SEA-BASED MISSILE AND AIR DEFENSES

A Key to U.S. Naval Power in the 21st Century

Executive Summary

Robust sea-based air and missile defenses will constitute a key strategic capability for the U.S. Navy in the 21st Century. Today the Navy is confronting a serious anti-access threat that will only grow over time. The proliferation of advanced combat aircraft, high-speed cruise missiles and ballistic missiles with a wide range of payloads will, if left unchallenged, threaten the Navy's basic power projection mission. The ballistic missile threat, in particular, could also hold at risk U.S. forward-deployed forces, friends and allies and even the homeland.

Air and missile defenses are a central element of the Navy's concept for sea-based power projection as laid out in *Sea Power 21*. This new doctrine has three main components: Sea Strike, Sea Shield and Sea Basing. Sea Shield exploits the unique virtues of sea basing — undisputed sovereignty at sea, maneuverability and endurance — that will permit the deployment of defensive capabilities forward in peacetime or rapidly as a crisis develops. It calls for the development of robust air and missile defense capabilities that will enable naval forces not only to defend themselves but also to project defensive power far inland and even shield the U.S. homeland.

The Navy is pursuing a range of programs to enhance existing air and cruise missile defenses and provide robust, multi-layer missile defense. Air defenses are being improved by the fielding of the advanced E-2C Hawkeye and an extended range air defense missile. The E-2C will also support ballistic missile defense activities. The Navy's Area Missile Defense program is intended to provide short-range or terminal defenses primarily for fleet units and co-located forces and installations.

The Theater Wide Missile Defense program will provide defenses against intermediate-range ballistic missiles and serve as the basis for a near-term sea-based homeland defense capability. Advances in booster and kill vehicle technology will be needed to enable a robust sea-based defense of the homeland. Navy missile defense systems will be based on upgraded versions of Aegis/Standard missile air defense systems currently deployed on some 60 Navy ships.

Information will be the key to effective sea-based air and missile defenses. A wide variety of space, airborne, sea and ground-based sensors will contribute to future defensive operations. These systems must be integrated. The Navy is developing Forcenet, an information architecture to support the rapid acquisition, processing and dissemination of useful information from a wide range of sensors to support the full range of defensive missions. Forcenet will also support joint defensive operations involving assets from the other Services. Much of the information gathered to support defensive operations could potentially also be useful in the conduct of offensive actions.

Countering the growing air and missile threat will require a substantial investment in sea-based defenses. It will also require the still broader investment by the Department of Defense in the sensors, communications and command and control necessary in order to enable a global and joint defense capability.

The initial draft of this report was written by Dr. Daniel Gouré of the Lexington Institute staff. All members of the Naval Strike Forum had an opportunity to review and modify the final report.


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A Key to U.S. Naval Power in the 21st Century

I. INTRODUCTION: SEA-BASED POWER PROJECTION IN A HOSTILE WORLD

The 21st Century sets the stage for tremendous increases in naval precision, reach and connectivity, ushering in a new era of joint operational effectiveness. Innovative concepts and technologies will integrate sea, land, air, space and cyberspace to a greater extent than ever before. In this unified battlespace, the sea will provide a vast maneuver area from which to project direct and decisive power around the globe.

–Admiral Vernon Clark, CNO

The end of the Cold War brought with it new challenges and threats that are in some ways more complex and stressful than those the nation or the Navy confronted in the last half of the 20th Century. The United States now faces an array of rogue regimes, failing states and terrorist groups that have the power to do great harm to this nation, its friends and allies and global interests. For defense-planning purposes these threats cannot be treated, as they were in the past, as lesser included cases. These threats can emerge quite rapidly, often without warning.

Although most threats arise in a regional context, today's global world provides the means for local threats to cross the globe in a matter of days, hours or even minutes. These new threats can be of a scale, intensity or in a location that would not have been predictable even a short time before. The United States is discovering the importance of being able to project direct and decisive power around the globe rapidly and with assurance.

While it is more difficult today to anticipate the identities of future adversaries or the locations of potential threats or crises, it is also more certain that these adversaries will possess new and deadly weapons. Prospective adversaries are investing in advanced air defenses, anti-shipping cruise missiles, sea mines and other means of denying U.S. access to prospective regions of conflict. They hope to make it difficult for U.S. forces to be present in regions of interest and extremely dangerous for the United States to project power ashore.

The Navy is testing a higher-speed variant of the Standard missile, the SM-3 with a third stage motor and the lightweight exo-atmospheric projectile (LEAP), a hit-to-kill warhead.

Rogue regimes and terrorist groups alike are pursuing weapons of mass destruction (WMD) and, in the case of state actors, long-range delivery means. U.N. inspections in Iraq uncovered illegal ballistic missile and unmanned aerial vehicle programs. Iran has deployed the intermediate-range Shahab 3 ballistic missile and is working on a longer-range Shahab 4 that would be able to reach targets in Europe. North Korea has deployed the Nodong missile. The North Korean Taepo-Dong I was judged by the Intelligence Community as able to reach parts of the United States with a small payload. The longer-range Taepo-Dong II could deliver a payload of several hundred kilograms to most of the continental United States. North Korea is believed to have one or two nuclear weapons already and is poised on the brink of a major weapons production program. Iran is believed to be only a few years away from having its own nuclear weapons production capability. More than twenty other nations have ballistic missile and WMD programs in various stages of completion. These capabilities could threaten U.S. in-theater basing or force deployments, as well as permit hostile states to turn a local crisis or conflict into a regional or even global conflagration.

