

Countering the EMP Threat

THE ROLE OF MISSILE DEFENSE

Henry F. Cooper and Robert L. Pfaltzgraff, Jr.



The Independent Working Group

The Independent Working Group (IWG) on Post-ABM Treaty Missile Defense and the Space Relationship was formed in 2002. Our goals are severalfold: (1) to examine the evolving threats to the United States, its overseas forces, allies, and coalition partners from the proliferation of ballistic missiles; (2) to examine missile defense requirements in the twenty-first century security setting; (3) to assess current missile defense programs in light of technological opportunities in the post-ABM Treaty world; and (4) to set forth general and specific recommendations for a robust, layered missile defense for the United States.

In pursuit of these objectives, the IWG meets several times a year. These meetings provide an opportunity not only to analyze issues directly related to missile defense, but also to identify a large number of additional topics for discussion. The IWG includes members with technical expertise as well as participants familiar with the politics of missile defense.

The 2009 report, our latest, is intended as a living document, to be updated as necessary in order to provide a basis for informed consideration of missile defense needs. As with the first edition of the report published in 2006, its contents will be reproduced and amplified in other formats in order to assure broader dissemination of the IWG's work.

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WHITE PAPER

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Introduction

Among the threats facing the United States are short-range ballistic missiles launched from vessels such as freighters, tankers, or container ships off our shores to detonate a warhead that could have catastrophic Electromagnetic Pulse (EMP) consequences for the United States. No national strategy addresses either the EMP threat or underwrites a serious program to counter the delivery of EMP by a bal-

listic missile launched from a vessel off our coasts.¹ Commissions, studies and hearings have produced no action beyond the byproducts of efforts to defend the United States against ICBMs that might be launched by a country such as Iran or North Korea, or our overseas troops, friends and allies against shorter range ballistic missiles.²

While in no way discounting the need for effective missile defenses against the growing ICBM threat, it is also imperative that the United States address the more immediate threat posed by the possible attack by shorter-range missiles, and the EMP threat in particular. Although some enemies of the United States are developing long-range missiles, they and others already have short- and medium-range missiles that could be launched from ships near our coasts. Several years ago, Iran tested a short-range ballistic missile in a way that indicated an interest in developing an EMP capability—so this threat is not hypothetical. It also must be remembered that terrorists might purchase such missiles—even possibly armed with nuclear weapons.

After discussing the potential for a successful EMP attack, we suggest what can (and should) be done to counter such an attack by using existing and near-term missile defense capabilities, beginning immediately. Currently deployed *Aegis* ballistic missile (BMD)-capable cruisers and destroyers, if appropriately stationed, can today provide mid-course-phase intercept capability, particularly during the threat rocket's "ascent phase." As soon as practical, a boost-phase intercept capability should be added to the *Aegis* system.³ Existing and planned improvements to *Aegis* BMD-ship capabilities should be accompanied with: (1) *Aegis Ashore*, consisting of the Navy's interceptors based on land (as is being planned for European sites) in U.S. coastal regions; and (2) unmanned aerial vehicles (UAVs) armed with advanced medium-range air-to-air missile (AMRAAM)-sized missiles.

In addition, *Aegis* ships, other Navy combatants, and "deep water" Coast Guard ships could interdict vessels that threaten a coastal EMP attack if they have sufficient warning to locate and disable/destroy such ships before they can launch

