GLOBAL MISSILE DEFENSE FOR THE 21st CENTURY

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It is critically important that legislators understand the need for effective defenses and the potential of today's technology in providing such needed defenses – and that, so informed, they avoid strategically flawed arms control, legislative and political initiatives that prevent using the best technology to provide needed defenses as quickly as possible. Only recently, have engineers been freed from such flawed ABM Treaty constraints to use their talents and the best technology to protect the citizens of free nations. Their ability to continue to do so is in no small measure dependent on assuring future arms control and other political initiatives do not reinstate debilitating constraints.

Background

The decades long debate over whether to protect the American people from the threat of ballistic missile attack moved sharply to the affirmative side when Congress passed by an overwhelming majority the National Missile Defense Act of 1999, stating: "It is the policy of the United States to deploy as soon as technologically possible an effective National Missile Defense system capable of defending the territory of the United States against limited ballistic missile attack (whether accidental, unauthorized or deliberate)." This act was signed into law by President Clinton in July 1999[1].

In 2002, President Bush took a major enabling step by withdrawing from the ABM Treaty, which had blocked even the development and testing of effective defense components for 30 years[2]. Since then, ground-based defense concepts, previously permitted in restricted Treaty-limited configurations, have been improved by 1) enabling deployment of defensive interceptors at previously precluded locations (Alaska and California) to permit broader coverage and 2) including mobile (primarily sea-based) components to extend the defense coverage and improve its ability to identify, track and intercept threatening warheads in space. Also, sea-based interceptors, previously constrained by the Treaty to a limited theater defense role, are being improved to intercept long-range ballistic missiles previously given a free ride over our ships at sea.

[1] This specific bi-partisan legislation was prompted by grass root demands for a defense of the entire United States after a 1996 CIA report left out Alaska and Hawaii in its assessment of the threat of ballistic missile attack – an oversight that led Congress to establish the Rumsfeld Commission to independently review the ballistic missile threat. The Rumsfeld Commission's conclusions were validated by North Korea's August 31, 1998 launch of a Taepo Dong ballistic missile over Japan and almost to U.S. territory, leading to a very unusual closed session of Congress to review the classified Commission report.

[2] For a discussion of key issues that set the stage for this important step, see Geoffrey Kemp et al, *The ABM Treaty in a Changed World,* Capitol Hill Forum Series, Center for National Security Law, University of Virginia School of Law, 1999; and Robert F. Turner, *The ABM Treaty and The Senate; Issues of International and Constitutional Law*, Occasional Paper Series, Center for National Security Law, University of Virginia School of Law, 1999.

Still, the most effective defense concept precluded by the ABM Treaty – precisely because it offered the greatest promise as an effective defense – has not yet been emphasized in the on-going missile defense development activities. Space-based defenses offer many benefits over proliferating fixed ground-based defenses – the apparent focus of current missile defense programs. Development programs are needed to build space-based defenses to meet 21st century challenges, which include a proliferating and growing threat of ballistic missiles that can attack the U.S. and our friends and allies with weapons of mass destruction.

Nature of the Threat

Rogue states – particularly North Korea and Iran – are working hard to acquire nuclear weapons and ballistic missiles to deliver them. Traditional competitors, Russia and China, are extending the sophistication of their strategic arsenals. And terrorist groups now pose a direct threat, including with at least short and perhaps medium range ballistic missiles that might be launched from ships near U.S. coasts. Detonation of even a single nuclear device on SCUD launched straight up from a ship off our coast could create extensive havoc in vital U.S. infrastructure[3].

Attributes of Needed Defense

An effective global layered defense to counter these threats to America and our overseas troops, friends and allies must provide multiple opportunities to intercept ballistic missiles along their trajectories, from launch point to target. Since an attack may come at any time and from almost any direction, an ever-present global layered defense is needed. An effective layered defense could intercept an attacking missile in its:

1. Boost phase, which lasts for a few minutes while the missile's rockets burn to accelerate its payload to near orbital speeds;
2. Midcourse phase, which lasts for about 20 minutes during which the payload rises above the atmosphere to the trajectory's highest point (apogee) and descends toward reentry into the atmosphere; and
3. Terminal phase, which lasts for a few minutes as the payload plunges into and through the atmosphere to its target.

