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**“Aegis International and Ballistic Missile Defense:
A New Interoperability Network”**

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ABSTRACT

The scope of the ballistic missile threat facing the United States and our allies is constantly expanding. Rising powers such as China and India have invested heavily in conventional and strategic strike capability, while rogue nations including North Korea and Iran continue to press their missile programs forward. Non-state actors have also joined in the game. According to the Department of Defense's 2010 Ballistic Missile Defense Review (BMDR), the ballistic missile threat will likely continue to increase over the next decade.

Ballistic Missile Defense (BMD) has been called the greatest systems engineering challenge ever undertaken. Hitting a "bullet with a bullet" has challenged policy, military and technical professionals for decades. But today, a U.S. National Ballistic Missile Defense (National BMDS) capability has emerged and a new, Aegis international taxonomy has opened the door for an international ballistic missile defense umbrella.

The push to enhance U.S. and international BMD capabilities is being supported by innovative, collaborative initiatives. We highlight several of these projects, and show how they are charting the course of future BMD capabilities by focusing on the interoperability of BMD missions. This interoperability will ultimately ensure the success of DoD's Phased Adaptive Approach to missile defense.

PERSPECTIVE

The attacks on the United States on September 11, 2001, galvanized an American people unaccustomed to direct assaults against the United States homeland. More than 3,000 people died as a result of terrorist attacks in New York, Pennsylvania, and northern Virginia. Tellingly, the only reason the terrorists killed 3,000 people and not 30,000 or 300,000 people, was because they did not have the means to do so. Today – and certainly tomorrow if current non-proliferation regimes are not successful – they could carry out such large-scale attacks.

The possession by potential adversaries of ballistic missiles armed with chemical, biological, radiological, nuclear, and high yield explosive (CBRNE) weapons of mass destruction (WMD) is an urgent security issue for the United States and its allies. The challenge is daunting, as ballistic missile defense is one of the most complex and difficult missions confronting the Department of Defense. Indeed, the National Defense University's Institute for National Security Studies report, *Global Strategic Assessment 2009: America's Security Role in a Changing World*, focuses intensely on the subject of proliferation of weapons of mass destruction, noting: "Our worst fears regarding the proliferation and use of weapons of mass destruction have not been realized to date, but important trends bearing on nuclear, biological, and chemical weapons have made it increasingly possible they will be."¹

The security of the U.S. homeland, deployed U.S. military forces, and allies is threatened by the proliferation of increasingly sophisticated and long-range ballistic missile systems. By 2009, more than 20 nations² had deployed ballistic missiles, compared to only eight in 1972. While many of these are allied or friendly nations, some critical technologies have been transferred – legally or illegally – to other countries or even to groups that seek to challenge the United States and our allies.

In 2007, for example, potential adversaries launched 120 ballistic missiles in tests and demonstrations, a significant total compared to previous years. This spike in foreign ballistic missile launchings, especially in the short- to intermediate-range category, was particularly pronounced in China, North Korea and Iran. China's impressive store of missiles hedges against a "Taiwan contingency" while simultaneously undergirding its anti-access/area denial (A2/AD) efforts in the Asia Pacific region. One notable effort in the advancement of China's A2/AD capabilities is the development of the world's first anti-ship ballistic missile, the DF-21D. Patrick Cronin, senior director of the Asia Program at the Center for a New American Security, writes that "the missile can be fired from protected land-based bastions far away, travels at high speed, and provides mid-course correction and a maneuverable reentry vehicle with great

¹ M. Elaine Bunn, editor, "The Proliferation of Weapons of Mass Destruction," in *Global Strategic Assessment 2009: America's Security Role in a Changing World* (Washington, D.C., National Defense University Institute for National Security Studies, 2009), pp. 162-185.

² National Air and Space Intelligence Center, "Ballistic and Cruise Missile Threat," June 2009. Accessible at <<http://www.fas.org/irp/threat/missile/naic/NASIC2009.pdf>>

precision and lethality ... The DF-21D is the ultimate carrier-killer missile.”³ Moreover, Commander of U.S. Pacific Command Adm. Robert Willard recently warned that the DF-21D is “close to being operational.”⁴

Iran’s missile development is perhaps even more troubling; CIA Director Leon Panetta has warned that it could be a mere two years before Iran is able to threaten other states with nuclear warheads mounted on ballistic missiles⁵, and a 2009 report by the International Atomic Energy Agency (IAEA) goes further, concluding that “Iran has acquired “sufficient information to be able to design and produce a workable” atom bomb the Defense Intelligence Agency has reported that Iran could field an intercontinental ballistic missile (ICBM) capable of reaching the East Coast of the United States by 2015.⁶ For years, directors of U.S. missile defense organizations testified before Congress that some countries regard ballistic missiles as the “air force of choice,” warning that countries hostile to the United States were developing and exporting ballistic missiles – if not CBRNE materials – as well.

Increasingly, potential enemies possess ballistic missiles *and* weapons of mass destruction. Today’s rogue leaders view WMD as weapons of *choice*, not of last resort. In this environment, it is imperative that the development of the United States’ ballistic missile defenses match the development of potential adversaries’ capabilities. President George W. Bush opened the door to further testing and development of anti-ballistic missiles when he withdrew the U.S. from the Anti-Ballistic Missile Treaty in 2002, thereby lifting the restriction on the U.S. Navy against developing an ICBM capability.

On September 17, 2009, President Barack Obama revealed yet another “sea change” in U.S. ballistic missile defense policy,⁷ following the unanimous recommendation of both the Secretary of Defense and the Joint Chiefs of Staff that the prior plan for missile defense protection in Europe be revised.⁸ President Obama announced that he was terminating the previous administration’s plan – based on the Ground-based Midcourse Defense system – to place dedicated ground-based interceptors and missile-defense radar sites in Poland and the Czech Republic. Instead, President Obama announced his plan to put in place a global land and sea-

³ “Adm. Willard: Chinese Anti-Ship Missile Close to Operational,” *Inside the Navy*, August 30, 2010.

⁴ Ibid.

⁵ Leon Panetta, Interview With Jake Tapper, “This Week,” *ABC*, June 27, 2010. Accessed at <<http://abcnews.go.com/print?id=11025299>>. For another assessment of Iran’s nuclear capabilities, see also: U.S. Congressional Research Service. Iran’s Nuclear Program: Status (RL34544; December 29, 2009), by Paul K. Kerr. Accessed at: <http://www.fas.org/sgp/crs/nuke/RL34544.pdf>, and William J. Broad and David E. Sanger, “Report Says Iran Has Data To Make A Nuclear Bomb,” *New York Times*, October 4, 2009.

⁶ Woolsey, James R and Rebeccah Heinrichs, “Iran and the Missile Defense Imperative,” *Wall Street Journal*, July 14, 2010.

⁷ White House Press Release, “Fact Sheet on U.S. Missile Defense Policy, A Phased Adaptive Approach for Missile Defense in Europe,” September 17, 2009.