The heart of the U.S. Navy's air and missile defense architecture is the Aegis Combat System deployed on both Ticonderoga-class cruisers and the Arleigh-Burke DDG-51 destroyers.

Rogue regimes are also seeking ways of protecting high-value assets by preventing U.S. forces from gaining and exploiting information superiority. High value targets are being placed underground or made mobile. Fiber optic communications systems are replacing radio, microwave and the telephone. Using such techniques, these regimes hope to avoid detection, undermine U.S. precision strike capabilities and, potentially, enhance their own prospects for strategic or tactical surprise in the event of conflict.

Terrorist groups such as Al Qaeda are pursuing WMD. They have sought refuge in remote corners of the world and, where possible, exploit the chaos created by failed states and persistent regional conflicts to establish their WMD laboratories. Accessing these bases can be extremely difficult due to their remote locations, the fleeting nature of the intelligence or interference by the host government.

New threats require new defense strategies and military capabilities. The *2002 National Security Strategy (NSS)* warned that radical states armed with WMD might not be deterred from aggressive actions by the same means that worked during the Cold War. As a result, the United States needs to be able to both undermine the incentives these regimes might have to acquire such capabilities as well as provide ways to defeating any attempts to employ them. The strategy proposed by the *NSS* stressed the use of a mix of offensive and defensive measures to both dissuade prospective proliferators from pursuing WMD programs and to defeat swiftly any attempt to strike at the United States, its friends and allies or forces overseas.

To accomplish this goal, the United States needs to transform its military. The

nation requires a force posture that is strategically agile and operationally flexible. U.S. forces must be mobile and highly responsive, able to change their posture from that of peacetime engagement to one of force protection or even offensive action rapidly. They must also be able to strike with great force and precision at long ranges against a wide variety of prospective targets. U.S. forces must be able to defeat asymmetric and anti-access threats, seize and maintain the initiative in combat and project overwhelming offensive and defensive power throughout the theater of conflict.

These new threats pose new challenges for field commanders too. The joint force commanders now must plan for adversaries potentially armed with WMD, long-range delivery systems and anti-access capabilities. This confronts them with the need to act more rapidly, at longer ranges and with greater decisiveness than ever before. In order to project power inland, U.S. forces need to be able to establish dominance of the air and sea environs around and over the zone of hostilities. Air and sea dominance supports the secure basing of joint forces at sea both during the initial phase of a conflict and as forces are moved into theater. Power projection deep inland is also necessary to ensure that an adversary does not employ any WMD. Finally, from the instant hostilities begin, joint force commanders must have the capability to protect their forces, both those forward deployed and those transiting into theater, as well as provide protection for friends and allies in the region.

II. SEA POWER 21

To meet the challenges of this uncertain era, the U.S. Navy is pursuing a new vision of how to organize, integrate and transform naval forces. *Sea Power 21* seeks to align the Navy's unique capabilities to operate under, on and from the seas with emerging technologies in a new operational construct. This new construct is intended to create a set of asymmetric military capabilities that will directly address the security challenges of this new era. The goal of *Sea Power 21* is to develop new ways of exploiting both technologies and the vast maneuver area provided by the world's oceans to enhance the effectiveness of U.S. naval forces while simultaneously fully integrating them into joint operations.

The effectiveness of sea-based air and missile defenses will depend on the ability to gather and exploit data from a variety of off-board sensors.

Sea Power 21 is built on three inter-related operational concepts and their supporting capabilities. The first is Sea Strike, the projection of offensive power. The second is Sea Shield, the projection of defensive power. The third is Sea Basing, the projection of sovereignty to team with and provide enhanced support for joint forces afloat and ashore. These operational capabilities are integrated through Forcenet, the fusion of naval, joint and national infor-

mation grids intended to provide unparalleled situational awareness, knowledge management and command and control.

A discussion of the future of sea-based air and missile, of necessity, must focus largely on Sea Shield. However, it is important to recognize that in the *Sea Power 21* vision, Sea Shield is inextricably linked to both Sea Strike and Sea Basing. Moreover, some of the capabilities central to Sea Shield, most notably those related to intelligence, command and control and communications, will also contribute to the effectiveness of Sea Strike.

Extended air defense will also be enabled by the deployment of the F/A-18 E/F.

III. SEA SHIELD

Sea Shield is perhaps the most novel, and in some ways the boldest, of the operational concepts supporting *Sea Power 21*. In addition to directing the development of defenses for at-sea forces or nearby bases, this concept envisions the projection of defenses from the sea for joint forces and allies ashore. The capability to protect forces deployed overseas or friends and allies on other continents can also be applied to defense of the U.S. homeland from attack. Describing the Sea Shield concept, Admiral Vernon Clark, Chief of Naval Operations, declared, "it is key to protecting our nation at home, assuring allies overseas, and dissuading and deterring potential adversaries in multiple theaters."

Sea Shield directly addresses the increased threat posed by anti-access capabilities and ballistic missiles in the hands of rogue regimes or terrorist groups. It exploits the U.S. Navy's unique strengths in sea control, forward presence, maneuverability, long reach and networked intelligence to provide both theater and strategic defense. It takes advantage of the inherent self-defense capability that sea-based air and missile defenses provide for fleet units.

