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14. ABSTRACT The United States will deploy an operational missile defense system of the homeland under the National Missile Defense (NMD) Program by 30 September 2004. Within the NMD framework, the Navy's role is to provide early warning, cueing, and forward ballistic missile engagement by deployed naval forces. Consequently, the Navy's NMD function has the least reaction time and is therefore most dependent on timely and relevant operational intelligence to successfully perform this mission. The foundation for this intelligence support hinges on a robust process from which commanders at every level can make informed decisions, maximizing the force's effectiveness against the enemy, and enabling the unimpeded conduct of other warfare areas. This paper discusses the advantages of forward deployed naval forces to the NMD and theater commanders, pertinent naval NMD intelligence requirements, and proposes a methodology to achieve this intelligence goal.					
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**NAVAL WAR COLLEGE
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Joint Maritime Operations Term Paper

**Effective Intelligence Support to Theater Ballistic Missile
Defense from the Sea**

BY
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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Joint Maritime Operations Department.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

09 February 2004

Prof. James Fitzsimonds, Advisor

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I. Thesis

The United States will deploy an operational missile defense system of the homeland under the National Missile Defense (NMD) Program by 30 September 2004. Within the NMD framework, the Navy's role is to provide early warning, cueing, and forward ballistic missile engagement by deployed naval forces. Consequently, the Navy's NMD function has the least reaction time and is therefore most dependent on timely and relevant operational intelligence to successfully perform this mission. The foundation for this intelligence support hinges on a robust process from which commanders at every level can make informed decisions, maximizing the force's effectiveness against the enemy, and enabling the unimpeded conduct of other warfare areas. This paper will discuss the advantages of forward deployed naval forces to the NMD and theater commanders, and pertinent naval NMD intelligence requirements; it will propose a methodology to achieve this intelligence goal.

II. Navy Ballistic Missile Defense

The Navy role in National Missile Defense integrates a strategic capability within a tactical Aegis platform operating under unique conditions, performing concurrent operations in support of a theater operational commander in a not-to-interfere basis with NMD. Aegis platforms can provide for self-defense¹ and can operate with a limited logistical tail. Aegis units can also operate pervasively in international waters close to the enemy. Therefore, it may likely be the first tactical unit to detect a launch, and the first to be capable of engaging a short- to medium-range ballistic missile exoatmospherically.² Lastly, Aegis ships can directly strike at the enemy.

¹ The Aegis system will have concurrent BMD and air warfare capability after a 2009 upgrade.

² Aegis with SM-3 will be able to intercept missiles outside the atmosphere. The U.S. Air Force Airborne Laser (Boeing 747) could also engage during ascent if properly positioned (IOC 2008).

Ballistic missile defense is an emerging warfare discipline designed to counter short- to intercontinental-range rocket-propelled, ballistic weapons through swift and coordinated action by joint forces. National Missile Defense (NMD) is the program under which the appropriate sensors and weapons will be fielded to provide a very limited defense of the homeland against a ballistic missile attack.³ Conceptually, NMD is designed to track and engage ballistic missiles launched against any of the 50 states by placing a premium on timeliness of response, effective target discrimination, and economy of force. To accomplish this, the NMD architecture seeks to track ballistic missiles from launch to re-entry using space-, sea-, and ground-based sensors.

Despite the primary goal of continental defense, NMD is fielding capabilities that are as relevant to theater defense. In many foreseen scenarios, many of the NMD capabilities can be used concurrently to support both a national strategic and a theater operational defense against ballistic missiles of varying ranges and payloads.⁴ These capabilities could also be used to support theater ballistic missile defense in support of strategic and operational goals, in a not-to-interfere basis with the support required for the defense of the homeland. The Navy's role in NMD supports both the national strategic and theater operational ballistic missile defense. The reader is directed to Appendix A for a primer on the NMD architecture.

The Navy's role in NMD is crucial in providing situational awareness to operational commanders at all levels. Aegis cruisers and destroyers place robust radar sensors close to the enemy to cue external sensors or weapons against the threat. This is important in the counter-intercontinental ballistic missile role, as time gained through early tracking is essential in facilitating an effective intercept. More importantly, when considering that longer-range

³ The initial NMD capability will only defend against ballistic missile attacks of one or two weapons based on the small number of interceptors fielded in Ft. Greeley Alaska by Q1, 2005.

missiles are likely carriers of weapons of mass destruction, the need to intercept these far from friendly shores is more apparent. Unlike other NMD assets, the Navy's Aegis platforms can go in harm's way and, if required, defend themselves with organic systems. They can also concurrently perform other missions: denying air-, surface-, and undersea-space to the enemy. An Aegis system also brings forward the capability to attack an enemy swiftly with Tomahawk cruise missiles. Perhaps of more significance, forward deployed naval forces are not constrained by issues of national sovereignty or access to friendly bases, despite limited logistical requirements.