⁸ Department of Defense, *Ballistic Missile Defense Review Report*, February 2010. Accessed at: <http://www.defense.gov/bmdr/docs/BMDR%20as%20of%2026JAN10%200630_for%20web.pdf>

based missile-defense posture centered on Aegis Ballistic Missile Defense (Aegis BMD). This new plan, called the Phased Adaptive Approach (PAA), includes several variants of the Standard Missile Three (SM-3) to better deal with the preponderant short- to intermediate- range ballistic missile threat from rogue nations.⁹

According to current and former U.S. officials, this shift was largely based on a determination that Iran is further along than previously thought in developing medium-range missiles that could strike Western Europe and the Middle East with nuclear warheads, while at the same time its long-range missile program has progressed slower than previously estimated, thereby posing less of a threat to the continental U.S. and major European cities.¹⁰ As President Obama explained, “President Bush was right that Iran’s ballistic missile program poses a significant threat.” Arguing, however, that this new assessment of the Iranian threat merits a different approach using existing technology, he continued on to note that “This new approach will provide capabilities sooner, build on proven systems and offer greater defenses against the threat of missile attack than the 2007 European missile defense program.”¹¹

To some, this was an astounding and risky gamble. One observer, Eric Edelman, the former Undersecretary of Defense for Policy in the George W. Bush administration, suggested this change would “raise questions” about the American commitment to Europe.¹² However, President Obama’s national security team, as well as others knowledgeable in the area of ballistic missile defense, were united in their support for this shift in emphasis, with Secretary of Defense Robert Gates noting several days later in an op-ed in *The New York Times*, “The future of missile defense in Europe is secure.”¹³ His words, coming from the original architect of the European

⁹ Department of Defense, *Ballistic Missile Defense Review Report*, February 2010. Accessed at: <http://www.defense.gov/bmdr/docs/BMDR%20as%20of%2026JAN10%200630_for%20web.pdf>

¹⁰ Peter Spiegel, “U.S. to Shelve Nuclear-Missile Shield,” *Wall Street Journal*, September 17, 2009.

¹¹ Peter Baker, “White House Scraps Bush’s Approach to Missile Shield,” *The New York Times*, September 18, 2009.

¹² Peter Baker, “White House Scraps Bush’s Approach to Missile Shield,” *The New York Times*, September 18, 2009.

¹³ Robert Gates, “A Better Missile Defense for a Safer Europe,” *The New York Times*, September 20, 2009. Mr. Gates also noted that the new approach “provides a better missile defense capability” for Europe and American forces “than the program I recommended almost three years ago.” (See Peter Baker, “White House Scraps Bush’s Approach to Missile Shield,” *The New York Times*, September 18, 2009.) See also comments from White House National Security Advisor Gen. James L. Jones (Ret.) in Bill Gertz, “Jones Defends Missile-Defense Move,” *Washington Times*, September 20, 2009. The overwhelming majority of the editorial and op-ed coverage in the national and defense media also supported this decision. See, for example, Hans Binnendijk, “A Sensible Decision,” *The Washington Times*, September 30, 2009, David Wood, “Missile Defense: Who’s Jeering Now?” *PoliticsDaily.com*, September 30, 2009, and Peter Baker and Thom Shanker, “A Pragmatist, Gates Reshapes Policy He Backed,” *The New York Times*, September 22, 2009,

Third Site, did much to mute criticism. Perhaps most tellingly, this shift was “unanimously welcomed” by the U.S.’ NATO allies.¹⁴

In February 2010, President Obama’s vision was outlined as official policy in the first-ever Ballistic Missile Defense Review (BMDR). The Phased Adaptive Approach (PAA), currently being implemented only in Europe, will eventually be adapted within other regions – most notably, the Middle East and East Asia. It will also be specifically tailored to the threats unique to that region – “including their scale, the scope and pace of their development, and the capabilities available and most suited for deployment.”¹⁵ The PAA is centered on the Aegis ballistic missile defense system, and includes four phases. In Phase 1 (2011 timeframe), existing sea-based Aegis missile defense ships and radars will be deployed to defend against short- and medium-range ballistic missiles in Southern Europe. This will entail as many as three Aegis ships, each carrying up to 100 SM-3 missiles, on patrol in the Mediterranean and North Seas at any given time.¹⁶ In Phases 2 (2015 timeframe), 3 (2018 timeframe), and 4 (2020 timeframe), the Aegis SM-3 missiles will be upgraded and also deployed from two land-based sites as part of “Aegis Ashore.” According to Gen. James Cartwright, Vice Chairman of the Joint Chiefs of Staff, this will allow for the protection of all of NATO by 2020.¹⁷

Before the president announced his decision to shift the focus of the ballistic missile defense of Europe and the Middle East from a fixed, land-based system to a more flexible and mobile deterrent utilizing both land- and sea-based elements with common components, he and his national security team had to weigh all available options. And most importantly, they had to determine whether the Aegis/SM-3-centered BMD option together with Terminal High Altitude Area Defense (THAAD)/TPY-2 radars was sufficiently mature for near-term operations and had the growth potential to perform this mission as it increases in complexity over the next five to ten years. Testing certainly indicates that the system is ready for deployment. The SM-3 missile version deployed on Navy ships today “has hit – within inches – its exact target in nine out of ten tests.”¹⁸ Moreover, according to the Missile Defense Agency, the Aegis BMD system has demonstrated 21 hit-to-kill intercepts out of 25 at sea firing attempts.¹⁹

¹⁴ Carter, Ashton B. and Michele Flournoy, “The Way Forward on Missile Defense,” *Wall Street Journal*, June 17, 2010.

¹⁵ Department of Defense, *Ballistic Missile Defense Review Report*, February 2010. Accessed at: <http://www.defense.gov/bmdr/docs/BMDR%20as%20of%2026JAN10%200630_for%20web.pdf>

¹⁶ Associated Press, “Missile Defense Plans Bet Heavily On Raytheon’s SM-3 Interceptors,” *Arizona Daily Star*, October 1, 2009.

¹⁷ “O’Reilly: Pentagon To Send BMD Ships To Eastern Mediterranean,” *Inside the Navy*, October 5, 2009.

¹⁸ Carter, Ashton B. and Michele Flournoy, “The Way Forward on Missile Defense,” *Wall Street Journal*, June 17, 2010.

¹⁹ “Sea-Based Missile Defense Flight Test Results In Successful Intercept,” *Missile Defense Agency*, april 15, 2011. Accessed at: <<http://www.mda.mil/news/11news0007.html>>

The president's decision to make this major shift in U.S. ballistic missile policy was a response to the clear and present danger of short- to intermediate-range Iranian ballistic missiles carrying WMD.²⁰ He was able to do so because the Aegis BMD weapon system was ready.²¹

With the proven Aegis BMD/Standard Missile 3 (SM-3) weapon system, the U.S. Navy was able to immediately “answer-all-bells” and step up to this challenge to provide a better option. As the president explained, the new system “will provide stronger, smarter and swifter defenses of American forces and America's allies.”²² General James E. Cartwright, vice chairman of the Joint Chiefs of Staff, addressed this topic in a bit more depth at the West 2010 convention on February 2, 2010. While discussing the 2010 Quadrennial Defense Review (QDR), Gen. Cartwright noted that the expanding multi-national missile defense web is rapidly becoming “an

²⁰ While recent Iranian ballistic missile firings have garnered most international attention, this is not a new phenomenon. In November 2006, Tehran launched dozens of ballistic missiles during its “Great Prophet” exercise. Some of these missiles were capable of striking American bases in the region as well as Israel, the Persian Gulf states, and Turkey. Iranian ballistic missile firings have continued, with several mid-range ballistic missiles launched in the summer 2008, through a spate of firings in 2009. Coupled with the determination to acquire WMD, Iran's missiles pose the gravest threat to U.S. interests and our Middle Eastern, South Asian, and European allies. Indeed, intelligence assessments predict that Tehran could possess intercontinental-range missiles capable of striking the United States as early as 2020. See also, Theodore Postol, *Defense Against Iran's Ballistic Missiles* (Cambridge, MA, Massachusetts Institute of Technology, May 2009) for a comprehensive report on Iran's nuclear and missile potential.