Sea-based defenses are inherently flexible. This reflects, in part, the maneuverability of naval forces and their ability to operate relatively close to hostile shores. The ability to deploy sea-based air and missile defenses forward contributes to force self-protection, assured access and the defense of other forward-deployed forces. These same naval forces can contribute to the defense of the homeland by engaging long-range ballistic missiles in the boost or mid-course phases of flight. Furthermore, Sea Shield complements the offensive capability present in Sea Strike to hold targets at risk, thereby providing, in effect, a layered defense capability.

Sea-based defenses generally can be divided into two types: short range or terminal defenses and longer range or theater defenses. While the two categories do overlap, there are differences with respect to the kinds of threats they can engage, the weapons systems they employ and the intelligence required for successful engagements. Terminal defenses are intended for force self-protection or for the defense of the immediate area around naval units. Currently, terminal defenses include ship-mounted guns, surface-to-air missiles and fighter aircraft. The Navy's Area Missile

Defense program is intended to provide protection against shorter-range ballistic missile threats. Such a system could potentially also serve as a second layer of defense against some longer-range ballistic missiles.

Theater defenses are intended to provide protection against air and missile threats over large areas. The Navy already possesses a substantial wide area air defense capability with its carrier aviation assets. These will be augmented by the deployment of the advanced E-2C Hawkeye and a long-range anti-air missile. In addition, the Navy is developing a Theater Wide Defense capability that will be able to engage long-range ballistic missiles.

One of the notable features of the Sea Shield concept is the projection of naval firepower through missile and air defenses deep over land. The Navy has long been able to project offensive power far inland. The ability to extend a defensive shield far overland, complementing traditional offensive power, is of both strategic and operational significance. Strategically, Sea Shield will provide a means for exerting control over events and forces at great ranges and far from the seas. Long-range air and missile defenses can limit the capability of adversaries to horizontally expand or otherwise escalate regional conflicts. The ability to defeat the threat of long-range ballistic missiles armed with weapons of mass destruction (WMD) also can negate attempts by rogue states to exercise coercive leverage against the United States. By limiting the prospects that rogue states will be able to undertake a successful first strike, Sea Shield can reduce the likelihood of conflict. In addition, effective global missile defenses can serve to provide reassurance to friends and allies.

Operationally, Sea Shield can help joint and coalition forces gain and maintain the initiative in the event of conflict. As an inherent part of peacetime U.S. naval presence, sea-based air and missile defenses will be able to provide critical protection for early entry forces and security for forward-deployed ground forces. Sea Shield is intended to gain and maintain sea and littoral superiority against the full range of anti-access threats: sea mines, cruise and ballistic missiles and aircraft. It can also complement Sea Strike capabilities to defeat hostile long-range strike systems.

Sea Shield is intended to be a joint capability. Navy assets will operate in conjunction with Marine Corps and Army air and missile defense assets such as the Patriot and, in the near future, Theater High

Broad area maritime surveillance will be supported by unmanned systems such as the Global Hawk UAV.

Altitude Air Defense (THAAD). Through its Cooperative Engagement Capability the Navy has demonstrated the ability to support distributed air and missile defense operations involving surface ships, manned aircraft, unmanned aerial vehicles and land based sensors and weapons systems.

The Navy's Forcenet capability will support the full range of Navy missions including joint air and missile defense operations. It is an information architecture that networks sensors, weapons, command and control, databases and platforms. Once in place, it will support the conduct of expeditionary warfare in the context of joint operations. Forcenet will serve as the structure for the acquiring, processing and distributing of information necessary to support both offensive and defensive operations.

The effectiveness of sea-based air and missile defenses will depend to a considerable degree on the ability to gather and exploit data from a variety of off-board sensors. In space this includes the Defense Satellite Program early warning satellites and, in the relatively near future, the Space Tracking and Surveillance System (STSS) and Space-Based Radar (SBR) satellites. In the air, naval defenses will be supported by such current systems as the improved E-2C, E-3 AWACS, P-3, EA6-B, RC-135 and the Global Hawk unmanned aerial vehicle (UAV). The Department of Defense (DoD) must also ensure that planned advanced airborne intelligence, surveillance and reconnaissance (ISR) platforms, for example the Multi-mission Command and Control Aircraft (MC2A), Broad Area Maritime Surveillance System (BAMS) and F/A-18 Growler electronic warfare aircraft, will be interoperable with all other systems engaged in air and missile defenses. Navy air and missile defenses can also find support from both existing ground-based ISR assets (e.g., the TPS artillery radar and Patriot air/missile defense system) as well as future systems (e.g., THAAD, X-Band radar).

The information requirements for highly effective sea-based air and missile defenses, properly managed and exploited, would also support timely counterforce operations under the rubric of the Sea Strike concept. The array of sensors available in the near future would allow the theater commander to implement a plan of persistent surveillance of the theater. By providing information on threat locations and movements prior to any launches, persistent surveillance will permit the optimum deployment of defensive assets and early planning for counterforce missions. Indeed, through Forcenet, the Navy may possess the capability to coordinate joint offensive and defensive operations against both air and missile threats.