While NMD is strategic in nature, it relies on tactical action to achieve this strategic effect. Navy participation is no exception, as multi-mission tactical units are used in roles concurrently impacting multiple levels of warfare. Subsequently, an Aegis platform on an NMD mission may also perform other tasks for the theater commander in a complementary and concurrent basis to supporting the defense of North America. This includes theater missile defense, conducted as a subset of the national mission under the concept of Navy Sea-Based Midcourse program. In this capacity, the Navy can provide defense in-depth due to weapon system capabilities and unit mobility within the area of operations. It is this theater ballistic missile defense that provides the operational commander with a new paradigm of deterrence, defense, and the associated second-order benefits to his power-projection capability.

For the nature and scope of its mission, the Navy's participation in NMD is dependent on solid intelligence support to maximize NMD's potential against the threat during time-critical engagements. Intelligence for naval NMD relies heavily on preparation and is hinged on structure and timeliness. In this new role in support of naval NMD, intelligence must remain the

⁴ The National Missile Defense program covers theater and strategic ballistic missile defense as

basis for deliberate planning, yet it must also evolve into fluid and concurrent operational support during the battle. The many unknowns and time constraints of NMD require a systematic, all-source intelligence fusion to optimize weapon allocation, interceptor attack geometries, and warhead/decoy characterization. Ultimately, ballistic missile defense operations must be driven by predictive intelligence.⁵ Once the battle begins, there is no time to make up for unpreparedness; the consequences of an effective enemy missile strike can be devastating and can have a strong strategic influence. Therefore, this area must be a significant priority to the commander in his contingency and campaign planning.

III. Navy Ballistic Missile Defense Scenarios

To better understand the intelligence requirements for naval ballistic missile defense, it is appropriate to provide two realistic scenarios from a potential near future. The first scenario, a theater-operational situation, revolves on the concept of defense in depth. The commander of a Navy Aegis cruiser, USS Lake Erie (CG 70), is forward deployed off the coast of a potential belligerent capable of threatening its neighbors with ballistic missiles. The cruiser is in a strategic location identified through the intelligence process where it can both monitor potential launches from known missile fields and maximize its intercept geometry advantage based on probable SRBM/MRBM⁶ launch areas and an assessed enemy target list. Enemy missiles could potentially carry biological, chemical, or nuclear warheads. In addition, the enemy possesses a

these take on a strategic connotation considering their potential WMD capability.

⁵ Predictive Intelligence is not foreknowledge, but an educated assessment made from the best available information on and about the enemy. It is at best a very likely probability.

⁶ Short range ballistic missiles (SRBM) are weapons with a range under 100 km (621 mi); medium range ballistic missiles (MRBM) range between 1,000 and 3,000 km (621-1,864 mi); intermediate range ballistic missiles (IRBM) range 3,000 to 5,500 km (1,864-3,418 mi); intercontinental ballistic missiles (ICBM) have a range in excess of 5,500 km (3,418 mi).

number of different types of ballistic missiles, each with unique ranges and capabilities. USS Lake Erie has been positioned forward near the enemy state and under the flight path of the threat ballistic missiles. A launch is detected through infrared satellite coverage of the area and the information is relayed to the cruiser within five seconds of determining a confirmed launch.⁷ Concurrently, the Aegis SPY-1B radar begins to track rapidly ascending contacts which are classified as ballistic missiles of unknown type. Information regarding launch time and track characteristics is forwarded to other commands.

The intelligence battle then begins. No envisioned missile defense can possibly match the enormous ballistic missile inventories available to some nations. Therefore, discrimination becomes a significant time-critical problem. A medium-range ballistic missile can accelerate under propulsion from 90 to 250 seconds after which it continues its ascent, but the type of weapon is unknown to the cruiser at this time. The missiles' flight time to the assessed target would be approximately ten minutes; however, the forward-positioned Aegis cruiser would likely have the weapons pass overhead in three to four minutes at approximately 200 miles altitude since the cruiser itself is about 100 miles off the enemy coast. SM-3 can intercept within the enemy missile's forward hemisphere; a tail chase is extremely difficult against a fast ballistic missile. A decision on which missiles need to be intercepted needs to be made within 60 seconds after detected launch.

Intelligence must now discern a number of things. The launch point determined through DSP and further refined through extrapolation from the Aegis track lends some information as to the type of missile and possibly the type of warhead. Intelligence knows that certain launch sites belong to units with certain types of weapons and capable of using certain types of warheads.

⁷ A DSP infrared detection must be analyzed prior to being confirmed an actual missile launch.

Although this is not definitive evidence, it is useful when compared to other data. The missiles' targets must also be assessed. This can be done based on the relative bearing of missile flight. Additionally, once potential targets are derived in that bearing, the missiles' angles of inclination provide clues as to its actual type as a missile type's burn time has been determined. Intelligence can then determine that half of the twenty missiles are of Type X, the other half of Type Y. Knowing the ranges, relative flight paths, and capability of the inbound weapons, intelligence can then discern the weapons' targets. Nonetheless, the type of warheads is not yet known. These can also be assessed, yet misjudgments may have catastrophic repercussions at theater and strategic levels. USS Lake Erie continues to accurately track the weapons in flight.