²¹ See, for example, “Aegis BMD Assets to Play Greater Role in European Missile Defense,” *Inside the Navy*, September 21, 2009. This article quotes Phil Coyle, the Pentagon's top weapons tester during the Clinton administration, who describes the rationale behind the President's decision, noting; “The Obama administration is recognizing that Iran does not currently possess any intercontinental ballistic missiles (ICBM) that could reach the United States, so it may be more prudent to address the short-term threat to southern Europe, where the short- and medium-range missiles that Iran possess can reach. Aegis BMD ships would be ideally suited for that job.” See also, “Lawmaker Questions Intel Underpinning Change in Euro BMD Policy,” *Inside the Pentagon*, September 24, 2009. This article provides further rationale for the administration's decision to shift the focus from Iranian ICBMs to Iranian short-and intermediate-range ballistic missiles, citing a May 2009 National Intelligence Estimate that concluded Iran would need three to five years longer than originally thought (the original estimate was 2015) to construct a long-range ballistic missile capable of carrying a nuclear warhead. Conversely, other reporting in the national and defense media supports earlier observations that Iran is accelerating development of short- and mid-range ballistic missiles. See, for example, “Missile Defense Plans Bet Heavily on Raytheon's SM-3,” *Arizona Daily Star*, October 1, 2009 and Peter Baker and Thom Shanker, “A Pragmatist, Gates Reshapes Policy He Backed,” *The New York Times*, September 22, 2009. This latter article goes into some depth regarding how Secretary of Defense Robert Gates was motivated to dramatically change his support from the land-based option he previously backed during the Bush administration to embrace President Obama's position specifically because advances in technology meant that the United States could counter shorter-range ballistic missiles more effectively with an expanded ship-based SM-3 system.

²² Peter Baker, “White House Scraps Bush's Approach to Missile Shield,” *The New York Times*, September 18, 2009. See also, “Thinking About Future Naval Ballistic Missile Defense,” *U.S. Naval Institute Online*, September 17, 2009.

anchor point for our deterrent strategy” by replacing the threat of nuclear weapons as the world (and official U.S. policy) moves away from the doctrine of mutually assured destruction.

But even in Navy circles, few understand how this happened. This is the story of the rise of the Aegis Weapons System, as well as some challenges it can be expected to face in the future.

THE PAST AS PROLOGUE

Aegis BMD takes maximum advantage of more than \$80 billion of investment in the sensors, weapons, command-and-control (C2) systems, ships, people, and facilities that comprise the Aegis Weapon System. Beginning in the early 1960s, when Aegis was first conceived, and throughout nearly two decades’ development that led to the commissioning of the Navy’s first Aegis cruiser in 1983, Navy planners and engineers structured the Aegis system with the *potential* to take on naval missions only dimly perceived at the time.²³

The Navy commissioned the pioneer Aegis missile cruiser *Ticonderoga* (CG-47) in 1983, at the height of the Cold War. The first of a force of revolutionary guided-missile warships that would be the “Shield of the Fleet” in any crisis or conflict against capable and widely proliferated Air- and Sea-launched Cruise Missiles, *Ticonderoga*’s impressive multi-mission warfighting capabilities centered on the Aegis Weapon System – the AN/SPY-1 multi-function phased-array radar, the leading-edge Aegis Combat System, and sophisticated surface-to-air missiles – in addition to highly capable anti-submarine, anti-surface, and land-attack weapons. These CG-47 Cruisers were followed by the even more flexible and effective Arleigh Burke Destroyers (DDG-51’s), and both were capable of operating in a nuclear electromagnetic pulse (EMP) environment, a key feature becoming ever more important in the 21st century.

Although initially designed to protect Navy carrier battle groups from onslaughts of Soviet aircraft and cruise missiles in a nuclear environment, as a global ballistic missile threat began to emerge decades ago, the Navy began to adapt the Aegis and Standard Missile systems to counter the threat.

Under the stewardship of visionary program managers, most notably the late Rear Admiral Wayne E. Meyer, widely regarded as the “Father of Aegis,” the system had an overarching imperative to “build a little ... test a little ... learn a lot.” (Sadly, Rear Admiral Meyer passed away on September 1, 2009, just weeks before the Aegis Destroyer bearing his name was commissioned). Despite some initial misgivings, what the Navy’s leadership *learned* was that an

²³ For an excellent overview of the Aegis program’s history, see “The Story of Aegis,” [Naval Engineers Journal](#) 121.3 (2009). In particular, this issue includes articles by Admiral Mike Mullen, Chairman of the Joint Chiefs of Staff; Admiral Gary Roughead, Chief of Naval Operations; and Rear Admiral Wayne E. Meyer, the “Father of Aegis.”

Aegis system designed originally to protect U.S. Navy carrier strike groups from waves of attacking Soviet aircraft and cruise missiles, potentially in a nuclear environment, also had the potential – with a disciplined process of sensor, weapon and systems upgrades – to be the key pillar of an integrated BMDS.

The early success of Aegis BMD is not surprising considering the almost half-century of progress – fueled by substantial and steady investment – in developing the baseline and upgraded systems: nearly 50 years of Aegis Weapon System and more than 60 years of missile research, development, testing and real-world performance. The decades-long system maturity of in-service systems and the evolutionary upgrading of technologies and systems to pace an evolving threat are unique among all the pillars of the national BMDS.

Much of the success of Aegis BMD can be attributed to the robust, comprehensive, seven-year test program, involving 23 live-firings between January 2002 and late 2009 – with more planned in the future. These tests have become progressively more challenging and operationally realistic throughout the course of the test program.

Since the first Aegis BMD intercept test conducted in January 2002, the Navy's element of the overall U.S. BMDS has enjoyed unprecedented success: 19 (out of 23 test events) target missile intercepts, including dual intercepts by two missiles during two test events..