The integration of Sea Strike and Sea Shield is consistent with the Department of Defense's new approach to the organization and operation of U.S. strategic forces. In the 2002 Nuclear Posture Review (NPR), DoD developed a new strategic posture based on enhanced strategic defenses, enhanced conventional strike capabilities and a secure, if reduced, strategic nuclear strike capability. According to the NPR, the combination of effective defenses and powerful conventional strike capabilities can undermine the credibility of rogue nations' arsenals of ballistic missiles. Taken together, the long-range strike capabilities envisioned for Sea Strike and the capability in Sea Shield for in-depth defenses against both air breathing and ballistic missile threats can provide a multi-layered architecture for countering the full array of anti-access and long-range strike capabilities.

Sea Shield also will be a critical part of the defense of the U.S. homeland. Naval

forces will be integrated with other military forces, civil agencies and law-enforcement to provide a robust capability to detect, track and defeat threats to the homeland. Operating under the aegis of Northern Command (NorthCom), Navy and Coast Guard units will be central to maintaining control over the maritime approaches to the homeland. These forces, along with such other elements of the joint force as are tasked to NorthCom, will also be responsible for preventing sea-based attacks against the homeland.

The most important contribution of Sea Shield to homeland defense will be its contribution to U.S. Global Missile Defense (GMD) system. Sea basing of missile defenses can provide, at times, the only feasible means of accessing hostile ballistic missiles once they are launched. Forward-deployed naval forces employing Sea Shield capabilities will often be the first line of defense against threats to the homeland. With appropriate capabilities, forward-deployed naval forces can provide early attack warning and tracking information, boost-phase engagement and multiple mid-course intercept opportunities against ballistic missiles and their warheads targeted on the U.S. homeland.

Sea Shield is a vital complement to both Sea Strike and Sea Basing. Sea Shield will enhance Sea Strike, freeing assets previously devoted to fleet defense for strike missions. Both Sea Shield and Sea Strike will leverage networked access to a common knowledge base in ways that will support the most efficient use of both offensive and defensive assets. Enhanced intelligence, surveillance, reconnaissance and targeting systems will be vital to the exploitation of new weapons systems being deployed as part of both Sea Strike and Sea Shield. Sea Shield will provide continuous sea control to protect forces operating in or staging from the sea.

Sea Shield is an operational concept designed to achieve three primary goals: establish and maintain battlespace superiority, enable joint force operations at sea and on land and extend defensive firepower far over land. It is the ability to extend a defensive umbrella beyond the immediate location of fleet units that is critical to providing sea-based protection for forces ashore, friends and allies and even the U.S. homeland. Forward-deployed naval forces exploiting Sea Shield capabilities can provide the National Command Authority with an expanded set of flexible deterrent options. Should deterrence fail, these same capabilities can support early entry operations, establish battle space superiority and support offensive and defensive joint-force operations.

Faced with the prospect of effective air and missile defenses, some prospective proliferators may be dissuaded from pursuing the ballistic missile option. Should rogue regimes nevertheless persist in their efforts to deny U.S. forces access or to hold at risk the U.S. homeland, deployed forces or regional allies, Sea Shield can negate this threat.

Air defenses are being improved by the fielding of the advanced E-2C Hawkeye.

IV. NAVAL MISSILE AND AIR DEFENSE PROGRAMS

The idea of basing missile defenses at sea is not new. Military planners have long recognized that naval forces offered the combination of sovereign basing, strategic mobility and forward presence that is uniquely suited to the requirements of missile defenses. Add to this the operational and tactical advantages inherent to modern U.S. naval forces – a large number of platforms, distributed sensors and deep magazines – and it is obvious why sea-based missile defenses make sense. For more than twenty years, the U.S. Navy and the Department of Defense have been pursuing the potential for highly effective sea-based missile defenses. Sea-based missile defenses are a core element of the Missile Defense Agency's (MDA) plan for the deployment of ballistic missile defense system (BMDS).

Two factors have historically limited the pace and scope of effort to develop and deploy sea-based missile defenses. The first was the 1972 Anti-Ballistic Missile Treaty (ABMT). The Treaty prohibited the development of elements of an anti-ballistic missile system capable of engaging strategic delivery systems that were sea-based. Tactical anti-missile systems, those intended only to defend fleet units against short-range ballistic missiles, were permitted; systems capable of tracking or engaging longer-range ballistic missiles were not allowed. Even sea-based sensors could not be developed or employed if their use was in the context of tests or defensive operations involving strategic delivery systems.

The second was the availability of technology. The strictures imposed by the ABMT on highly effective sea-based missile defenses negatively impacted the development of relevant capabilities. Existing systems were limited in their performance to avoid crossing the threshold of capability against strategic ballistic missiles. For example, the Aegis SPY-1 radar system did not have the necessary software that would allow the maximum exploitation of that system's potential for tracking ballistic missiles. Even so, in 1996 an Aegis cruiser deployed near Taiwan was able to track the launch of Chinese M-9 short-range ballistic missiles into the Taiwan Straits. Technological possibilities for new systems, such as space-based interceptors or multiple miniature kill vehicles, were not explored because of concerns that they would violate the ABMT.

In December 2001, the Bush Administration announced its decision to withdraw from the ABMT. This opened up the possibility to develop and deploy a range of new capabilities for missile defenses, including advanced sea-based systems. The impact of withdrawal on the development of sea-based missile defenses was readily demonstrated once the six-month notification period had passed. In a test of the ground-based mid-course interceptor planned before the withdrawal, MDA employed the Aegis radar system to track successfully a simulated strategic delivery vehicle. Over the past year, MDA has conducted several successful intercepts of longer-range missiles employing a test version of the Standard 3 Theater Wide interceptor. Testing began of an advanced sea-based interceptor that would permit engagement of medium-range ballistic missiles.