Although the cruiser cannot do so organically, the track information is analyzed off ship and the relative impact point for the weapons is predicted and compared with the assessed target and current meteorological conditions. Since the ballistic missiles in question are known to be guided using accurate space-based navigation systems, it can be assessed that any weapons drifting off course within certain parameters that correlate to meteorological patterns in vicinity of the ballistic missile's target have a higher probability of carrying chemical or biological warheads.⁸ This is weighed against what is known about the parent missile unit based on the launch point. Three of the Type Y missiles are assessed to have malfunctioned, having drifted from their predicted flight paths, and will impact on uninhabited areas. Other factors in this problem include the terminal defenses; the assessed target is defended by Patriot PAC-3 which is more capable against the Type X missile than the Type Y. Seven of the ten Type Y missiles and four of the Type X missiles are assessed as having a higher probability of carrying chemical

There is a small period of time spent from detection to a reported confirmed missile launch.

⁸ Biological and chemical munitions require particular dispersal patterns to maximize the effects onto the target. Dispersal patterns are dependant on meteorological conditions.

warheads. With this information, intelligence can sort the enemy weapons based on track information and pass this data to USS Lake Erie with a recommended engagement sequence. This was accomplished within the allotted 60 seconds. USS Lake Erie fires multiple weapons almost instantaneously, targeting the fourteen greatest threats and leaving the remaining targets for the Patriot PAC-3 forces to engage if required.

The 1998 Rumsfeld Commission Report⁹ indicated that ballistic missile and weapons of mass destruction proliferation in the developing world has advanced to a degree that it represents a prospective danger to the national security of the United States. This document stated that, “Concerted efforts by a number of overtly or potentially hostile nations to acquire ballistic missiles with biological or nuclear payloads pose a growing threat to the United States, its deployed forces, and its friends and allies. Developing threats in North Korea, Iran and Iraq...[these weapons] would be able to inflict major destruction on the U.S. within about five years of a decision to acquire such a capability. During several of those years, the U.S. might not be aware that such a decision had been made.”

The second scenario is of a strategic nature and is based on the Rumsfeld Report: after a period of heightened tensions, North Korea attacks Hawaii using a Taep’o-dong 2 (TD2) ballistic missile. The first launch indications are received from a Defense Support Program infrared detection satellite. USS Lake Erie (CG 70) is a picket ship off the North Korean coast and it is positioned based on intelligence indicators of an imminent threat. The cruiser is the first tactical unit to detect the launch and gain an initial track on the TD2 on its ascent. This weapon has a burn time of over 250 seconds. At burn out, the TD2 is traveling at Mach 16 to 22.¹⁰ Even

⁹ Rumsfeld, Donald H., et al. Commission to Assess the Ballistic Missile Threat to The United States. July 1998. Pursuant to Public Law 201, 104th Congress.

¹⁰ This denotes 16 to 22 times the speed of sound.

though USS Lake Erie is over 100 miles out to sea, the TD2 overflies it less than 3 minutes after launch. However, due to the intercept geometry and closing velocities, an SM-3 intercept is not an option. Upon launch, the total flight time to Hawaii is approximately 15 minutes. Soon after detection, the cruiser began passing track data through the NMD battle management command and control system to higher echelon commands to assist in further tracking the TD2 in flight. Approximately five minutes after the initial TD2 detection by the Aegis, an Alaskan-based Ground Based Interceptor (GBI) is launched to destroy the oncoming weapon over the Pacific Ocean. The GBI intercept can take place over water and away from Hawaii due to early cueing from the Aegis. Without the precise tracking data, the GBI could not have been launched as early, thereby increasing the danger of any harmful remainders of a potential chemical, nuclear, or biological warhead from the TD2 reaching U.S. soil. While intelligence does not play a significant role during the intercept, the intelligence preparation prior to the conflict has enabled knowledge of the target and assured that the technical capabilities can meet the challenge.

IV. Benefits of National Missile Defense from the Sea

Simplistic scenarios such as those presented above show the complex nature of this problem. In particular, the intelligence and operational challenges become more apparent in a theater-operational scenario if such an attack occurred concurrently to five or ten other such events originating from different launch areas within the threat country. Perhaps a future enemy can attain the potential to volley 200 missiles at a defended area in the theater of operations. The common thread among ballistic missile attack scenarios is that time is a priceless commodity to enable enhanced situational awareness and an effective defense. The Navy provides NMD with

this essential time through early tracking. As shown in the scenario, a properly positioned Aegis can track the missiles early on, provide precise track data, and intercept some of the weapons.

Concisely, Aegis and SM-3 provide commanders with the capability for ballistic missile defense in depth. That is, a capability predicated on the SM-3's significant intercept range, kinematics, and ascent-phase intercept capabilities. Because this system can attack a target many hundreds of miles away, it need not act as an area defense system, which would lock the Aegis ship onto a compressed operating area in the vicinity of a defended zone. One or more Aegis platforms can operate hundreds of miles forward, creating an "area of negation."¹¹ With support from intelligence, Aegis platforms need only deny the enemy ballistic missiles' path to the target enabling a kinetic intercept against many missile threats' flight corridors. Subsequently, Aegis provides a commander with a platform capable of operating in international waters near the enemy and depriving him of operational freedom and the element of surprise.