Additionally, joint tests involving the U.S. and partner nations have demonstrated the promise of a broad-based coalition enterprise that will link several navies' Aegis capabilities to address shared operational requirements. Japan is one such partner, working with the United States to further develop a layered BMD capability in the Pacific. Japan plans to incorporate the Aegis BMD system on all six of its Aegis-configured destroyers, four of which had been modified as of December 2010.²⁴ Aegis tests involving the Japanese Maritime Self-Defense Force guided-missile destroyers *JS Kongo*, *JS Chokai* and *JS Myoko* have successfully demonstrated the capability of the Japan Aegis BMD Combat System configuration installed on these ships.²⁵ In addition to using the Aegis system to develop its own maritime BMD capability, Japan is also cooperating with the U.S. on the development of technologies for an upgrade of the Standard Missile-3, the SM-3 Block IIA. Several European nations are also procuring the Aegis weapons

²⁴ U.S. Congressional Research Service. Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress (RL33745; April 19, 2011), by Ronald O'Rourke. Accessed at: <<http://www.fas.org/sgp/crs/weapons/RL33745.pdf>>

²⁵ "Japan/U.S. Missile Defense Flight Test Successful," *Missile Defense Agency*, October 28, 2009. Accessed at: <<http://www.mda.mil/news/09news0021.html>>. See also "Japan/U.S. Missile Defense Flight Test Successful," *Missile Defense Agency*, December 17, 2007. Accessed at: <<http://www.mda.mil/global/documents/pdf/07news0053.pdf>>.

systems, presaging potential partnering opportunities for mutual self-defense.²⁶ In the Middle East, Israel hosts a U.S. strategic radar, X-band, and its Arrow II missile interceptor, which was financed in conjunction with the United States, is interoperable with Aegis.²⁷ According to Arrow designer Uzi Rubin, Aegis could be brought into line with Israel's air defenses "at the flick of a switch."²⁸ Partnering opportunities have even been discussed with Russia; during NATO's 2010 Lisbon Summit, Russian President Dmitry Medvedev endorsed missile defense cooperation between Russia and the alliance, removing what many observers noted was a major impediment to the development of a European missile defense shield. All of this international cooperation is firmly in line with the Administration's key objective to "lead expanded international efforts and cooperation on missile defense."²⁹

One event in particular generated the confidence that Aegis BMD was mature enough to take on the missions directed by the President. In late 2007, an inactive 5,000-pound U.S. reconnaissance satellite was predicted to reenter the Earth's atmosphere soon, posing risk of injury and death or property destruction. The President directed the U.S. Strategic Command to develop a course of action – codenamed Operation Burnt Frost – to destroy the satellite at an altitude where it would pose no hazards to population centers and other satellites in earth orbit.

To carry out Operation Burnt Frost, the United States had to go where no Aegis – or any other navy's – warship had gone before. The technical and operational challenges posed by the decision to destroy this satellite were significant. The school bus-size satellite was higher, faster and larger than any target engaged during years of testing the national BMDS and Aegis BMD systems, and the hydrazine tank, the real target, was only a fraction of the overall mass of the satellite. Given the higher closing velocities due to the satellite's speed of greater than 17,000 miles per hour, a successful intercept would require longer radar and missile-seeker ranges, extended missile flight time and greater guidance accuracy. The Navy's BMD warships were the assets of choice – indeed, the *only* assets likely capable of destroying the satellite and, most important of all, doing it reliably and efficiently.

Three Aegis warships – USS *Lake Erie* (CG 70), USS *Russell* (DDG 59) and USS *Decatur* (DDG 73) – were tasked to participate in the satellite shoot-down, with *Lake Erie* designated as the principal firing ship. Following extensive materiel, electronic and training preparations (including critical, one-time modifications to the missiles), on February 20, 2008, *Lake Erie* launched a single Standard Missile 3 (SM-3), which intercepted the satellite at an altitude of 153

²⁶ In addition to the United States, Aegis is the surface naval weapon system of choice for Australia, Japan, Norway, South Korea and Spain. The Aegis Weapon System in 2009 is deployed on 88 ships in these navies, with another 18 Aegis warships under construction or planned.

²⁷ Dan Williams, "In Restive Med, U.S. Ship Eyes Risk of Missile War," *Reuters*, September 8, 2009.

²⁸ Ibid.

²⁹ ²⁹ Department of Defense, *Ballistic Missile Defense Review Report*, February 2010. Accessed at: <http://www.defense.gov/bmdr/docs/BMDR%20as%20of%2026JAN10%200630_for%20web.pdf>

nautical miles and a closing speed greater than 22,000 miles per hour. The results were spectacular – with the errant satellite’s fuel tank detonating in a brilliant flash. The Joint Space Operations Center in Vandenberg, California confirmed the breakup of the satellite and that the hydrazine was completely neutralized, leading the Vice Chairman of the Joint Chiefs of Staff to note, “This was uncharted territory. The technical challenge was significant. You want to reach out to all of the sailors on the ship, the technicians and the software programmers, grab them by the hand and thank them for what they did.”³⁰

Today, the multi-mission Aegis weapon system is again at the crossroads of providing a revolution in sea-based capabilities – to defend U.S. forces at sea and ashore, America’s friends and allies, indeed, even the American homeland – against the proliferating threat of ballistic missiles, as well as cruise missiles, UAVs, and aircraft. Coupled with other ground-, sea-, and air/space-based elements of the U.S. Ballistic Missile Defense System (BMDS), such as THAAD, GMD and the Precision Tracking Space System (PTSS), Aegis BMD already provides significant capabilities to deter and defend against a growing global threat. Aegis BMD is on station in the oceans and seas of the world today with as many as six (or more) ships conducting routine, “in-stride” ballistic missile defense, according to Vice-Chairman of the Joint Chiefs of Staff, General James Cartwright, ready to provide our allies with defense against ballistic missiles fired by rogue regimes such as Iran.³¹ The increasingly capable Aegis BMD fleet will, along with the other elements of the Ballistic Missile Defense System (BMDS), provide what the President described as “...stronger, smarter, and swifter defenses of American forces and America’s allies.”³²

Today in 2010, 23 BMD-capable multi-mission warships³³ – three *Ticonderoga*-class cruisers and 17 guided-missile destroyers of the *Arleigh Burke* (DDG 51) class³⁴ – are standing BMD watch, ready to respond, enabling President Obama to make his decision with confidence. In addition, Navy international programs are generating a global Aegis maritime partnership with key allied navies that can energize coalition ballistic missile defense world-wide.

AEGIS BMD WITHIN THE NATIONAL STRATEGIC FRAMEWORK

³⁰ *Rhumb Lines*, February 21, 2008, accessed at: www.navy.mil. *Rhumb Lines* is provided by the Navy Office of Information.

³¹ “Cartwright: Navy May Station Six Aegis BMD Ships Near Europe,” *Inside the Navy*, September 28, 2009.

³² Peter Baker, “White House Scraps Bush’s Approach to Missile Shield,” *The New York Times*, September 18, 2009.

³³ Vice Admiral J.D. Williams (Ret.), “Defending the Skies: U.S. Navy Taking Lead in Missile Defense,” *Defense News*, July 12 2010.

³⁴ U.S. Congressional Research Service. Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress (RL33745; June 10, 2010), by Ronald O’Rourke. Accessed at: <http://www.fas.org/sgp/crs/weapons/RL33745.pdf>

Since the early 1950s, the United States has addressed the ballistic missile threat in several programs, but early efforts for a *national* BMD system advanced only in fits and starts. In its 2008 *Study on the Mission, Roles, and Structure of the Missile Defense Agency (MDA)*, the Institute for Defense Analyses noted:

...there has been an enduring national commitment to ballistic missile defense, including direction currently embodied in law. This commitment has been expressed in presidential direction since the 1950's and 1960s (NIKE Hercules, Sentinel, Safeguard, Site Defense, etc.). The objectives have been pursued by a centralized organization (the MDA and its predecessors) over multiple administrations—President Ronald Reagan, President George H.W. Bush, President William Clinton, President George W. Bush, and now President Barack Obama.³⁵

Today, the United States has fielded an initial national-level BMDS capability, with all aspects of the integrated system – land, sea, air and space – linked together to provide the best possible defense. The U.S. Navy's contribution to BMDS, built around the Aegis Weapon System, has grown in importance based on its proven performance and long-term potential. Indeed, Aegis BMD complements and integrates seamlessly with other elements of the BMDS.

