and Russia, but were never ratified.

With this background we now consider the ABM Treaty implications for each of the defense systems under development by the Bush administration.

Ground-Based Midcourse Hit-to-Kill

The ground-based midcourse system can be fully tested under the ABM Treaty. This system would not face any ABM Treaty constraints until deployment begins. The research and development tests scheduled for this system run through 2006, and initial operational testing is not scheduled to be completed until 2008. Thus, the United States will not have adequate information about the system's performance on which to base a deployment decision until at least 2008.

Sea-Based Midcourse Hit-to-Kill

The only sea-based midcourse system currently under development is the Navy Theater Wide Block I system, which is nominally intended to intercept short- to medium-range ballistic missiles. The Block I interceptor will use a modified version of the Standard Missile with a speed of 3 kilometers per second to launch a LEAP (Light Exo-Atmospheric Projectile) kill vehicle. The unratified amendments to the ABM Treaty permit this system to be fully tested against short-range and intermediate-range missiles, with ranges up to 3,500 kilometers. The first intercept test for the Block I system is scheduled for 2002, with a limited initial deployment planned for 2005-6.

A Block II version of the system, with a faster interceptor and perhaps new ship-borne radars, is under consideration as well but decisions about the interceptor and system design have not yet been made. The Block II system would be intended to intercept intermediate- and long-range missiles, and is not expected to be available for initial deployment until the 2008-2010 timeframe. Tests of this system that would violate the ABM treaty would not take place for at least several years.

Airborne Laser

The Airborne Laser (ABL) under development is also nominally designed to destroy short- and medium-range ballistic missiles. The ABL would use a high-power laser carried by a Boeing 747 airplane to target a ballistic missile during its boost phase and cause it to fall short of its intended target.

Work on a prototype laser has been underway since 1996. If the current schedule is met, the ABL will have its first trial in late 2003, when it will attempt to shoot down a short-range missile similar to the Scud missiles used by Iraq during the 1991 Gulf War.

Administration officials contend that the current ABL test program is compliant with the ABM Treaty as long as it is tested against short-range missiles. The ABL, however, is also being considered for use against long-range missiles. On July 12, BMDO Director Lt. Gen. Ronald Kadish told the Senate Armed Services Committee, "We are taking deliberate steps to prepare ABL for a strategic role as well."

If the Airborne Laser proves to be capable against short- and medium-range missiles, it could also be capable against long-range missiles since they generally have a longer boost phase during which the laser can focus on the missile, are made of thinner materials, and can be engaged at higher altitudes where the thinner atmosphere would have less effect on the laser beam. In practice, the utility of the Airborne Laser against long-range missiles might be quite limited since the laser has a short range of perhaps a few hundreds of kilometers.

Tests of the ABL against missiles with ranges greater than 3,500 kilometers would clearly violate the treaty. At present, BMDO has not scheduled a test against such long-range missiles, but presumably it could do so any time after 2003, assuming that the tests against short-range missiles are successful. Thus, the United States has several years before the ABL program might bump up against the ABM Treaty.

Space-Based Boost-Phase Hit-to-Kill

President Bush requested $15 million dollars in FY02 to revive research on a space-based hit-to-kill defense, which would involve orbiting kill vehicles intended to destroy missiles during boost phase. The ABM Treaty prohibits testing of any practical space-based interceptors against ballistic missiles of any range. However, this program is in a very early stage of development, and such testing could not plausibly take place before the end of the decade. There are numerous fundamental technical issues that first need to be addressed, including how to locate the booster in the middle of a large enveloping plume of hot exhaust gases, and whether it is possible to destroy the warhead rather than just the booster.

Sea-Based Boost-Phase Hit-to-Kill

The Pentagon's FY02 request included $50 million for research on a sea-based boost-phase hit-to-kill system. This relatively small amount again indicates that this program is in the early stages of research and development. Again, there are several fundamental issues that must be addressed to assess whether the basic concept of boost-phase hit-to-kill is workable. Testing that would violate the ABM Treaty need not take place for many years.

Space-Based Laser

Of all the systems under development by the Bush administration, the space-based laser may be the furthest from potential deployment, and from testing that would violate the ABM Treaty. Currently, the planned design for the laser is too heavy to be launched into space by existing US rockets. Moreover, the prototype laser is not powerful enough to destroy missiles in their boost phase. There are currently no plans to put even a prototype in space until at least 2012.