MDA is pursuing a capabilities-based approach to the fielding of a multi-layered global BMDS. The goal is to create a seamless system that can engage ballistic missiles of all ranges throughout their flight path. The plan is to build a system of systems, eventually incorporating ground-based, airborne and space-based sensors as well as land-based, sea and airborne

The launch of a Tomahawk cruise missile will be one element of an integrated offense-defense capability.

weapons. Because the United States faces an immediate set of threats, initial defensive capabilities will be deployed as soon as they become available. Improvements on basic elements and expansion to address other segments of ballistic missile flight will occur as the capabilities become available.

Missile defenses can engage ballistic missiles in three distinct segments of their flight trajectory. The first is boost phase, soon after the missile is launched and before it is able to dispense warhead(s) and or penetration aids. The second is mid-course, generally the longest period of flight, during which warhead(s) and penetration aids will be deployed. The third or terminal-phase is that closest to the target as the warhead re-enters the atmosphere. In principle, the longer the missile's range, the more time there is in each phase and the higher the ballistic path the missile/warhead(s) follow. Short-range ballistic missiles may not even leave the atmosphere and have a very short overall time of flight.

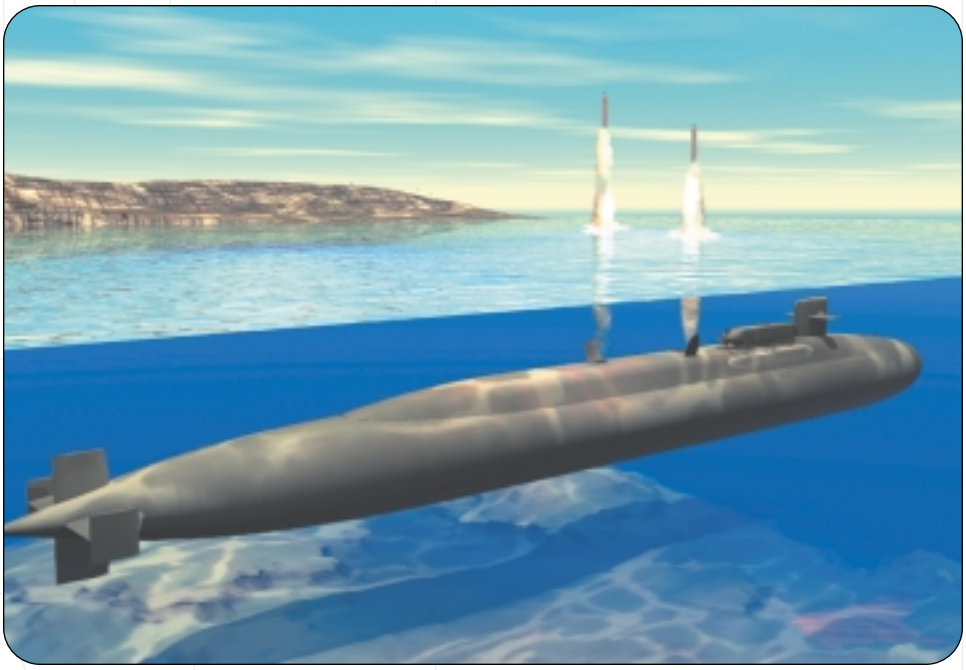
MDA is developing multiple systems to engage ballistic missiles in each of these segments as part of a global missile defense system. Free of the constraining effects of the ABMT, MDA's new approach eliminates the distinction between national missile defense and theater missile defense. Employing instead a schema based on the phases of ballistic missile flight, MDA is seeking in the near term to provide limited defense against long-range threats and robust defense against shorter-range threats. The system will then grow until it can provide robust defense against all threats.

The U.S. Navy will be playing a central role in this effort. There are programs underway or plans for the development of sea-based missile defense capabilities that address the full range of global missile threats.

The heart of the U.S. Navy's air and missile defense architecture is the Aegis combat system deployed on both Ticonderoga-class cruisers and the Arleigh Burke DDG–51 destroyers. This system consists of the SPY-1 radar, a vertical launch system that carries versions of the Standard missile in both air and missile defense variants, and a unique battle management/command, control communications, computing and intelligence system (BMC4I).

Beginning with the basic system elements, MDA and the Navy are developing a series of "step function" improvements in the capability of the radar, the interceptor and the BMC4I system to permit

engagements of ballistic missiles of increasing range and speed over time. The SPY-1 radar is being upgraded with new software to improve its high range resolution and to enable it to provide more accurate tracking data of fast moving ballistic missiles and warheads at increased ranges. The current Standard SM-2 Block IV air



defense missile is being modified to improve its air defense function and to support missile defense missions. The Aegis BMC4I system is being upgraded to enable it to handle more targets and to accept tracking and targeting information from off-board sensors. A new, more powerful radar and a more capable interceptor are in development either for backfitting to existing platforms or equipping the planned DDX and CGX.