The first priority of the BMDS implementation strategy – establishing a limited defensive capability against North Korean ballistic missiles – has largely been achieved with Patriot Advanced Capability-3 (PAC-3) batteries, the Ground-based Mid-course Defense (GMD) System, the Forward-Deployed TPY-2 Radar, and Aegis BMD long-range search, cueing, and engagement ships. The Aegis BMD system is integrated with Fleet and Joint Force standards, and the BMDS Command, Control, Battle Management and Communications (C²BMC) elements. Aegis BMD interoperates with other in-theater assets, including the Terminal High-Altitude Area Defense (THAAD) system, as well as other ground-, air-, and space-based sensors. Aegis BMD has the ability to operate independently to defeat ballistic missiles, but also to function as an integral node in the overall, integrated national BMDS. Furthermore, and perhaps most critically, Aegis BMD maintains this capability while also being able to carry out other vital naval warfare missions and tasks. This in turn allows Aegis BMD to demonstrate on a day-to-day basis the Department of Defense and Department of the Navy's commitment to network-centric operations using existing mobile and flexible multi-mission systems fully enabled by adaptable networks

Aegis BMD boasts several attributes key to future military operations, including inherent mobility, persistent forward presence, readiness, the ability to operate in international waters and conduct simultaneous multi-warfare operations, including long-range strike and scalability to match the need.. Aegis BMD can reposition in response to a crisis, cover un-defended flanks,

³⁵ Larry Welch and David Briggs (Project co-leaders), *Study of the Mission, Roles, and Structure of the Missile Defense Agency (MDA)* (Washington, D.C., Institute for Defense Analysis, August 2008).

thicken defenses of key areas and regions, and add firepower that brings more options to world leaders when faced with the unthinkable. Therefore, it is the ideal solution for protecting our friends and allies as well as the U.S. Homeland when called upon. Indeed, this was the conclusion reached in 2009 by the Independent Working Group on Missile Defense, the Space Relationship, & the Twenty-First Century, which strongly recommended limiting fixed ground-based missile defense deployments based on GMD, and instead expanding Theater/Regional defenses centered on sea-based missile defense deployments (along with Aegis Ashore, Land Based SM-3 and THAAD radars), recommending in particular: “Equip additional U.S. vessels with the Aegis anti-missile system. Encourage U.S. allies equipped with Aegis/SM to do the same.”³⁶

THE SHIP-BASED SOLUTION

The U.S. Navy’s strong commitment to a national BMDS is articulated in the 2007 tri-service *A Cooperative Strategy for 21st Century Seapower*, which explains, “Maritime ballistic missile defense will enhance deterrence by providing an umbrella of protection to forward-deployed forces and friends and allies, while contributing to the larger architecture for defense of the United States.” Emphasizing the Navy’s intent to push this defensive capability forward, the 2007 strategy also states, “Maritime forces will defend the homeland by identifying and neutralizing threats as far from our shores as possible.”³⁷

The inherent mobility and flexibility of multi-mission naval forces, further enabled by flexible and adaptable sensor networks and battle management, have allowed them to operate far forward, on the high seas as well as in the littorals, and to provide instantly available assets to Combatant Commanders and joint and coalition task force commanders – all without requiring the permission of any government and without increasingly tenuous and brittle host-nation basing agreements. The ability of these naval forces to use the vastness of the world’s oceans for strategic and tactical movement, combined with the increasing stealth and self-defense capabilities of U.S. warships, as well as their increasing ability to fully exploit the Global Space Commons for additional capability, allows commanders to maintain a persistent, scalable and visible naval presence anywhere in the world with low risk. In the words of Michele Flournoy and Ashton Carter (Undersecretary of Defense for Policy and Undersecretary of Defense for Acquisition, Technology & Logistics, respectively), “We are no longer building systems anchored in one place and wedded to current threat assessments. We know that the capabilities

³⁶ *Independent Working Group on Missile Defense, the Space Relationship, & the Twenty-First Century 2009 Report* (Washington, D.C., Institute for Foreign Policy Analysis, 2009), Recommendations, pp. x-xi.

³⁷ *A Cooperative Strategy for 21st Century Seapower* (Washington, DC, Department of the Navy, October 2007).

of potential adversaries do not always progress according to intelligence assessments. Our program must adapt accordingly in the face of evolving and unpredictable threats.”³⁸

Moreover, the multi-mission capability of Aegis guided-missile cruisers and destroyers enables them to defend themselves, other forces in the region, and assets ashore from air, surface and subsurface threats, and, with organic logistics support, the Navy can sustain these ships on station for extended periods. The operational agility and flexibility of these networked BMD-configured Aegis warships enables them to conduct other critical missions while tasked as ballistic missile defense assets – from humanitarian-relief and disaster-response tasks to launching long-range precision strikes with their Tomahawk land-attack cruise missiles. No additional personnel or assets are needed for these full-spectrum operations.

DEFENDING ALLIES – AND AMERICA

The half-century of Aegis System and Standard Missile development that enabled President Obama to make his announcement on September 17, 2009 signals not only a reliance on Aegis BMD to defend Europe and the Middle East, as well as its previous mission to protect much of the Pacific Rim, but also so much more. It is the precursor to a fundamental shift in the Nation’s BMD policy, from a predominantly land- and space-based system to a predominantly sea-based system further enabled by Space and Airborne sensors.

In a 2002 comprehensive assessment of the impact of globalization on maritime power published by National Defense University’s Institute for National Security Studies, Hans Binnendijk and George Stewart noted that “events of the past 18 months have created new possibilities for the U.S. Navy to contribute to defense against intercontinental ballistic missiles (ICBMs).”³⁹ Later, in an article for *Defense Horizons*, these same authors opined, “Using missile interceptors based at sea to defend the United States against ICBMs offers several advantages.”⁴⁰

With each success of the Aegis BMD test program, more observers began to come to grips with the enormous potential of Navy BMD to defend against short-, mid-, and long-range ballistic missiles. In a July 2009 article in the *U.S. Naval Institute Proceedings*, one observer built a strong case for Aegis BMD to serve as the *primary* National BMD asset, concluding:

The United States should place a higher priority on its sea-based systems than on land-based or airborne weapons or sensors. In particular, the Department of Defense should further modify and upgrade the Aegis weapon system to a full

³⁸ Carter, Ashton B. and Michele Flournoy, “The Way Forward on Missile Defense,” *Wall Street Journal*, June 17, 2010.

³⁹ Hans Binnendijk and George Stewart, “Naval Contributions to National Missile Defense,” pp. 455-469, in *Globalization and Maritime Power* (Washington, D.C., National Defense University, 2002).