- 1 According to the 2004 *Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack, Critical National Infrastructures*, a single nuclear weapon exploded at high altitude above the United States will interact with the Earth's atmosphere, ionosphere, and magnetic field to produce an electromagnetic pulse radiating down to Earth and additionally create electrical currents in the Earth. EMP effects are both direct and indirect. The former are due to electromagnetic "shocking" of electronics and stressing of electrical systems, and the latter arise from the damage that "shocked" upset, damaged, and destroyed electronics controls then inflict on the systems in which they are embedded. See http://www.empcommission.org/docs/A2473-EMP_Commission-7MB.pdf.
- 2 The February 2010 Department of Defense *Ballistic Missile Defense Review Report* states, "The United States seeks to dissuade such states (as Iran and North Korea) from developing an intercontinental ballistic missile, deter them from using an ICBM if they develop or acquire such a capability, and defeat an ICBM attack by such states should deterrence fail."
- 3 In most missile defense literature, the trajectory of a ballistic missile is described as following three phases: boost, midcourse, and terminal. The boost phase begins immediately after launch, while the booster rocket is burning, emitting bright exhaust gases that are relatively easy for sensors to detect and track—the principal challenges for a boost phase defense is to discriminate between that bright plume and the target rocket—and to intercept it in a very brief time (a minute or so) during which the rocket accelerates to reach its "burnout" velocity and the weapon separates from the launching rocket. The separated weapon then coasts through the much longer midcourse phase in outer space—first ascending (while decelerating because of gravity) to the trajectory's high point, or apogee, and then descending (while accelerating) back toward the earth's atmosphere. Then, during its terminal phase, the weapon descends through the atmosphere to its target. The Missile Defense Agency (MDA) now divides the trajectory into four phases: boost, ascent, midcourse, and terminal (see <http://www.mda.mil/system/elements.html>), a formulation due in part to the increased emphasis MDA has placed in the past year on ascent phase intercept (see page 9 as well as footnote 19 in this White Paper). The "ascent phase" which begins immediately following boost phase and lasts until apogee, technically is the initial part of the midcourse phase.

an attack. Such operations would place a special burden and responsibility on early warning and intelligence capabilities, and would have important command and control implications, as discussed later in this White Paper.

The EMP Threat

During the Cold War, an ICBM attack from the Soviet Union could have brought us unthinkable devastation and destruction within 30-35 minutes. Although that threat has receded since the end of the Cold War, we now face the possibility that within the much shorter time (on the order of five minutes) that it takes to execute an EMP launch near our coasts, we could be put back into an pre-industrial economy facing possibly irreversible societal breakdown, as William Forstchen so graphically describes in his recent book *One Second After* and as the 2004 bipartisan Congressionally-mandated EMP Commission set forth in its detailed report. Short- and medium-range missiles with nuclear warheads could be launched from the sea against targets on land, including cities. They could also be launched with nuclear warheads to detonate at altitudes sufficient to have devastating EMP effects.⁴

According to the EMP Commission, the United States faces an EMP threat that could have catastrophic consequences from even a single nuclear warhead. The EMP threat arises from the ability, whether by terrorists or states, to launch even relatively unsophisticated missiles with nuclear warheads to detonate from 40 to 400 kilometers altitude above the Earth's surface, with greater heights-of-burst exposing larger areas on the ground to EMP.⁵ Such action would provide the attacker with high political-military payoff in the form of devastating consequences. An EMP attack would constitute an asymmetric strategy against the United States, which is heavily dependent on electronics, energy, telecommunications networks, transportation systems, banking, the movement of inventories, and food processing and distribution capabilities.

The EMP Commission reported that EMP was an unanticipated result of a nuclear detonation at an altitude of about 400 kilometers during the Starfish nuclear weapons tests above Johnston Island in the Central Pacific in 1962. Effects, felt some 1400 kilometers away in Hawaii, included "the failure of street lighting systems, tripping of circuit breakers, triggering of burglar alarms, and damage to a telecommunications relay facility." The Commission also reported that 1962 high altitude nuclear tests conducted by the Soviet Union also produced damage at distances as far away as 600 kilometers to overhead and underground buried cables, together with surge arrester burnout, spark-gap breakdown, blown fuses, and power-supply interruption.

The destruction and mayhem caused by an EMP explosion would be far more substantial today given the ubiquity of more fragile electronics

4 On June 15, 2010, the National Geographic Channel presented "Electronic Armageddon," which provided a vivid description of the vulnerability of critical U.S. infrastructure to the EMP threat and its potential consequences. See <http://channel.nationalgeographic.com/series/explorer/4821/Overview>.

5 According to the EMP Commission, potentially damaging EMP will be experienced at a distance from "ground zero" of 110 kilometers times the square-root of the burst-altitude measured in kilometers; thus, a nuclear weapon with a burst height of 100 kilometers (whose square-root is 10) will expose an underlying area with a radius of 1100 kilometers (or about 1200 miles in diameter) to the effects of its EMP. A burst-height of 400 kilometers over Omaha is the usual "base case," as it suffices to cover most of the continental United States (that is, approximately 2400 kilometers (or about 1440 miles) east or west) with its EMP.

and our greater reliance on them to run critical infrastructures. Moreover, an EMP burst could directly affect the 3,000 commercial and military flights airborne over the United States at any given time, possibly causing them to crash. Most of those aircraft, equipped with electronic-interface fly-by-wire control systems, would become unguided missiles, plummeting to Earth and leading to many thousands of fatalities and enormous physical damage.