During the initial stages of a potential conflict, the enemy would likely have a larger offensive ballistic missile arsenal than U.S. interceptors in theater; therefore, ballistic missile defense may not be predicated on defense alone. Subsequently, offensive action should be used within the ballistic missile defense operational concept, preventing additional enemy strikes. The Tomahawk Land Attack Missile (TLAM) provides a unique capability for time-sensitive strikes. Intelligence preparation provides precise targeting coordinates and safe flight routes. This is accomplished at either the Cruise Missile Support Activity Atlantic (Norfolk, VA), or the Afloat Planning System Detachments onboard aircraft carriers. If the target is pre-programmed into the weapon and the ship is inside its launch basket, TLAM can be launched within minutes. Otherwise, new missions can be planned and executed within a few hours.

It is essential for the Joint Forces Maritime Component Commander (JFMCC) to view the role of ballistic missile defense as a campaign enabler, from both a military and political perspective, and similarly prioritize the associated intelligence process. More than any previous threat, rogue nation ballistic missile forces pose a direct threat to four U.S. centers of gravity.¹² First, ballistic missiles directly threaten our military forces, particularly when centralized at ports of debarkation. In doing so, ballistic missiles put at risk any force heavy or numerous enough to require sea or heavy air transport. Second, the emerging ballistic missile threat constitutes an unprecedented challenge to American strategic mobility. This challenge concurrently threatens U.S. logistical networks, lines of communication, intermediate and forward bases of operation, and any interior positions held with respect to the enemy. The implications of such a threat greatly reduce America's strategic options through denial of access. Moreover, this threat could potentially deny U.S. ability to conduct operations such as ALLIED FORCE in Kosovo, or theater conflicts such as Operation ENDURING FREEDOM. Modern operations in the scope of DESERT SHIELD would be untenable without missile defenses. Third, ballistic missiles threaten the resolve of potential regional allies, given the direct threat to their interests. Lastly, these weapons could test the political will of the United States. The threat of such devastating attacks could severely and negatively affect American public opinion and strongly influence the degree and nature of American involvement around the world.

Ultimately, the Navy brings an unequaled capability to the field of missile defense, and creates significant options for the Joint Forces Commander. The results of Navy Aegis participation in NMD operations denies operational freedom to the enemy and provides for

¹¹ Swicker, Charles. Theater Ballistic Missile Defense from the Sea. Newport Paper 14. Naval War College, Newport. 1998.

defense in depth. Since Aegis mitigates enemy ballistic missile capabilities, it can provide the second order effect of forcing the enemy into a naval engagement, a fight in which the U.S. Navy can exert its full might.

V. Intelligence Support to National Missile Defense from the Sea

Ballistic missile defense is unique within naval warfare disciplines in that it demands structured, time-sensitive operational intelligence support. In either a national-strategic or theater-operational support role, Aegis requires the same level and depth of intelligence support to enable mission success. This support is predicated on an intelligence process that meets the timeline requirements of decision-makers at all levels in the chain of command. Given the highly integrated and joint nature of missile defense, it is also imperative that all forces involved share the same intelligence picture. A common intelligence baseline also fosters operational integration, as it more clearly defines the operational challenge in this primarily defensive warfare area. The Joint Staff correlates operational integration with a shared information baseline, of which intelligence is a subset. “Integration suggests more than just compatibility. It suggests a decision to respond to shared information in accordance with prearranged conventions and agreements. The net effect is a degree of synergy that would otherwise not occur.”¹³

Therefore, when considering the degree of required commonality, the need for relevance to all members of a joint force, and the multiple operating environments and geographic areas that the support must address, then a need for a structured intelligence process becomes evident. Global Wargame 95 at Newport RI, and Global Wargame 95B at the National Test Facility, Schriever

¹² ADM Cebrowski Foreword to: Swicker, Charles. Theater Ballistic Missile Defense from the Sea. Newport Paper 14. Naval War College, Newport. 1998. (Defines three centers of gravity.)

¹³ Joint Staff J36 TMD CONOPS, Pg 6.

AFB CO both arrived at similar findings: intelligence, early warning, and effective information dissemination are vital to successful missile defense.¹⁴

As previously discussed, missile defense from the sea is a critical facilitator of strategic mobility. Subsequently, this underscores the importance of the structured ballistic missile defense intelligence process within the context of the overall campaign. While a detailed specific description of such a structured intelligence process is outside of the scope of this paper, it is clear that such a process must be based on the tenet of minimizing risk and uncertainty for the operational commander. Risk and uncertainty can only be reduced, not mitigated as we will never gain full knowledge on the enemy. Nonetheless, a structured intelligence process fuses enough seemingly unrelated operational knowledge on the enemy, thereby revealing a sufficient knowledge of his capabilities and intentions. This logic leads to four basic concepts for intelligence support, which directly address those areas required for successful ballistic missile defense operations.