While plausible ballistic missile defense concepts to counter attacking ballistic missiles in each of these three phases of flight were defined over 40 years ago, the 1972 ABM Treaty limited serious development and testing of any except a midcourse and terminal defense for a very limited deployment area. The legacy of 30-years of such constrained thinking continues to limit the options available for defending America today. But the 2002 removal of ABM Treaty constraints frees today's designers to take full advantage of modern technology in providing effective defenses for all three phases of flight.

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[3] The 2004 *Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack* identified a major societal threat that could result from a nuclear detonation over the U.S., including from a SCUD fired from a ship near our coasts. It would harm no one directly, but could literally shut down a major portion of the U.S. power grid, communication networks and other critical infrastructure dependent on sophisticated electronics and computers – creating havoc with major national and international economic consequences. The current missile defense sites will not rectify this shortcoming.

Boost-phase defenses are the most effective from a technical point-of-view, because they can destroy a threat missile, launched from anywhere at a target anywhere else, while its burning rockets make it very visible and vulnerable – before it can deploy its warhead(s) and decoys. Furthermore, if it can be destroyed early enough, the debris (including the bomb) will fall back on the launching nation's territory – a consequence that could deter an attack in the first place. The defense must engage in a very short period of time after an attacking missile is launched, requiring an effective command and control system to launch a high speed interceptor located close to the threatening missile's launch point, within a minute or so after the threatening rocket lifts off. A speed-of-light system can be further away, but it must also be at the ready. The airborne laser (ABL) is the only serious on-going boost-phase defense development effort – and it will be too expensive to provide global capability. Attempts to achieve boost-phase capabilities with ground-based and sea-based defenses will have only limited success because of the difficulty of always being close to all locations from which threatening missiles might be launched. Only space-based defenses can provide an ever-present global boost-phase defense capability.

Midcourse-phase defenses have the most time to engage an attacking missile, but they have to contend with a complex range of countermeasures, including numerous light-weight decoys. All defense basing modes can provide opportunities for intercepting ballistic missiles in their midcourse phase; those based close to the launch point of threatening missiles would provide the earliest intercept opportunities – some in their boost-phase, which would provide the best opportunity for defeating the aforementioned countermeasures. However, countermeasures deployed after the boost-phase can be difficult to defeat. For example, the current Alaska/California ground-based interceptor system is being designed to counter a restricted countermeasures threat presumed to be representative of North Korean capabilities in the near future. Sophisticated midcourse countermeasures, such as may already exist in the Russian and Chinese arsenal, will be much more difficult to defeat.

Terminal-phase defenses can exploit the fact that atmospheric drag will strip away light weight decoys that may confuse the midcourse defenses, leaving the warhead for easy identification and intercept. However, maneuvering warheads may make intercept difficult – as was demonstrated by Patriot's difficulties in hitting tumbling warheads during the 1991 Gulf War. Debris from intercepts will likely fall on friendly territory.

Common sense and detailed technical analysis affirm that it is best to destroy attacking missiles as far from their intended targets as possible – and as early in their flight trajectories as possible. A layered defense, incorporating all three capabilities, is the best way to counter a dedicated, intelligent adversary armed with effective modern offensive ballistic missiles. Thus, the kinds of defense (midcourse and terminal) explored under the terms of the ABM Treaty must be supplemented with boost-phase defenses to achieve a robust defense capability against the eventual long-range ballistic missiles of a nation state such as North Korea. Furthermore, a boost-phase intercept capability is needed to counter shorter-range missiles as well.

Near-Term Sea-based Global Defense Alternatives

Near-term options to begin countering these existing threats on a global basis can be derived fairly rapidly by adapting on-going successful development programs, such for sea-based defenses[4]. The U.S. Navy has amassed an enviable 5-out-of-6 successful test record with its Standard Missile-3, Block 1 (SM-3, Block 1) interceptor, and now has deployed a limited operating capability against short- and medium-range ballistic missiles. Moreover, the Japanese decided in 2004 to deploy sea-based missile defenses and are joining with the United States to fund further development of a system for the defense of Japan based on the existing Aegis architecture – and this same capability is of interest to a number of other nations as well. Thus, within the next several years, an internationally capable global defense should evolve from current programs, which could be accelerated with greater funding.