Such a weapon need not be detonated directly over the United States itself to produce major damage to America's critical infrastructures such as telecommunications, banking and finance, fuel/energy, transportation, food and water supply, emergency services, government activities, and space systems. U.S. satellites, both civilian and military, are vulnerable to a range of attacks that include EMP, especially in low-Earth orbits. Again, as the EMP Commission concluded, "The national security and homeland security communities use commercial satellites for critical activities, including direct and backup communications, emergency response services, and continuity of operations during emergencies." Such satellites could be disabled by collateral radiation effects from an EMP attack on ground targets.

Thus, it is obvious that an EMP attack would have cascading effects. Disabling even one of the elements of our critical infrastructure, such as telecommunications or electricity, would have severe consequences for others – effects from which an advanced, technologically dependent society such as the United States might not easily recover. An EMP attack on the United States would have global consequences, extending from Europe to Northeast Asia and in and beyond this Hemisphere given America's interdependence with other economies. By the same token an EMP attack against other technologically advanced economies, such as Japan or Europe, would have major effects in the United States. The services essential to coping with the consequences of a terrorist attack, such as hospitals and emergency services, might be disabled and therefore unavailable when and where they were most needed. As Senator Jon Kyl has pointed out:

*"A terrorist organization might have trouble putting a nuclear warhead 'on target' with a Scud, but it would be much easier to simply launch and detonate in the atmosphere. No need for the risk and difficulty trying to smuggle a nuclear weapon over the border or hit a particular city. Just launch a cheap missile from a freighter in international waters – al-Qaeda is believed to own about eighty such vessels – and make sure to get it a few miles in the air."*⁶

Several countries either already have, or could soon acquire, such EMP attack capabilities. For example, during the May 1999 NATO air campaign against Serbia, members of the Russian Duma, meeting with

6 Jon Kyl, "Unready for This Attack," *Washington Post*, April 16, 2005, <http://www.washingtonpost.com/wp-dyn/articles/A57774-2005Apr15.html> (as of November 12, 2008).

⁷ Ibid.

⁸ See *WorldNetDaily.com*, "From Joseph Fareh's G2 Bulletin: Iran plans to knock out U.S. with nuclear bomb," April 25, 2005, http://www.worldnetdaily.com/news/article.asp?ARTICLE_ID=43956 (as of November 12, 2008).

U.S. congressional counterparts, reportedly speculated about the paralyzing effects of an EMP attack on the United States.⁷ Iran is reported to have tested whether its ballistic missiles, such as the *Shahab-3* or the *Scud*, could be detonated by remote control while still in high-altitude flight. One plausible explanation for such tests is that Iran is developing the capability to explode a high-altitude nuclear weapon that could destroy critical electronic and technological infrastructures.⁸ Without a countervailing strategy that includes a missile defense configured against an EMP attack, the United States will remain especially vulnerable to the EMP threat given its extensive dependence on high-tech, electronic infrastructure that cannot easily be hardened to withstand such an attack.

The Role of Missile Defense

Before discussing missile defense and the EMP threat, it is essential to frame the setting in which the potential role of missile defense has been debated. The better has often become the enemy of the good, the argument being that since we cannot protect everything at all times, it is futile to have any defense at all. Although it may not be affordable or practical to achieve total coverage against an EMP attack, the issue is what can be done to begin to deal with this major twenty-first-century national security threat even though such an initial defense will be imperfect. This White Paper argues for a deployment strategy that begins immediately with partial coverage provided by a near-term combination of sea, land, and armed unmanned aerial vehicle (UAV) elements followed by further improvements, some of which are already being developed.

A would-be EMP attacker could be deterred by an integrated system with an ability: 1) to detect a ship carrying one or more ballistic missiles and initiate interdiction activities (e.g., via the Proliferation Security Initiative and the Global Initiative to Combat Nuclear Terrorism)⁹ prior to that ship reaching striking distance of the United States, and, failing that detection and interdiction; 2) to intercept the attacking missile, following tactical warning of its launch, before detonation of its nuclear EMP-producing warhead. Beyond deterrence and active defenses, our goal should be to reduce casualties and provide post-attack infrastructure reconstitution.