Theater ballistic missile defense combat conditions would require intelligence, which fulfills the requirements of multiple units. As these units must act in complementary coordination, they must share a common intelligence picture. This support must address other concurrent activities, such as strike or self-defense. Based on foreseen NMD operational requirements, this paper proposes the following four concepts that address the knowledge areas, the appropriate responsiveness, and the format required for intelligence support to mitigate the commander's operational risk and uncertainty:

1. Intelligence-enabled Common Operating Picture (COP)
2. A structured Intelligence Preparation of the Battlefield (IPB)

¹⁴ Swicker, Charles. Theater Ballistic Missile Defense from the Sea. Newport Paper 14. Naval

3. Self-Contained Intelligence Products
4. Pervasive Intelligence

A. Intelligence-Enabled Common Operating Picture. The intelligence-enabled Common Operating Picture is the fusion of all operational and intelligence sensor data derived from organic, theater, and national sources, and fused into a coherent representation of the battlespace. Sensor data is subsequently compared and weighed against each other, providing the best possible representation of the battlespace.

The intelligence-enabled COP required for NMD is much like the modern concept of a Common Operating Picture. However, the integration of all-source intelligence makes this concept far more expansive in content. The intelligence-enabled COP is not a system but a model for the type, sourcing, and representation of intelligence-derived knowledge to the commander. Succinctly, the ballistic missile defense COP can present two basic sets of information about enemy forces. It fuses a picture of what is known on enemy forces based on sensor data. It also integrates that which is assessed as probable onto knowledge gaps on enemy forces. This assessed-probable information would be based on theater and national SIGINT, and MASINT¹⁵ sources adding a new dimension of information to assist the commander.

For example, a missile volley displayed on a screen may be initially classified as an unknown based on sensor data. However, value added from multi-source intelligence could indicate that the missiles are likely of a particular Type X, based on the known location of that

War College, Newport. 1998. Pg 15.

¹⁵ These acronyms denote Signals Intelligence (SIGINT) and Measurements and Signatures Intelligence (MASINT).

type of missile correlating to the launch area. Although this one source of information is not decisive, MASINT data from the missile plumes may correlate to the same missile type as is known to operate in that area, thereby adding to the likelihood that the salvo is in fact composed of one class of missile, assessed to be Type X. In addition, SIGINT data can add further value as it can disclose particular precursor indications of launch. These indications, if added to the picture, would create very valuable knowledge to the missile event prior to detected launch, and long before other methodology for missile classification could provide any insights.

The effective integration of the battlespace requires that all enemy and friendly forces be assessed in respect to their relative position to each other. Blue forces must be continuously correlated in regard to the location and disposition of enemy forces within a single picture. This in turn would inform joint commanders on the location of units that could be affected by, or otherwise affect their operational decisions. Succinctly, the joint commander must consider the possibility of second-order effects on friendly forces. One such example may involve the need to ascertain the location of friendly aircraft prior to selecting a firing unit for a missile intercept. In another example, the COP would inform a commander that a missile intercept carrying assessed WMD might spread fallout or other material over friendly forces downrange of the intercept. When considering the situations listed above, the need for blue, neutral, and enemy force tracking within a common picture becomes apparent.

The primary dividends obtained from the intelligence-enabled COP concept are speed and efficiency of operations, a derived ability to better penetrate the enemy's OODA loop¹⁶, and increased freedom of operations. With the benefit of time and knowledge, a commander can

¹⁶ OODA Loop. Decision and analysis process defined as the sequence of: Observe, Orient, Decide, and Act.

better chose the most effective course of action. The intelligence-enabled COP brings a crisis situation closer to a level of structured and informed decision-making.

B. Intelligence Preparation of the Battlefield. A properly structured Intelligence Preparation of the Battlefield (IPB) provides a detailed framework by which to group all-source information on the enemy, conduct detailed analysis, and assess enemy capabilities and intentions. This structure provides a framework from which to better analyze what the enemy can do, what he is likely to do, what he can't do, and what would be most dangerous to U.S. forces. If IPB is shared amongst all NMD operating forces in a structured and relevant manner, it enables a more efficient use of scarce national and theater intelligence resources. The following narrative defines the concept of IPB for ballistic missile defense. The reader should refer to Appendix B for more specific areas required to form a picture of the enemy.

The NMD IPB must be a fusion of multiple intelligence disciplines, to include IMINT, SIGINT, HUMINT, OSINT, MASINT¹⁷ used in a complementary manner to build a credible and reliable picture of the enemy. As importantly, this IPB must integrate the myriad of variables, which make up the thorough analysis of ballistic missile defense.¹⁸ The unique nature of any operation will require that the IPB be enhanced through Priority Intelligence Requirements (PIR) to increase knowledge on the enemy. An effective IPB must assemble the information in a manner that transcends the cultures of the different services and national-level intelligence

¹⁷ These acronyms denote Imagery Intelligence (IMINT), Signals Intelligence (SIGINT), Human Intelligence (HUMINT), Open Source Intelligence (OSINT), and Measurements and Signatures Intelligence (MASINT)