The Navy's current focus is on two missile defense programs: a terminal defense against short-range ballistic missiles, Navy Area Defense, and a mid-course system intended to counter longer-range ballistic missiles, the Navy Theater Wide system. The Navy is also investing in a new capability for extended air defense that will complement new missile defense capabilities. There are future possibilities for an expanded role for Navy missile defense. One such option is for a capability to engage ballistic missiles in the boost phase. Another is for an enhanced mid-course capability that would permit engagement of ICBMs as part of homeland defense.

Both types of missile defenses will require extremely robust Intelligence, Surveillance and Reconnaissance (ISR) capabilities and a battle management/command, control and communications system that can coordinate offensive and defensive operations that are distributed, combined and joint. Ensuring interconnectivity among sensor platforms will be critical to the success of integrated air and missile defenses. In addition, there is a requirement for an overall information architecture that allows data and directions to be shared among a wide range of platforms and weapons systems. This the Navy will hopefully achieve through its Forcenet program. Finally, there is the need for additional tools to support defensive planners. One such system in development by MDA is the Joint Defense Planner (JDP). The JDP will assist both air and missile defense planners to conduct both deliberate and contingency planning for the employment of air and missile defense assets from all the Services.

Area Defense

Because of the greater speeds and complexity involved in intercepting long-range ballistic missiles, it has been considered easier to intercept short-range ballistic missiles in the terminal-phase of flight. Initially, the Navy planned to begin by fielding a terminal defense based on the Aegis/Standard system. Not only was such a system permitted by the ABMT, but also it was believed to be less technologically challenging. Because of its limit-

ed defensive "footprint," the Navy Area system would defend fleet units, ports and geographically limited locations of interest either alone or, when long-range mid-course and boost-phase defense systems were deployed, as part of a layered architecture.

The day after the United States formally withdrew from the ABMT, DoD canceled the Navy Area missile defense system. Although the system had demonstrated successful intercepts of short-range missiles, it was experiencing technical and cost problems. The Navy is currently exploring options for a terminal defense system.

Theater Wide Defense

The nominally more challenging theater wide program, intended to provide mid-course intercept against intermediate-range ballistic missiles, is making tremendous progress. This system is intended to project missile defense far inland. It can also provide defense of widely spaced assets and friends and allies from a limited number of platforms.

The keys to the theater wide defense are an improved sensor suite and a new interceptor. The Navy is already enhancing the performance of the SPY-1 radar. A newer version, the SPY-1E, is being tested.

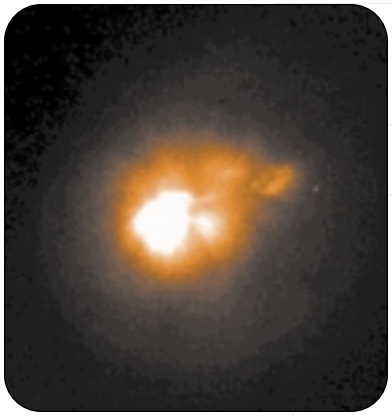
The Navy is testing a higher-speed variant of the Standard missile, the SM-3 with a third stage motor and the lightweight Exo-Atmospheric Projectile (LEAP), a hit-to-kill warhead. The SM-3 with LEAP conducted two successful tests in 2002, leading MDA to move the system into development.

Although the Navy Theater Wide system can engage ballistic missiles in mid-course, it will not be able to engage ICBMs. In order to perform this mission, the Navy would require cueing data from off-board sensors, thereby supporting the earliest possible launch of an interceptor. The Aegis BMC4I system would accept data from ground-based sensors as well as from the Space Based Infra-Red Surveillance (SBIRS) Low system. Among the plans under consideration to deploy both an S-Band and an X-Band radar on the new CGX allowing for significantly enhanced detection and tracking capability. This will also allow the CGX to serve as a forward-deployed sensor platform for other missile defense systems, both in theater and globally.

In order to exploit the engagement possibilities created by forward-deployed or space-based sensors, a naval system capable of intercepting ICBM warheads would require a new, larger booster. Such a booster would be required in order to increase the kill vehicle's acceleration beyond the current 4.5 km/second provided by the SM-3. A more advanced kill vehicle would also be required to exploit the full potential of a naval system for both theater and homeland missions. In principle, a larger missile could be deployed in the Vertical Launch System (VLS) of the current generation of CGs and DDGs.

Boost-Phase Defense

The ability to deploy naval units forward in peacetime, close to potential ballistic missile launch sites, makes them extremely attractive platforms for a boost-phase defense. There are three principle challenges confronting a land or sea-based boost-phase defense. The first is to be close enough to the missile's launch point. The second is to detect the missile's launch and establish timely track of its flight path. The third is to be able to engage the missile while it is in powered flight, that is, before it exits boost phase for mid-course. This last challenge is particularly challenging because in most instances the interceptor must chase down the ballistic missile.



With appropriate capabilities, forward-deployed naval forces could provide boost-phase engagement and multiple mid-course intercept opportunities against ballistic missiles and their warheads targeted on the U.S. homeland.

A sea-based boost-phase intercept system must have sufficient range to permit engagement of boosting missiles far inland without requiring that the launch platform be so close to shore as to be at significant risk. A Navy boost-phase system would exploit the Aegis radar and combat system but would certainly require both a new, more energetic booster and a faster interceptor. Because of the extremely stressing timelines involved in executing successful boost-phase intercepts, off-board sensor support will be absolutely critical.