Such capabilities would increase in effectiveness with time after beginning initial operations, and would introduce ever increasing planning uncertainty for the would-be perpetrator of an EMP attack against the United States. Even the initial limited missile defense, as contrasted to no missile defense, could lead potential attackers to conclude that there are formidable obstacles to an EMP attack, rather than America's current essentially complete vulnerability.

⁹ The Proliferation Security Initiative, launched by President Bush in May 2003, is a global effort that seeks to stop trafficking of WMD, their delivery systems, and related materials to and from states and non-state actors of proliferation concern: see <http://www.state.gov/t/isn/c10390.htm> The Global Initiative to Combat Nuclear Terrorism is an international partnership of 81 nations and four official observers to prevent, detect, and respond to nuclear terrorism by conducting multilateral activities that strengthen the plans, policies, procedures, and interoperability of partner nations: see <http://www.state.gov/t/isn/c18406.htm>,

The missile defense architecture discussed below would protect cities against attack by short- and medium-range nuclear missiles, while countering an EMP attack that could affect a significant area of the United States. Because we are highly vulnerable to EMP effects, steps should be taken as a matter of urgency to harden infrastructure against EMP effects, as recommended by the EMP Commission. And as a top priority, we can (and should) adapt our missile defense systems to meet the EMP threat. Our primary goal should be to deter or defeat such an attack by the clear ability to intercept a missile before it detonates a nuclear warhead, preferably in the ascent phase. As already noted, the architecture set forth in this White Paper contains essentially three components – *Aegis* BMD ships, *Aegis Ashore*, and UAV capabilities – in addition to command and control system and intelligence/early warning system components to be discussed.

Aegis BMD Ships

Standard Missile (SM)-2 *Block IV* anti-ballistic missiles deployed on U.S. Navy *Aegis* BMD-capable cruisers and destroyers that periodically transit our coastal waters provide a limited near-term defense against a *Scud*-type missile launched from a ship. Far more capability to defend larger areas is provided by the faster SM-3 interceptor—with a burn-out velocity just over 3 km/second. (The midcourse defended area, increases as the square of this velocity.) Over 60 SM-3s and 70 SM-2 *Block IV*s are currently deployed on 20 US Navy ships and 3 *Aegis* ships in Japan's Navy.¹⁰ *Aegis* BMD is already “on call” to defend friends and allies in the Mediterranean, the Persian Gulf, the Sea of Japan and the Atlantic and Pacific Oceans.

The SM-3 interceptor has established an impressive testing track record,¹¹ including a successful ascent-phase intercept in 2002. This proven ability of the SM-3 to destroy theater ballistic missiles (TBMs) can help to deter and defeat an EMP attack, provided the *Aegis* ship is close enough to intercept the attacking ballistic missile before its nuclear weapon is detonated.

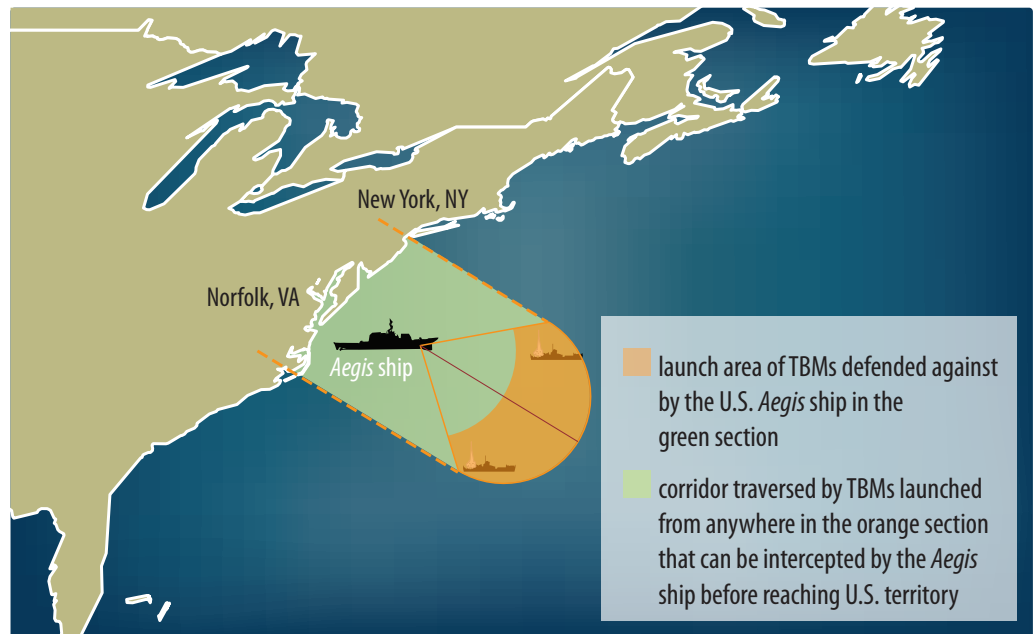
The ascent phase intercept capability is illustrated in the chart below against 600-km range TBMs that could be used to launch an EMP strike. The orange-shaded section is the launch area of TBMs defended against by the U.S. *Aegis* ship shown in the green-shaded section. The green-shaded section represents the corridor traversed by missiles launched from anywhere in the orange-shaded section that can be intercepted by the *Aegis* ship before they reach U.S. territory.