¹⁸ See Appendix B for proposed specific variables required for analysis within the missile defense IPB.

agencies. Also, IPB must lend itself to crisis planning. In general terms, IPB contains four basic steps, all of which are conducted and analyzed within the framework of the BMD mission:

- Define the battlespace environment
- Define the battlespace's effects
- Evaluate the threat
- Determine threat Courses of Action (COA)

The four steps of the IPB are essential at defining the enemy, his capabilities, possible courses of action, and setting the stage for devising allied plans to deter the conflict, or decisively defeat the enemy. Defining the battlespace is crucial for the ballistic missile defense problem as it drives the geometry and constraints of ballistic missile intercepts, and time sensitive strikes. In defining the factor of space, one must account for meteorology, topography, oceanography, political demarcations, terrain shape, and distances. However, the IPB must also account for the enemy and friendly relative geostrategic positions, lines of communication, as well as lines of operation. Once the battlespace has been outlined, the analyst must account for element of force defined by enemy capabilities in the context of the battlespace, thereby laying out the battlespace's effects on enemy operations. In this stage, the IPB process takes the factor of time into account as it is correlated to space, and force. The ultimate result is a compilation of assessments derived from the enemy's capabilities and intentions in context with the battlespace's imposed limitations. From this process, one can evaluate the threat expressed as enemy courses of action (COA).

Initially, enemy COAs are numerous and are the direct extrapolations of all physical variables derived from the interaction of space-time-force. From these, all intangible variables such as enemy leadership intentions, leadership effectiveness, internal political support, and

strength of alliances are assessed so as to define a finite group of possible and probable courses of action. Ultimately, a few enemy COAs can be distilled, from which the most likely and most dangerous COAs are thoroughly evaluated.

The IPB is a practical tool to guide commanders' decisions and operational planning. For example, the time of greatest risk in a ballistic missile defense environment is during the early stages of the conflict, when there is a mismatch between the enemy strength and available friendly firepower. It is during this period that the danger of enemy attack is least predictable, friendly forces are least prepared, and the commander's risk and uncertainty is greatest. The IPB and subsequent analysis provides the commander with indications of enemy activity and potential COAs. This must include a structured study into those enemy actions deemed precursors to an attack. By isolating these events, a structured IPB can become the foundation for defining ambiguous and unambiguous warning of imminent hostilities.

As IPBs are primarily geographic-theater dependant, it is the theater Joint Intelligence Center's responsibility to produce a compiled intelligence product. This must account for knowledge derived from tactical, operational, and national intelligence organizations addressing concepts proposed in Appendix B, and include technical studies on the enemy. Examples of technical reports include Area Limitation studies, Parametric Trade studies, Radar Coverage studies, and enemy Network Analyses. In respect to ballistic missile defense, Area Limitation studies provide a detailed correlation of the enemy's geography and the associated launch requirements for mobile missiles. Based on complex research, launch areas on a vast geographic expanse can be significantly narrowed. Parametric Trade studies compare competing weapons' kinematics, producing analysis defining maximum, minimum, and optimum operational parameters. Examples include optimized engagement areas, interceptor launch timing and

separation sequences, and optimized numbers in interceptor salvos. Radar Coverage studies correlate terrain features and atmospheric conditions with radar propagation, defining a radar system's actual coverage area and range. A Network Analysis is an analytical tool designed to map an enemy's command and control structure based on all-source intelligence.

Defining enemy capabilities, intentions, and courses of action through the IPB process guides the commander in planning operations, optimizing the placement of resources to optimize their effects against the threat. By using a structured and shared IPB, joint commanders ensure that forces from all services are privy to a thorough analysis of the enemy, and can formulate their own operational plans based on a common thread.

C. Self-Contained Intelligence Products. Intelligence products in support of NMD must be based on the IPB and provide the appropriate level of detail to commanders and subordinates. The intelligence products must tell the required story for a unit or individual to perform his/her duties without the need for previous knowledge of the problem, or requirements for external amplifying reference. In other words, the intelligence provided to the theater and tactical forces must be self-contained, self-supporting, benefiting from the breadth of the intelligence community, and in agreement with other products on the subject disseminated to NMD forces.

Deploying naval forces are uniquely handicapped in their intelligence picture, as intelligence preparation is not effectively integrated into the operational pre-deployment cycle. When intelligence is integrated into pre-deployment exercises, it is often scripted and frequently based on hypothetical threats. Succinctly, NMD intelligence products must be instructive to an audience that in general terms may be ill-prepared in its knowledge of the enemy. Intelligence products which enumerate knowledge are not enough. These must provide a concise and

effective medium to convey concepts and insights in an eloquent and brief manner. Products must quickly teach enough for the operator to effectively and economically employ force against the enemy, achieving the mission objective.