In the long-term, other possibilities exist for the U.S. Navy to support boost-phase operations. Forward-deployed aircraft carriers could serve as platforms for both manned and unmanned boost-phase defenses. The Navy is also exploring the use of the Global Hawk high-altitude/long-endurance UAV for its broad area maritime surveillance (BAMS) mission. Because of its high altitude flight regime and on-station time, Global Hawk, which can carry a relatively large payload, may be a candidate for an unmanned boost-phase missile defense system.

Homeland Defense

Providing security for the U.S. homeland is about more than missile defense, although that is a critical part of the Navy's role. The current MDA plan includes the early deployment of a limited sea-based missile defense capability against shorter-range ballistic missiles. Such a capability will be useful in defending the homeland against short and intermediate-range ballistic missiles that could be brought close to the U.S. homeland aboard ships. As noted above, improvements to on and off-board sensors, an advanced, netted BMC4I system and new, faster interceptors, will enable future Navy missile defenses to provide protection of the homeland against

ICBMs. Forward-deployed naval platforms capable of boost and/or mid-course defense could also provide a first line of defense of the homeland.

Navy platforms deployed close to the homeland will also be able to provide security against non-ballistic threats. By patrolling homeland littoral waters, Navy ships, patrol aircraft and, in the future, maritime surveillance UAVs, can prevent hostile threats from approaching the United States. In addition, most surface combatants – and all the aircraft carriers – possess means to defend the homeland against air-breathing threats should an adversary be successful in launching cruise missiles or UAVs.

Extended Air Defense

Enhanced air defenses are just as important as missile defenses to the realization of the vision in *Sea Power 21*. The U.S. Navy is aggressively pursuing a program that will provide a quantum leap in the Fleet's air defense capabilities. The Navy is moving forward with its Radar Modernization Program (RMP) for the E-2C Hawkeye. The RMP, also known as the Advanced Hawkeye or AHE, includes a new UHF electronically scanned radar array, advanced internetted sensor technology to support the Navy's Cooperative Engagement Capability (CEC), new avionics and battle management capabilities for both theater missile and enhanced air defenses. The RMP/AHE upgrade will provide better detection of air-breathing and ballistic threats than is presently available, longer detection ranges and improved target identification and localization against complex land backgrounds.

The combination of the upgraded Hawkeye and an extended range anti-air missile will not only extend the reach of naval air defenses far inland but also provide for a radical shift in the mission profile of naval forces. The Navy is examining possible technologies to support long-range engagement of air breathing threats. One concept is the Extended Range Active Missile (ERAM) based on the Standard missile booster but with a new warhead incorporating an active RF seeker. Another is for a more advanced version of the Standard, the Block V. Either of these, perhaps with a hit-to-kill warhead, might also serve as the Navy's Area missile defense interceptor.

Extended air defense will also be enabled by the deployment of the F/A-18 E/F. With its enhanced radar, large payload, increased range and networked data sharing, the F/A-18 E/F will support both Sea Strike and Sea Shield missions. The addition of the F-35 Joint Strike Fighter beginning at the end of the decade will further enhance the contribution of naval air to Sea Shield.

V. DEPLOYMENT OF SEA-BASED MISSILE DEFENSES

In December 2002, in light of the new security environment, the need to meet near-term ballistic missile threats and

progress made to date in missile defense technology efforts, President Bush directed that DoD would begin fielding initial missile defense capabilities in 2004-2005. DoD announced that it would employ an evolutionary approach to the development and deployment of missile defenses over time. Unlike past deployment plans, an evolutionary approach would not be based on a pre-defined architecture. The character of the missile defense system would necessarily evolve over time with more capabilities and layers being added as the threat changed and new technologies became available. So-called "technology off-ramps" will be available to transition useful technologies from R&D to limited field deployment as soon as they are available.

The current deployment plan envisions deploying defenses in two-year cycles or blocks. The first two blocks, for 2004 and 2006, have been defined. The 2004 block will see the deployment of some 20 ground-based mid-course interceptors at the Ballistic Missile Defense System Test Bed at Fort Greeley, Alaska. A sea-based X-Band radar will be deployed as part of the Test Bed. Existing early warning radars at Fylingdales and Thule will be upgraded.

The naval component of this first deployment block will consist primarily of some 20 interceptors deployed on three Aegis cruisers. These cruisers and approximately 18 Aegis destroyers will be equipped with upgraded SPY radar for surveillance and target tracking. This capability will be employed against short and medium-range threats.

As currently planned, the 2006 block will provide additional improved sensors

as well as an upgraded BMC4I capability. It will also see deployment of the initial Airborne Laser (ABL) system, the first Theater High Altitude Air Defense (THAAD) missiles and an operational sea-based X-Band radar to support the ground-based mid-course missile defense segment.

In the 2006 deployment block the Navy will continue to expand on the Aegis portion of the ballistic missile defense system. The Aegis program will emphasize improved radar discrimination. There will also be opportunities to modify the SPY radar on additional Aegis ships. Development of a more advanced, faster booster will continue with initial deployment anticipated in the 2010 block. In addition, an advanced technology kill vehicle, one with a substantial 3-axis divert capability, will be required to fully exploit the intercept potential of the Navy Theater Wide System particularly when it is integrated with the space tracking and surveillance system (STSS).