The purpose of the chart below is to show that SM-3 interceptors on a single *Aegis* ship operating in a region near Norfolk, Va. could protect a significant portion of the Eastern seaboard. Additional ships with this capability could extend this coverage to the remainder of the East Coast from New England to Florida. Five *Aegis BMD*-capable

¹⁰ Additional ships and SM-3s are being deployed—the current deployment of 60 SM-3s on 20 *Aegis* ships will grow to 240 on 40 ships by 2015, divided equally between Pacific and Atlantic operations. There are no additional SM-2 *Block IV*s being planned for deployment.

¹¹ Authoritative witness to this proven capability is provided by Under Secretaries of Defense Michele Flournoy and Ashton B. Carter in their June 17 *Wall Street Journal* article on the way forward on Missile Defense: “The SM-3 version deployed on Navy ships today has hit—within inches—its exact target in nine out of 10 tests. The accuracy of these tests has been confirmed in a variety of ways: by fiber-optic grids that can precisely indicate the point of impact on the target; by images taken from the interceptor in the very last moment before impact (images not available to the public for security reasons); by data from highly accurate radars and airborne sensors; and by extensive rocket sled tests and computer simulations on the ground. All these verification sources confirm that when a missile warhead was hit, it was destroyed. These results have been validated by an independent panel of experts with access to all of the classified and unclassified test data.”

***Aegis*/SM-3 Notional Interception Footprint for Coastal Defense Against an EMP Attack**



¹² The *Aegis* platforms normally conduct multiple operations, including air defense, antisubmarine warfare, anti-surface warfare, naval surface fire support for forces ashore, and Tomahawk cruise missile strike operations.

ships are now stationed in the Atlantic—a number that is scheduled to grow to 18 by 2015, and only several would be required to provide extensive East Coast/Gulf Coast coverage. All *Aegis* ships with the SM-3 and its associated support equipment could provide a limited defense against the EMP threat while still performing their day-to-day normal operations.¹² The more ships that have this capability, the better. If the SM-3 interceptors on these *Aegis* ships were periodically tested on East Coast Test Range (supported by radar and other existing sensors located along the Eastern Seaboard), then those who would like to conduct an EMP attack might be deterred—and if not the *Aegis* ships could provide a defense against that attack.

It should be noted that such a capability, provided by *Aegis* BMD ships operating near Hawaii and our West Coast, is regularly tested in the Pacific Missile Range Facility at Kauai, Hawaii. Today there are 16 such ships in the Pacific, a number that will grow to 19 by 2015. This capability, along with the ground-based interceptors in Alaska and California, could defend Hawaii and the West Coast against missiles launched from ships off the West Coast. An East Coast Test range would help provide those living on the East Coast comparable protection.

Currently, only a few U.S. Navy ships infrequently support counter-drug operations in the Gulf of Mexico and they usually do not have an ability to shoot down ballistic missiles that might threaten those who live along the Florida-to-Texas coasts – but they could be given that

capability. Also, *Aegis Ashore* SM-3 interceptors based at military bases along that coastal region—e.g., at Tyndall, Eglin and McDill AFBs—could provide such a capability.