D. Pervasive Intelligence. This last construct of intelligence support to NMD underscores the need for rapid intelligence support of the two most time-sensitive areas of ballistic missile defense: missile discrimination and time sensitive strikes. This level of intelligence is purely tactical in nature as it seeks to provide sensor-to-shooter data in the most expeditious manner. “Pervasive Intelligence,” is the intelligence support to ongoing tactical operations where predictive analysis, IPB, and all-source national and theater intelligence sensor fusion enable time-sensitive targeting. In missile discrimination, Pervasive Intelligence enables fast decision-making for immediate action. In time sensitive strikes, Pervasive Intelligence allows a targeting process against mobile systems independent of range capabilities, and friendly operation inside the enemy’s OODA loop. Nonetheless, Pervasive Intelligence affects tactical actions with significant strategic implications and changes the paradigm of how we view the intelligence process.

Since Operation ENDURING FREEDOM and Operation IRAQI FREEDOM, the United States Armed Forces have proven a sensor to shooter capability. However, this has been primarily reserved to passing coordinates from a battlefield sensor to an orbiting aircraft or a cruise missile mission-planning group. Recalling the theater ballistic missile defense scenario from page 4, the process used to determine the type of inbound ballistic missiles and the projected impact points is Pervasive Intelligence. This primarily automated process discerned

the type of weapon based on the trajectory, altitude, and other physical variables derived from known data. Subsequently, this knowledge is applied to a database reflecting known population areas, military units, and other high value assets within a Defended Areas List (DAL). This analysis discriminated which missiles are of military or political value to the enemy. Despite its automation, Pervasive Intelligence is a decision assistance tool based on intelligence derived from the IPB. Therefore, it is a concept that must be employed to maximize knowledge on the enemy—a new paradigm of sensor to shooter intelligence support.

Pervasive Intelligence must also be used on the flip side of the ballistic missile engagement scenario. Some of the data collected during the previous sample scenario is critical in ascertaining the ballistic missile launch site(s) in support of Time-Sensitive Targeting (TST). Additionally, since the Pervasive Intelligence analysis also determines the type of missile, the type of launcher can be derived, giving a reliable estimate of the time required to place weapons on target before the threat launchers can relocate. This and other data can assist sensors in gaining a more accurate geolocation of the threat systems. For example, trajectory analysis coupled with DSP data and the IPB can provide sufficient data to employ standoff weapons in a counter-force strike within the required timelines. Among other insights, IPB could provide knowledge of the enemy's pre-surveyed launch sites. The strike's precision can be further refined through tasked imagery if this is available in a timely manner. This imagery may provide mensurated coordinates of the target for GPS weapons. Ultimately, the concept of Pervasive Intelligence enables the theater commander to inhibit the enemy's ability to fire subsequent missile salvos against a defended area.

VI. Summary and Recommendations

Some may continue to argue that intelligence support for NMD, like other warfare areas, is hinged on an accurate and updated IPB alone. The nature of NMD contends that the timeliness requirements and the need for intelligence integration with operations demands that the intelligence process be expanded into more defined support concepts: Intelligence-enabled Common Operating Picture (COP), a structured Intelligence Preparation of the Battlefield (IPB), self-Contained Intelligence Products, and Pervasive Intelligence.

When the United States fields NMD by 30 September 2004, the Navy must be prepared to meet the operational challenges of early warning, cueing, and forward ballistic missile engagement. As the challenges to naval operations evolve, our understanding of intelligence must change, shifting the paradigm from an enabling specialty to a naval warfare discipline. In ballistic missile defense, naval intelligence must become integrated within operations, prior to and during hostilities. In doing so, naval intelligence will thereby become the future catalyst for tactical decision-making in the same degree as it influences operational-level planning today. The Navy must understand the risks involved in operating beneath full efficiency. Subsequently, the Navy must approach ballistic missile defense with a new analytical approach, using the four discussed intelligence concepts as the force multiplier that the ballistic missile defense problem demands.

Appendix A

Summary of the National Missile Defense Program Operational Concepts

The National Missile Defense (NMD) program tracks and engages ballistic missiles placing a premium on timeliness of response, effective discrimination amongst targets, and economy of force. To accomplish this, the NMD architecture seeks to track a ballistic missile from launch until re-entry using a myriad of space-, sea-, and ground-based sensors.

Tracking. At initial operational capability (IOC), the NMD architecture will make use of the Defense Support Program (DSP), and after 2009, the Space Based Infrared System (SBIRS) family of infrared satellites for missile launch warning. Ballistic missiles will be tracked by DSP/SBIRS until booster burnout and by radar thereafter.

Despite its technical merits, the physics behind NMD radar tracking pose significant challenges to these systems: they must track at extremely long ranges; must track within the atmosphere and in excess of 400 miles into space; radars tracking medium- and intercontinental-range missiles must communicate track data along a radar network to maintain situational awareness on the weapons while in flight through space. In addition, many of the NMD radars are Cold War era systems. These include assets originally designed to monitor and track Soviet ballistic missiles in support of strategic I&W. To complement these aging radars, a new generation of X-band radar systems is being developed to overcome many of the NMD radar limitations mentioned above. These include the land-based, phased array X-Band Radar (XBR) being built on Shemya Island, Alaska, and the Sea-Based X-Band Radar (SBX), a mobile version of XBR to be located in the Pacific and moved as required to support operations. X-band radars

will provide enhanced tracking fidelity, more accurate trajectory plotting, and better predict impact areas.