Sea-based defenses, operating near the U.S. coasts, can provide a counter to the potential threat from SCUDs launched from ships off our coasts – whether by terrorists or nation states. The ability of a nominal sea-based air defense interceptor to hit a rocket in its boost phase was demonstrated in the 1960s – and there is no reason to doubt that the Navy's existing air defense interceptors can be given this same capability for a relatively small investment – under $100 million – and it could begin operating near our coasts within a few months. All that is required is software improvements and the dispersal of available interceptors for the Navy to incorporate this mission with Aegis cruisers and destroyers operating in U.S. territorial waters. And regular testing as part of East and West Coast Test Range activities can enhance its deterrent value.

Over the longer term, the U.S. and Japanese governments have agreed to pursue a joint program to provide an improved sea-based interceptor missile defense capability. This jointly funded effort will develop over the next 5-7 years a moderate speed interceptor compatible with existing Aegis infrastructure – particularly a 21-inch diameter Standard Missile-3, Block 2 (SM-3, Block 2) that fits in the existing Vertical Launch System (VLS) deployed on about 100 U.S. and allied ships, on station around the world. A number of other nations could easily join Japan in working with the United States to deploy and operate a joint global sea-based defense, which could be rapidly improved.

The anticipated speed of the U.S.-Japanese SM-3, Block 2 interceptor will be about 5 km/sec. A faster follow-on interceptor (about 7 km/sec) is needed to provide the boost-phase capability for many applications of interest – e.g., to give ships in the Sea of Japan a boost-phase capability against North Korean missiles launched at the U.S. A lighter kill vehicle is needed to provide this higher speed follow-on to the SM-3, Block 2 and retain compatibility with the current VLS and other key existing infrastructure on host ships around the world[5]. Technology for such a light-weight kill vehicle was

[4] Ground-based defenses, such as the U.S. Patriot, the Israeli Arrow and Russia's S-300 theater defenses, also can be incorporated into a global defense system, but their limited range capability and lack of flexibility for easy movement limit their application as components of a global defense – much more than operations in international waters that compose over two-thirds of the Earth's surface.

[5] A lighter kill vehicle on the SM-3, Block 2 means that this VLS-compatible rocket can accelerate faster to a higher velocity. A heavier kill vehicle would require development of a new larger booster rocket that would exceed the VLS diameter, leading to an expensive retrofit program to accommodate the new

demonstrated over a decade ago, but was abandoned because it was associated with system concepts that could not be built under the ABM Treaty. With the necessary funding, such a light-weight kill vehicle can be tested within 3 years – and included as a block improvement of the currently-planned U.S.-Japanese acquisition program[6].

Needed Space-Based Global Defense Alternatives

Space-based systems compose the optimum layered defense. Basing in space would maximize the ability of the defense to observe the developing threat and minimize the proximity between the defense and target to achieve an effective intercept in all three phases of the attacking missile's flight trajectory. Such concepts were conceived in the 1950s, examined in detail during the 1980s and early 1990s and then abandoned in 1993 because they were contrary to the spirit if not the strict terms of the ABM Treaty. In fact, these were the most effective of all the technologies developed for the Strategic Defense Initiative (SDI) investment of $30-billion between 1984 and 1993, when missile defense programs were redirected to consider only ABM Treaty compliant defenses.

Nevertheless, associated commercially available technology has advanced several generations beyond that employed in the most advanced concept of that era, which was formally scrubbed by numerous government and outside scientific groups during 1989 and which passed a formal Milestone I review by the Defense Acquisition Board in 1991. It met with congressional opposition in 1991 and 1992, and was officially canceled in 1993 for political, not technical, reasons[7]. At least some of the political opposition has been reduced since the ABM Treaty no longer restricts the development, testing or deployment of such a capability – nor does any other legal instrument.

Based upon the technology available over 15 years ago – and space-qualified on the award winning 1994 Clementine mission to the Moon[8], an effective development activity could be revived and, under competent management, provide a tested space-based defense option within about 5 years. The realism of this objective is reinforced by the fact that, during a 5-year period in the mid 1990s, Motorola led a completely commercial effort to use SDI technology and operational concepts to build a 66-satellite communication satellite system (Iridium) for about $5 billion – the Defense Department uses it today. This rapid and effective acquisition effort was entirely consistent with the 1990 programmatic and cost estimates, made by the Pentagon's independent costing group, for a much larger constellation of much more capable space-based interceptors.