Aegis Ashore

- 13 The Missile Defense Agency has asked Congress to reprogram \$68.5 million of its 2010 appropriation to begin construction of an *Aegis Ashore* Test Facility in Hawaii and requested \$281 million for land-based SM-3 missile development in the FY2011 budget. Romania and Poland have agreed to host an *Aegis Ashore* site in 2015. See <http://www.spacenews.com/military/100208-md-a-budget-request-new-european-strategy-more-emphasis-testing.html> and the testimony of Lieutenant General Patrick J. O'Reilly, USA, Director, Missile Defense Agency, before the House Armed Services Committee, Strategic Forces Subcommittee on April 15, 2010, (particularly pages 5-6), which can be downloaded at http://www.mda.mil/news/public_statements.html.

The *Aegis Ashore* concept is essentially to replicate the U.S. Navy's *Aegis* ships' deckhouse on land to house several of the same ship board launchers and SM-3 interceptors to defend against attacking ballistic missiles. This *Aegis Ashore* system is being developed for deployment abroad but could be part of an anti-EMP capability to protect the United States, our forward deployed forces, and allies. It could be a reinforcing layer deployed, as noted above, on military bases along the U.S. coastal regions to supplement the sea-based SM-3 capability. Since *Aegis* ships seldom operate in the Gulf of Mexico, *Aegis Ashore* interceptors on coastal military bases could provide the primary defense for Americans living along the Gulf Coast.

Aegis Ashore would require a 24/7 electrical power generating capability that is internal to the system. This power plant would be hardened as a design requirement, and, under certain conditions, could be available for emergency response to lessen the impact of the loss of electricity-generating capabilities, thus reducing the vulnerability of disruption from an EMP attack, beginning to mitigate its consequences, and increasing the deterrence value of the overall architecture set forth in this White Paper. The first *Aegis Ashore* battery could be tested in Hawaii as early as in 2012 and be available for deployment in eastern Europe (or along the Gulf Coast) by 2015.¹³

Unmanned Aerial Vehicles (UAVs)

- 14 Brilliant Pebbles is a space-based missile defense system that was designed in the early-1990s to consist of 1,000 small satellites in low-Earth orbit, capable of destroying as many as 200 nuclear warheads. Weighing only 45 kilograms, each *Brilliant Pebble* platform would detect, track and intercept hostile missiles within its field of view. See *The Post-ABM Treaty Missile Defense and Space Relationship Report*, pp 26-31, which can be downloaded at <http://www.ifpa.org/currentResearch/currentResearch.htm>
- 15 During the George H. W. Bush administration, SDI pressed for a UAV capable of boost-phase intercept. The *Raptor-Talon* program (developed by Lawrence Livermore National Laboratory (LLNL)) was approaching the testing stage in 1993. The idea was that UAVs would orbit on the edges of a battle area to detect launches of short-range tactical ballistic missiles and perform boost-phase intercept using extremely fast hypervelocity interceptor missiles. The Clinton administration transferred the program to NASA and drastically reduced its scope. A solar-powered version (which charged the batteries during the day and flew on battery power at night), also developed under LLNL management, was also transferred to NASA and has set high-altitude records.

Our proposed architecture also includes a UAV component to provide a capability to intercept missiles in their boost- and ascent-phases. This technology is not new; the Strategic Defense Initiative (SDI) in 1992 initiated technology development for a system concept called *Raptor-Talon* (*Raptor* was the UAV and *Talon* was the airborne interceptor based on lightweight *Brilliant Pebbles* technology).¹⁴ The *Raptor-Talon* could be revived and developed for the coastal defense mission.¹⁵ Frequently lost in BMD discussion are the critically important sensor and C3I key elements needed to guide interceptors to their targets. Rather than waiting years for preferred full sensor capability and coverage from space-based assets, UAV-borne sensors have demonstrated capability (e.g., in Afghanistan, Pakistan, and Iraq) and show promise as near term, scalable regional missile defense sensor solutions. UAVs can be on station in "orbits" off the U.S. coast to identify ballistic missile launch preparations and provide early warning of a ballistic missile launch. If armed, these same UAVs could intercept a missile launched from a ship in their boost- and ascent-phases.