⁴⁰ Hans Binnendijk and George Stewart, “Towards Missile Defenses from the Sea,” *Defense Horizons*, June 2002.

national missile-defense asset ... were the U.S. government to commit immediately to doing so, maritime ballistic-missile defense assets – building almost entirely on the mature and hardy Aegis infrastructure – could provide the full range of boost, mid-course, and terminal defense against missiles from the SRBM class to large ICBM types by 2015. This capability will come at a fraction of the price of other weapon systems where the Defense Department must build the system infrastructure from scratch.⁴¹

Indeed, today, Navy BMD is the only certified, operationally effective and suitable system that the MDA can field to defend our allies and friends from theater and regional ballistic missile attack.⁴² This is only possible due to the Navy's commitment to make BMD an in-stride core mission for all Aegis ships and the continued growth in capability and capacity these ships deliver. This vital capability has been delivered while utilizing only 10% of the Total Obligational Authority of the MDA and its predecessors. And while cost was reportedly not a primary factor in the President's final decision, the Government Accountability Office recently revealed new estimates of the cost of the land-based system in Europe, which substantially exceeds the original cost estimate of more than \$4 billion, making Aegis BMD an even more affordable and cost-effective short- and long-term option, especially when paired with the emerging THAAD radar system as well as space and airborne Sensors.⁴³

To defend Europe, the United States will call on a scalable number of Aegis ships to protect our friends and allies in a crisis, delivering what Secretary Gates called, "A very real manifestation of our continued commitment to our NATO allies in Europe – iron-clad proof that the United States believes the alliance must remain firm."⁴⁴ Indeed, just two weeks after the President's announcement, one op-ed captured the efficacy of this decision:

Even as some were gnashing their teeth at this "abandonment" of the European allies, U.S. guided missile cruisers and destroyers armed with SM-3 missile interceptors were moving into position, in places like the eastern Mediterranean and the South China Sea, against missile threats from Iran and North Korea. More such ships, tied to land-based radars, are being deployed. And if the threat

⁴¹ Bart Denny, "Put the Navy in the LEAD!" *U.S. Naval Institute Proceedings*, July 2009, pp. 48-52.

⁴² There is increasing recognition that the primary threat to U.S. forces forward and to allies is short- and mid-range ballistic missile. See, for example, Jeff Bliss and Tony Capaccio, "Short-Range Missiles Biggest Threat, General Says," *Bloomberg.com*, July 28, 2009. This article quotes Missile Defense Agency Director, Lieutenant General Patrick O'Reilly, who notes, "Short- and medium-range weapons represent ninety-nine percent of the threat today."

⁴³ See, for example, Walter Pincus, "GAO: Missile Site Costs Likely to Rise," *Washington Post*, August 15, 2009, Judy Dempsey and Peter Baker, "U.S. Mulls Alternatives for Missile Shield," *The New York Times*, August 29, 2009, and Christopher Drew, "Soaring Costs Jeopardize Missile Defense Systems," *The New York Times*, March 18, 2009

⁴⁴ Robert Gates, "A Better Missile Defense for a Safer Europe."

develops as intelligence agencies predict, this anti-missile system will thicken and deepen to include land-based missiles in Europe.⁴⁵

Tomorrow, as new systems are delivered and Aegis Ashore is added to the mix, the Navy will continue to build towards an in-stride Aegis BMD capability that is EMP protected and fully enabled by space and airborne sensors for our Fleet in order to provide maximum flexibility to Combatant Commanders. The recent establishment of the Navy Air and Missile Defense Command (NAMDC) as the center-of-excellence for Navy BMD is but one indicator of how vital this mission is to the future of the Navy and indeed the entire Nation.⁴⁶

THE FUTURE OF AEGIS BMD

The Navy will continue to populate its current Aegis Fleet with BMD via modernization and upgrades. Current MDA and Navy plans have the Navy on a path to increase the number of Aegis BMD-capable ships from 20 today to 38 at the end of fiscal year 2015.⁴⁷ Moreover, according to *Inside Defense*, the Navy “expects to fund installations for nearly 60 cruisers and destroyers through fiscal year 2024, with all new-build DDG-51s getting the systems” in response to sharply-growing demand for Aegis BMD assets.⁴⁸ In the wake of the President’s announcement, and as the outstanding capabilities and future potential of Aegis BMD becomes well-recognized, this schedule could certainly be accelerated.

The decision to truncate the DDG-1000 program at three ships and the concomitant decision to continue the Aegis Destroyer program beyond the numbers originally envisioned is mute testimony to the importance of Aegis BMD for the Navy and the Nation. Indeed, the Chief of Naval Operations has stated his intention to make BMD a fundamental capability. Further, recognizing the likely growth in importance of Aegis BMD, the Navy has proposed a 20-year,

⁴⁵ David Wood, “Missile Defense: Who’s Jeering Now?” *PoliticsDaily.com*, September 30, 2009.

⁴⁶ “Integrated Air and Missile Defense,” *Rhumb Lines*, April 7, 2009, accessed at: www.navy.mil. This issue of *Rhumb Lines*, quotes then-U.S. Third Fleet Commander, VADM Sam Locklear, who notes; “Navy Air and Missile Defense Command will mature our proven ballistic missile capability and move us towards a new level of integrated air and missile defense dominance in the maritime domain.” NAMDC was established in April 2009 at Naval Support Facility Dahlgren, Virginia. The *Rhumb Lines* notes further; “Integrated Air and Missile Defense (IAMD) is a core mission of the U.S. Navy and one of the key enabling capabilities that the Navy provides the joint force...NAMDC brings together the technology, concepts and programs for air and missile defense.”

⁴⁷ U.S. Congressional Research Service. Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress (RL33745; June 10, 2010), by Ronald O’Rourke. Accessed at: <http://www.fas.org/sgp/crs/weapons/RL33745.pdf>

⁴⁸ “Navy Plans To Have Nearly 60 Ships Funded For Aegis BMD By FY-24,” *Inside the Navy*, May 17, 2010. See also “The Future Force – Surface Combatants,” *Rhumb Lines*, September 18, 2009, accessed at: <http://www.navy.mil/navco/speakers/currents/The%20Future%20Force%20Surface%20Combatants%2018%20Sept%2009.pdf>. *Rhumb Lines* is provided by the Navy Office of Information.

\$10 billion program to upgrade and modernize its existing fleet of 84 Aegis-class warships – 22 *Ticonderoga* cruisers and 62 *Arleigh Burke* guided-missile destroyers, ensuring that these ships serve up to and past their original 30-year service lives.⁴⁹

As part of the president's decision, the United States will deploy existing Standard Missile-3s (SM-3) using the sea-based Aegis BMD system, and then field an improved version in 2015 on both ships and land. Rather than the ten initially-planned ground-based interceptors originally envisioned in Poland, this plan calls for 40 to 50 SM-3 missiles on land, with more onboard Navy BMD ships. More advanced versions will be deployed in 2018 and yet another generation in 2020, the latter based on the US/Japan cooperatively developed SM-3 Block IIA, with more capability to counter intercontinental ballistic missiles.⁵⁰ Testifying before the Senate Armed Services Committee on September 24, 2009, Undersecretary of Defense Michelle Flournoy described the rationale behind the President's decision:

“The new approach in Europe would also rely on a distributed network of sensors and proven SM-3s, which can be fired from both Aegis ships and from land. This means greater geographic flexibility, greater survivability and greater scalability in response to an evolving threat. That's exactly what we mean by a phased, adaptive approach.”⁵¹

The updated SM-3 missiles will provide a key capability that the Ground-Based Interceptor lacks – namely, the ability to defend against missiles in their boost phase. According to Gen. James Cartwright, this is “by all accounts and all analysis, the most effective way to take on the threat,” which is “most vulnerable as it is ascending. It can't defend itself. It can't maneuver. It is very ballistic at that stage. If we can get it at that stage, we can thin out the threat substantially, if not eliminate it.”⁵²

Going forward, the Aegis program is also expected to take advantage of newer platforms, such as unmanned aerial vehicles (UAVs). This process actually began in March 2009, when the Stellar Daggers series of Aegis BMD intercept tests “demonstrated the capability of unmanned aerial vehicles as highly accurate forward-based missile defense sensors.”⁵³ This line of testing is expected to continue; indeed, the DoD has requested additional funding to develop UAVs for use as sensors in sea-based Aegis BMD exercises.⁵⁴

⁴⁹ The Navy's plan is to have these Aegis cruisers and destroyers reach as service life of 35 years, unprecedented for Navy surface combatants.