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interceptor and reducing its "universal" ability to fit into existing U.S. and allied Navy infrastructure. This is the primary problem in adapting the Pentagon's KEI program for Navy applications.

[6] Such a light weight kill vehicle would also have other applications, e.g., heavier ground based interceptors could carry many such kill vehicles to help defeat midcourse countermeasures.

[7] See the record of this important program as recorded by the Missile Defense Agency's Historian, Donald R. Baucomb, "The Rise and Fall of Brilliant Pebbles," *International Flight Symposium* sponsored by the North Carolina First Flight Centennial Commission, 23 October 2001; subsequently published in the *Journal of Social, Political and Economic Studies*, Volume 29, Number 2, September 2004, pp. 145-190.

[8] The Clementine spacecraft, composed of Brilliant Pebbles hardware and software, was launched within 2 years after program conception to return to the Moon for the first time in 25 years at a cost about $80 million. It mapped the entire Lunar surface in over 1.3 million frames of data from 13 spectral bands, a scientific achievement which won awards from the National Academy of Sciences and NASA – while space qualifying Brilliant Pebbles technology. A replica now hangs in the Smithsonian.

Updated for inflation, that approved plan indicates a global space-based defense could be operating within five or so years for a fraction of the investment already made in the Alaska site. Such an effort would reach an operational capability many years before called for in current plans for a space testbed, recently discussed by Lt. General Obering, Director of the Pentagon's Missile Defense Agency.

Conclusions

Thus, there are near-term options to begin building effective sea-based and space-based defenses within the next decade – resulting in a comprehensive, global layered missile defense system to protect the citizens of free nations of the world from the ballistic missiles of adversary states and terrorists. While the current deployed defenses may have only a limited capability, a fully funded program to build this global defense should assure a growing and viable effective defense capability – a capability that could dissuade would-be ballistic missile possessors from costly investments in ballistic missile technologies because they could not overcome the defenses. The strategic goal of such a global defense should be to make it impossible for any adversary to undermine responsible decision-making in times of crisis or conflict by threats of ballistic missiles armed with weapons of mass destruction.

In looking ahead to supporting such needed defenses, legislators should seek to avoid the mistakes of the past – when arms control and other legal constraints restricted the development of the most effective means of providing for the common defense. It took over 20 years to reverse the very unhelpful constraints of the 1972 ABM Treaty which prevented the use of the most effective technology in providing the best possible needed common defense[9]. Previously, persuasive arguments have discouraged other attempts to employ arms control constraints that were unverifiable and not in the U.S. national interest[10] – hopefully, that precedent will again be repeated in the current round of attempts to limit out ability to build the most effective defenses.

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[9] The author has testified repeatedly on the costs of the ABM Treaty, e.g., see *Engineering Risk and the ABM Treaty,* Testimony before the September 8, 2000 House Subcommittee on National Security, Veterans Affairs, and International Relations; and *ABM Treaty Costs,* Testimony before the September 26, 1996 Senate Foreign Relations Committee.

[10] As argued in the President's March 31, 1984, *Report to the Congress on U.S. Policy on ASAT Arms Control*, a comprehensive ban then being advocated by the Soviet Union and others would not be verifiable; would be ineffective in precluding the development of a number of systems – including ICBMs and various space systems – which would have inherent ASAT capability; and, in any case, is not in the U.S. national security interest. President Reagan declared, "[N]o arrangements or agreements beyond those already governing military activities in outer space have been found to date that are judged to be in the overall interest of the United States or its Allies." Subsequently, Congress removed its legislated constraint on testing the F-15 ASAT which had been under development since the latter days of the Ford administration (1976); it was successfully tested on September 13, 1985, and subsequently cancelled by Congressional directive. The failure of the F-15 ASAT program, after a decade of research and development costing over $1.5 billion, can be traced to incoherence in program advocacy and related arms control initiatives during several administrations. See Henry F. Cooper, "Anti-Satellite Systems and Arms Control: Lessons from the Past," *Strategic Review*, Spring 1989, pp. 40-48. For example, President Carter, while continuing the same F-15 ASAT program, proposed a comprehensive ASAT ban in 1977 in his first package of arms control initiatives – fortunately, the Soviets rejected this proposal outright. Then, beginning with their 1981 U.N. proposal, the Soviets proposed a comprehensive ban – while conducting major military exercises including multiple tests of their Co-orbital ASAT – which was rejected by the U.S.