¹⁶ The strike-fighter-sized NUCAS aircraft is envisioned as a sea-based, ultra-stealthy, force multiplier in high threat environments that will provide aircraft carriers with leap-ahead combat capability and survivability, particularly for ISR and long-range strike missions.

The Navy is evaluating a carrier borne UAV called the X-47B Navy Unmanned Combat Air System or NUCAS for intelligence, surveillance, and reconnaissance (ISR), command and control and strike missions.¹⁶ This UAV is large enough to carry missiles for boost- and ascent-phase interception. With the Airborne Laser (ABL) now facing a lengthening technology development phase because of the decision to reduce funding and slow the program down, the NUCAS system is the only viable boost-phase missile defense concept that might become operational over the next 7-8 years. Finally, NUCAS could be staged either from carriers or military airfields.

In sum, there are near-term opportunities to meet the EMP threat with an increasingly robust architecture. These include *Aegis* BMD based on the SM-3 (available now and in increasing numbers, and with planned improvements on subsequent versions); *Aegis Ashore* (available by 2015), and the NUCAS that could carry interceptors for boost- and ascent-phase (available by 2018). The already-deployed SM-3 can begin to counter the EMP threat now; and the higher-velocity SM-3 improvements and increased numbers planned in the years ahead will make an EMP attack even less likely to succeed. These programs should be expanded to enable a boost-phase intercept capability.

Command/Control Issues

As noted above, early warning of a pending attack could empower the U.S. Navy (and our allies and friends) with an ability to identify, tag, track and interdict a vessel carrying nuclear-armed short- and medium-range ballistic missiles capable of delivering an EMP attack on the United States before it approaches U.S. territorial waters. Accomplishing this objective is closely aligned with an Obama administration top priority, which in turn can be associated with the Proliferation Security Initiative and the Global Initiative to Combat Nuclear Terrorism—international operations that involve many nations. Meeting this challenge should be integrated with the on-going development of the objectives and capabilities associated with the National Plan to Achieve Maritime Domain Awareness¹⁷—and they in turn should be integrated with the missile defense command and control architecture to defeat an EMP attack on the United States. Such operations are, in fact, the first line of defense in the layered defense against EMP attacks on the United States from off our coasts.

If such operations are unsuccessful and ships carrying EMP-threatening missiles approach our shores, then confidence in a well ordered command and control system is crucially important to enable an effective missile defense system to defeat that time urgent threat. Real-time information and pre-delegated authorization are needed by the on-the-scene commander who must launch the interceptor in time to destroy the threatening missile in its early stage of flight—within a

¹⁷ The National Plan to Achieve Maritime Domain Awareness (NPAMDA) is one of the supporting implementation plans that grew out of the December 2004 National Security Presidential Directive-41/Homeland Security Presidential Directive-13 on *Maritime Security Policy*. The goal of NPAMDA is to identify maritime threats as early and as distant from U.S. shores as possible by providing accurate information, intelligence, surveillance, and reconnaissance of all vessels, cargo, and people extending well beyond our traditional maritime boundaries. See the *National Plan to Achieve Maritime Domain Awareness for The National Strategy for Maritime Security*, October 2005 at http://www.dhs.gov/files/programs/editorial_0753.shtm.

few minutes after its launch. Such a concept-of-operations must define the conditions under which appropriate authorization is delegated to the on-the-scene commander to enable interception of the ballistic missile early in its flight. There is simply not time for all players in the chain of command to gain a common understanding of the tactical situation and consult on the “missile defense launch order.” If this threat materializes, the launch authority must be “pre-delegated.” Everyone can watch, but the launch authority must be given to the on-the-scene commander, i.e., the captain of the *Aegis* ship that has the intercept opportunity.

The U.S. Navy has devoted great effort to providing to all appropriate command levels the necessary real-time information with its Cooperative Engagement Capability (CEC)¹⁸ as the key enabler for the detection, tracking, and identification of air targets. The above stated need for prior authorization to launch anti-EMP interceptors implies that many previously conceived battle management/command-control and communications operations assumptions must be re-evaluated. This requirement for pre-delegated launch authorization for anti-EMP interceptors is not inconsistent with those that must also flow from the new emphasis on achieving theater/regional defense and ascent phase engagements.¹⁹

Thus, no longer are decision times measured in tens of minutes—the timelines are now much shorter. Reliable, uninterrupted data from sensors and commanders must be available to the on-the-scene commander much sooner—in near-real time. The many nodes and burdensome overhead in current command and control concepts that would delay information and cause confusion must be streamlined. Simulations that include EMP scenarios could elaborate response requirements and needed corresponding command capabilities.