⁵⁰ Peter Baker, “White House Scrap's Bush's Approach to Missile Shield,” *The New York Times*, September 18, 2009.

⁵¹ “Cartwright: Navy May Station Six Aegis BMD Ships Near Europe,” *Inside The Navy*, September 28, 2009.

⁵² “Cartwright: Navy May Station Six Aegis BMD Ships Near Europe,” *Inside The Navy*, September 28, 2009.

⁵³ “O'Reilly: DoD Seeks Funding To Develop UAVs For Aegis BMD Tests,” *Inside the Navy*, September 28, 2009.

⁵⁴ “O'Reilly: DoD Seeks Funding To Develop UAVs For Aegis BMD Tests,” *Inside the Navy*, September 28, 2009.

Even with delivery of new capability like Aegis Ashore, sea-based BMD will likely remain a core element of any defense against ballistic missiles. The inherent flexibility and mobility of Navy BMD assets provides a missile defense option Combatant Commanders count on as part of their defensive arsenal. Indeed, surging Aegis BMD has become Standard Operating Procedure in any crisis where defense against ballistic missiles is needed.

However, this high demand for the Aegis Weapons System will likely be the source of its greatest future challenges – namely, integration and interoperability. The Aegis BMD system relies on the Command and Control, Battle Management, and Communications (C²BMC) system for its overarching command and control. The C²BMC system “brings together information from the various sensors, provides planning capability for missile defense operations, and makes available situational awareness for all levels of decision-making.”⁵⁵

The Aegis BMD system is already well-integrated and interoperable with other U.S. assets; however, it will eventually be held to this same standard with regard to coalition operations. This process has already begun – a fact that Lt. Gen. Patrick O’Reilly, Director of the Missile Defense Agency, highlighted in 2009. He noted that under Obama’s missile defense plan, radars and other sensors from different parts of the world would be linked to enable the early targeting of ballistic missiles, which is a breakthrough capability that did not exist five years ago.⁵⁶

Achievement has been made in other areas as well. Still, while NATO’s Active Layered Theatre Ballistic Missile Defense (ALTBMD) program has conducted tests demonstrating Shared Situational Awareness with the U.S. C²BMC system, the goal of true C2 interoperability has not yet been achieved. The 28 NATO allies decided during their summit in Lisbon in November 2010 to connect the European allies’ short- and medium-range theatre missile defense systems via NATO to the U.S. long-range missile defense system.⁵⁷ According to Allied officials, this move would cost only EUR200 million, or USD252 million.⁵⁸ This interoperability issue will eventually be raised in other regions as well, such as the Middle East and East Asia. The high level of commitment to international partnership from both the United States and its allies will help to spur interoperability initiatives on to success. This interoperability between U.S. and coalition BMD systems will, in turn, ultimately ensure the success of the U.S.’ phased adaptive approach to missile defense.

The Aegis System would also benefit from integration with non-kinetic capabilities for ballistic missile defense. These include, for example, electronic attacks and jamming. An author at the U.S. Naval Institute Proceedings blog argues that:

⁵⁵ Department of Defense, *Ballistic Missile Defense Review Report*, February 2010. Accessed at: <http://www.defense.gov/bmdr/docs/BMDR%20as%20of%2026JAN10%200630_for%20web.pdf>

⁵⁶ Walter Pincus, “New Missile PLAN Would Link Allies’ Radar, Other Systems,” *Washington Post*, October 8, 2009.

⁵⁷ Brooks Tiger, “NATO’s Missile Defence C2 Plans Move Forward,” *Jane’s Defence Weekly*, July 09, 2010.

⁵⁸ Ibid.

One potential vulnerability of mobile Theatre Ballistic Missiles is their command and control networks, especially if there is intent to employ them in saturation raids in concert with anti-ship or land-attack cruise missiles. Identification of critical communications nodes and attack via non-kinetic means may result in disruption of attacks or even disablement of the missiles themselves.⁵⁹

The emphasis on non-kinetic capabilities has strengthened in the wake of renewed focus on ascent phase intercept (API), an area that remains more problematic than mid-course/exo-atmospheric or terminal/endo-atmospheric interception. However, with the U.S. Navy's demonstrated commitment to excellence in the field of cyber operations, we can expect that the capabilities offered by non-kinetic means will continue to be explored and developed. It will be imperative that the Aegis system work seamlessly with such new capabilities.

FORWARD ... ON PATROL

Two seemingly unrelated events just over a quarter-century ago have now converged, and the result is an Aegis BMD capability that embraces allies and friends in a Global Maritime Partnership that protects U.S. and allied forces, and defends the U.S. homeland.

The first event was commissioning of the USS *Ticonderoga* on January 22, 1983. "*Tico*" brought revolutionary naval warfare capabilities to the planned 600-ship fleet, centered on the Aegis Weapon System capable of tracking more than 200 individual targets and guiding numerous Standard surface-to-air missiles in flight, simultaneously, while also remaining ready to carry out vital anti-surface, anti-submarine, and land-attack missions.

The second event was the March 23, 1983 speech by President Reagan. "What if free people could live secure in the knowledge that their security did not rest upon threat of instant U.S. retaliation to deter a Soviet attack," he asked, "but instead that we could intercept and destroy strategic ballistic missiles before they reached our own soil or that of our allies?"⁶⁰ This was the catalyst for the United States to create a truly national ballistic missile defense system.

Now, just over 25 years on, Aegis BMD is a crucial, and indeed pivotal, element of the nation's defense in the 21st Century. And, as Aegis BMD continues to evolve, America's ability to defend the homeland, our friends and allies worldwide, and our forces at sea and ashore against ballistic missiles of all ranges and during all phases of flight will keep us ahead of the threat.

⁵⁹ "BMD From the Sea – It's Not Just For SWO's," *U.S. Naval Institute Blog*, May 28, 2009. Accessed at: <<http://blog.usni.org/2009/05/28/bmd-from-the-sea-its-not-just-for-swos/>>.

⁶⁰ *A Historic Beginning* (Washington, D.C., Ballistic Missile Defense Agency, 2005). This Second Edition of the BMDS "Booklet," the Missile Defense Agency's summary of accomplishments and future plans, cites President Reagan's March 23, 1983 speech on the inside-front cover. This speech is widely-recognized as the beginning of missile defense for the United States.

Aegis BMD is today at sea, in areas far forward as well as near the homeland, on patrol – the Shield of the Fleet, the nation, and key friends and allies worldwide.