VI. THE FUTURE OF SEA-BASED AIR AND MISSILE DEFENSES

It is obvious that sea-based air and missile defenses will play an increasingly significant, even central, role in U.S. power projection strategies in the new century. The requirement to project defensive power over ever-larger portions of the earth's surface will grow as more states acquire long-range strike capabilities. Defensive power will be one of the keys to a credible U.S. deterrent strategy and to effective defense in an era marked by new and unpredictable threats. The deployment of strategic defenses, both to protect the United States and to project power abroad, will provide the National Command Authority (NCA) with new and effective options for influencing international affairs and controlling the prospects for conflict. By exploiting the strategic and operational advantages that derive from sea basing, the United States can help to maintain its posture of strategic preeminence well into the 21st century.

Sea-based defensive capabilities also will become of increasing importance to the joint-force commander confronted by growing anti-access threats. Sea-based defenses can support forcible entry operations, protect early arriving forces and provide force protection for at-sea forces.

Homeland defense is a new mission for which sea-based defensives are particularly well suited. Forward-deployed naval forces can provide the first layer of defense against threats to the homeland. They can also operate as part of a layered defense system adding their weight to other defensive capabilities or providing unique sea-based defense against offshore air and missile threats.

The operational concept of a Sea Shield is a central element of the Navy's vision of its future, according to *Sea Power 21*. Along with two other operational concepts, Sea Strike and Sea Basing, Sea Shield will provide the basis for effective employment of naval power both at sea and on land for decades to come.

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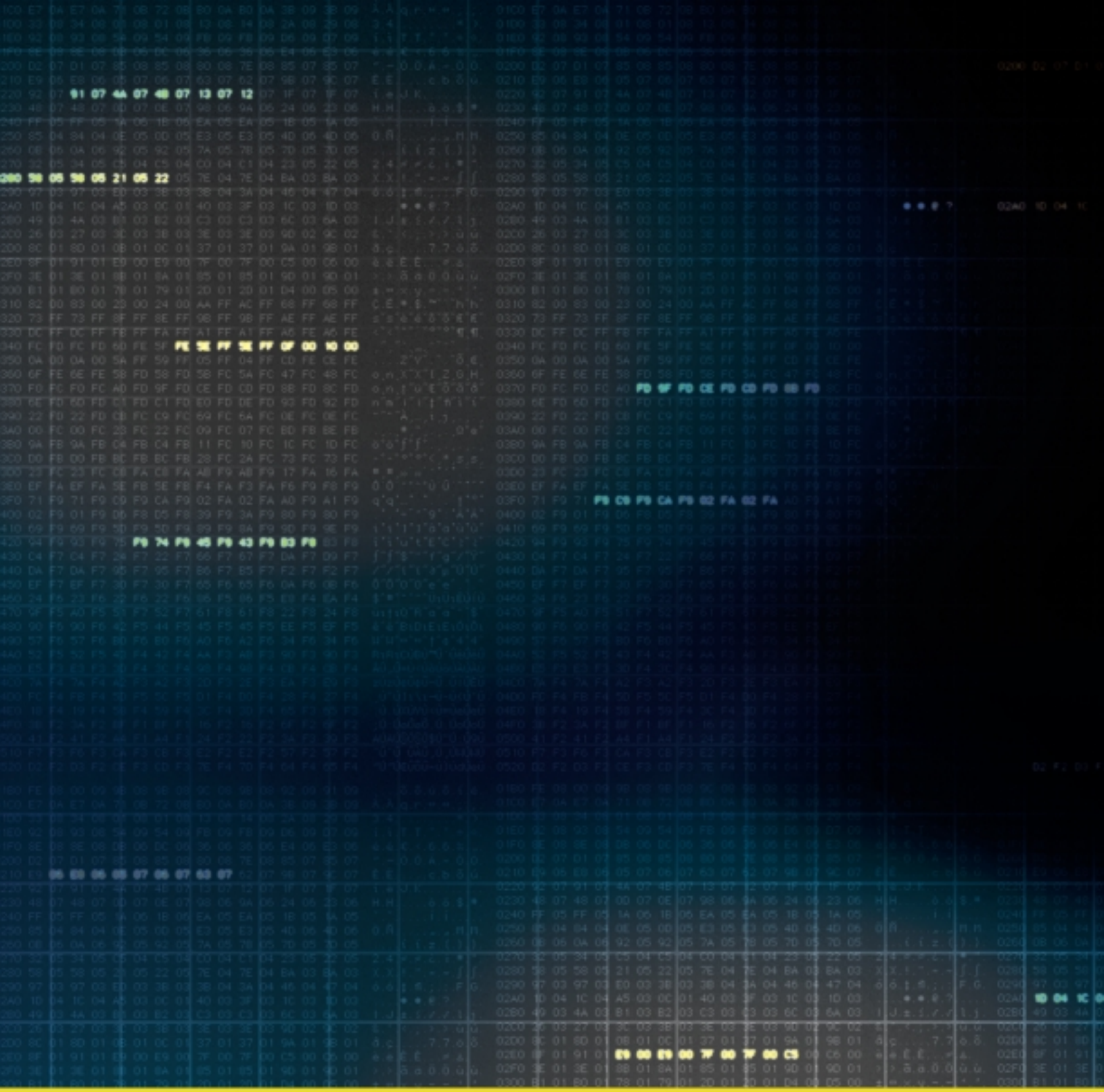

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