18 CEC is a sensor netting system that allows many ships to pool their radar and sensor information together, creating a more detailed picture than any one ship could generate on its own. The data is then shared among all ships and participating systems at sea, in the air, and on the ground, using secure frequencies.

19 In 2009 U.S. defense officials announced an increased focus on developing technologies for ascent phase intercept (API) to hedge against the growing threat and to realize the greatest potential for reducing cost and increasing the operational effectiveness of missile defense. This decision was based in part on a Defense Science Board 2002 Summer Study, which underscored the advantages of ascent phase intercepts and that they are significantly less challenging than boost phase interception. Among other benefits, APIs allow interdiction before countermeasures are deployed, minimize the potential impact of debris, and reduce the number of interceptors required to defeat threat missiles in the later stages of a threat missile's flight. See *DefenseNews*. “MDA Request Kills KEI, Focuses on Ascent Phase, May 7, 2009: <http://www.defensenews.com/story.php?i=4079560>

Conclusions/ Summary

Given that EMP could have devastating and possibly permanently crippling affects, the United States must have the capability to deter or defeat an EMP attack. In particular, this means that we should seek all means to prevent a threatening vessel from approaching U.S. territorial waters close enough to launch an EMP threatening ballistic missile—and failing that, to intercept the missile in its ascent phase before it releases a nuclear warhead. We should increase deployment of – and continue to improve – this defense capability, which will be imperfect initially.

One of our goals should be to introduce uncertainty in planning for the would-be perpetrator of an EMP attack. This can only be accomplished if we have some defense, as contrasted with no ability to intercept an EMP launch, which could lead a potential attacker to conclude that there are no major obstacles to such an attack. The architecture

proposed in this White Paper contains essentially three components – *Aegis* BMD ships, *Aegis Ashore*, and UAV capabilities, in addition to meeting enhanced command and control and intelligence/early warning requirements.

- Defensive interceptors on *Aegis* BMD-capable ships operating off U.S. shores could offer extensive protection because of their ability to intercept short- and medium-range ballistic missiles in their ascent and midcourse phases.
- This sea-based capability could be supplemented with a ground-based SM-3, *Aegis Ashore*. This could constitute a reinforcing layer deployed at various locations on land, and could constitute the main defense against an EMP attack along the coast of the Gulf of Mexico. It would have the added advantage of requiring an electrical power generating capability that would be hardened against EMP and therefore could be available for emergency response.
- The proposed architecture includes a UAV component to strengthen boost- and ascent-phase interception of short- and medium-range missiles. UAV-borne sensors and missiles could be stationed off our shores to detect ballistic missile launch preparations and a missile's infrared signature if launched, as well as to intercept it.
- Command and control issues are formidable but not insurmountable. Efforts to provide maritime awareness seek to identify and prevent suspicious vessels from getting close enough to the U.S. coast to launch an EMP attack. Failing that, an effective intercept in the face of the very short warning time requires prior authorization for the on-the-scene commander to launch anti-EMP interceptors. Data from sensors must be available in seconds, not tens of minutes. In light of EMP timelines, battle management and command, control and communications must be reassessed and improved.

We urge that, as a matter of priority, steps should be taken to build into U.S. warning systems and missile defense systems the means to address this twenty-first-century national security threat. What is suggested is a system that would deter a would-be EMP attacker; detect a ship carrying a ballistic missile and preparing its launch; and/or, provide early warning and intercept the missile if launched.

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Dr. Henry F. Cooper has had a distinguished career of government and private sector service in matters relating to national security. He was Chief US Negotiator at the Geneva Defense and Space Talks with the Soviet Union (1985-1989) and was appointed the first civilian Strategic Defense Initiative (SDI) director in 1990. Previously he served as Deputy to the Assistant Secretary of Air Force for Research and Development, with responsibility for Air Force strategic and space systems. Ambassador Cooper is Chairman of High Frontier, a non-profit organization studying issues of missile defense and space, and of Applied Research Associates. He is a member of the Independent Working Group.

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