Aegis International & BMD: A New Interoperability Network

Track 9: Networks and Networking

Mr. Frank Anderson
Mr. George Galdorisi
Ms. Amanda George
Ms. Rachel Volner

WAR MADE NEW

「 TECHNOLOGY, 「
WARFARE, AND THE
COURSE OF HISTORY
「 1500 TO TODAY 」

MAX BOOT

AUTHOR OF THE SAVAGE WARS OF PEACE



“My view is that technology sets the parameters of the possible; it creates the potential for a military revolution.”

Max Boot
War Made New

Outline

- ▼ U.S. BMD: Ready To Meet The Global Threat
- ▼ U.S. Naval BMD: Leading the Way
- ▼ Lab-based Initiatives
- ▼ Into the Future

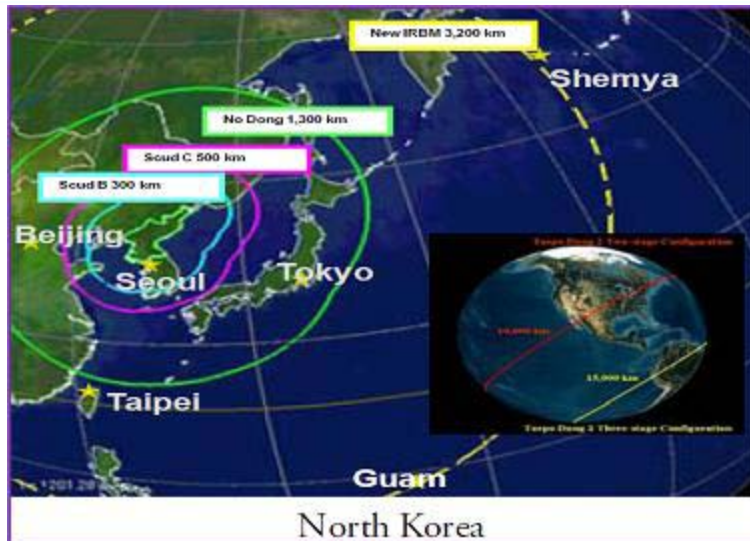
A Cooperative Strategy For 21st Century Seapower

U.S. BMD: Ready To Meet The Global Threat

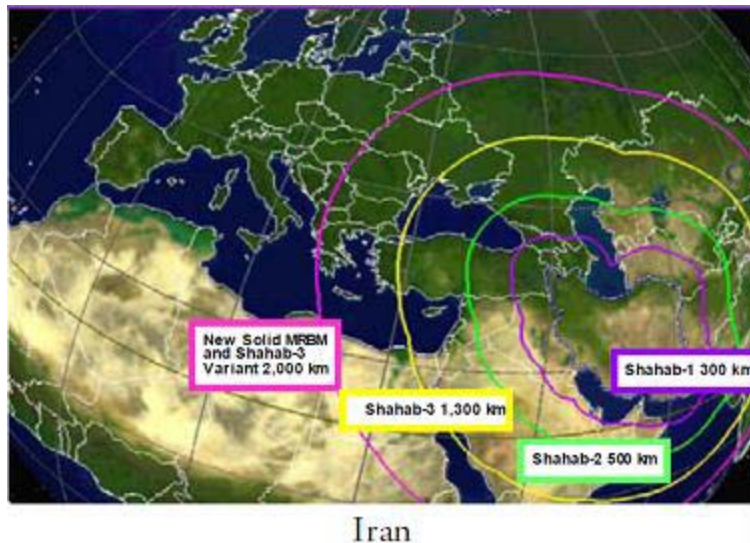
“The threat posed by ballistic missile delivery systems is likely to increase while growing more complex over the next decade ... Ballistic missile systems are becoming more flexible, mobile, survivable, reliable, and accurate while also increasing in range.”

Ballistic Missile Defense Review Report

U.S. BMD: Ready To Meet The Global Threat



- ▼ The global BMD threat has grown both qualitatively and quantitatively
- ▼ In response, the U.S. has adopted the Phased Adaptive Approach (PAA)
- ▼ The Aegis Weapons System is the cornerstone of the PAA



U.S. Naval BMD: Leading The Way

“We are no longer building systems anchored in one place and welded to current threat assessments. We know that the capabilities of potential adversaries do not always progress according to intelligence assessments. Our program must adapt accordingly in the face of evolving and unpredictable threats.”

Michele Flournoy, Undersecretary of Defense, Policy
Ashton Carter, Undersecretary of Defense, AT&L
The Way Forward on Missile Defense
Wall Street Journal, June 17, 2010

U.S. Naval BMD: Leading the Way



- ▼ The Aegis Weapons System boasts 50 years of research and development
- ▼ The Aegis system occupies a key position within the national BMDS
- ▼ Demand far outpaces supply, and is expected to continue to do so

Lab-Based Initiatives

“We will win – or lose – the next series of wars in our nation’s laboratories.”

Admiral James Stavridis

EUCOM Commander

“Deconstructing War”

U.S. Naval Institute Proceedings

December 2005

Lab-Based Initiatives

- ▼ Research and Development
- ▼ Testing and Evaluation
- ▼ Ongoing Support

Research and Development

▼ **SSC PAC and PEO C4I aligned with Missile Defense Agency (MDA) for C4I Systems Development, Integration, and Test**

- Command and Control (C2)
- Tactical Data Links (TDLs)
- Tactical Networks
- Communications
- Battle Space Awareness
- Ship & Shore Integration

▼ **Partner with NSWC PHD, NSWC Dahlgren, NSWC Corona, Lockheed Martin, JHU/APL, Northrop Grumman**

International BMD Support

▼ Japan Aegis BMD (JABMD)

- SSC PAC instrumental in providing operational capability for JABMD
 - Teaming with MDA/International for C4I systems integration on Japanese Ships
 - Japanese Flight Test Missions (JFTM 1-4)
 - Proven Interoperability during Real World Events



▼ Israeli Missile Defense

- SSC PAC teaming to support Arrow Weapons Systems and Bi-National Interoperability
 - Developing solutions for Link 16 systems and Israeli Missile Defense Architecture
 - Teamed with MDA, PEO C4I, and Fleet Commanders to execute BMD system level testing

Ongoing Support

▼ European Phased Adaptive Approach (PAA)

- Aegis Ashore Assured C4I (A3C4I) T&E Lead
- Evaluating C4I requirements to support Aegis Ashore (AA)
- Coordinating with PEO, MDA AB, and NAMDC

▼ Continued Operational and Integration support for MDA

- Helping to bring BMD capability to the Fleet and Warfighter

Into the Future

“I believe that cooperative missile defense with Russia has enormous potential, since the sharing of our technologies and information, which we currently collect about missile launches from third countries, can make both of our countries more secure.”

President Barack Obama

Into The Future

- ▼ Opportunities abound: Aegis expected to be installed in 60 cruisers & destroyers by FY2024; the system will also boast significant upgrades as the PAA is implemented.
- ▼ Challenges persist: Need for integration & interoperability both with coalition partners and with emerging capabilities (i.e., non-kinetic capabilities).
- ▼ The success of the Aegis Weapons System and the Phased Adaptive Approach will be dependent on continued high-level commitment and funding

Questions?