Engagement. The primary weapons system in NMD is the Ground-Based Interceptor (GBI), being based at Ft. Greely, Alaska, and Vandenberg AFB, California. This weapon will achieve its IOC in 2004, and is designed to engage intercontinental ballistic missiles in mid-course flight using a Kinetic Kill Vehicle. The system is designed to take cues from tracking radars and fly to an intercept point. Near this point in space, the GBI will acquire the target missile using an organic sensor and maneuver to collide with the oncoming weapon. The kinetic energy achieved by the closing speeds of the collision precludes the need for an explosive warhead on the GBI.

In the near term, other weapons systems are being fielded as a means to complement the GBI. The USAF Airborne Laser (ABL) is a Boeing 747-mounted high-powered laser designed to destroy ballistic missiles in the ascent phase. This system is slated for IOC in 2008. Also complementing ABL, the Navy's Standard Missile 3 (SM-3) is an interceptor scheduled for IOC in 2006. The SM-3 missile is part of the Aegis weapon system and can intercept short-to-medium range ballistic missiles outside the atmosphere during the ascent and mid-course phases.

National Missile Defense will use two Army weapon systems for area defense, the Theater High Altitude Air Defense (THAAD) system, and the Patriot Advanced Capability-3 (PAC-3). THAAD is scheduled for IOC in 2009 and is capable against short-to-medium range ballistic missiles in the midcourse and terminal phases of flight, and will use an X-band radar system to track targets and direct the interceptors. Also, the Army's Patriot Advanced Capability-3 (PAC-3) missile system is currently fielded and capable against short- and some medium-range ballistic missiles in the terminal phase.

Appendix B

Proposed Intelligence Preparation of the Battlefield for National Missile Defense from the Sea

The following is a proposal for concepts required of a robust Intelligence Preparation of the Battlefield supporting National Missile Defense from the sea. This structure provides a framework from which to better analyze what the enemy can do, what he is likely to do, what he can't do, and what would be most dangerous to U.S. forces. The author has used the U.S. Army's FM 34-130, Intelligence Preparation of the Battlefield, as a starting point for this IPB. Although the concepts derived from FM 34-130 are applicable to missile defense from the sea, this new warfare area must develop its own process based on unique operational requirements, further honing it through experience. This list of areas is not all encompassing and may be adjusted based on the operational situation. However, it is designed to illuminate areas that affect enemy operations and are relevant to the U.S. commander's operational risk and uncertainty, and subsequent decision-making process. The points made in this appendix should, through refinement and practice, become a tool from which to derive those few crucial areas that would become the commander's Priority Collection Requirements (PIRs). The following list is not all encompassing, but an initial baseline from which a commander and the N2 can extrapolate in devising a real-world IPB.

Missile Threat

- Location of enemy ballistic missiles by type and modifications
- Flight range capability of ballistic missiles

- Flight profiles of ballistic missiles
- Define the time and equipment required to move ballistic missile
- Location of ballistic missile deployment sites
- Type and characteristics of any buildings, bunkers, or other construction in deployment area (composition, location, depth, layering, location and characteristics of access points)
- Define all lines of communications that can be used to move missiles/TELs to deployment sites
- Known warhead handling capabilities of unit to which the missile is attached
- Engagement tactics of threat air defense artillery
- Commercial airways within area of operations
- Commercial operating schedules
- Known threat combat air patrol orbits (see IADS)
- Potential, likely threat combat air patrol orbits (see IADS)
- Number and types of missile stages
- Missile flight profile
- Separation times for missile stages
- Characteristics of each stage separation
- Number, types, and characteristics of warheads
- Warhead fuse type and fuse triggering characteristics
- Warhead types which could be mated with the missile but have not been associated with that type of weapon
- Separation characteristics of warheads from bus
- Types of decoys or penetration aids

- Time and methods of decoy and/or penetration aid separation
- Determine the launch routine for the missile systems
- Determine at what part of the launch sequence the flight program and target are inserted into the missiles
- Determine how the targeting information is passed to the tactical element and when
- Determine the specific indicators of the start of pre-launch activities
- Determine the specific indicators of the end of pre-launch activities
- Determine the navigation system used by the ballistic missile for pre-launch, midcourse, and terminal updates
- Determine if there is an update capability to the missile system post-launch
- Define likely weighted target set for enemy ballistic missile force defining probably salvo assignments by numbers and types of missiles and salvo timing
- Parametric trade study of most advantageous position for Aegis in cueing role (maximize probability of detection, minimize attenuating factors for radar system)¹⁹
- Parametric trade study of most advantageous position for Aegis in BMD active defense role (maximize Pk for SM-3 engagement)

Logistical Requirements

- Location of missile reload areas
- Location of missile depots
- Location of TEL maintenance areas

¹⁹ Parametric Trade studies compare competing weapons' mechanics and kinematics, producing analysis defining maximum, minimum, and optimal operating parameters. Examples of these

- Location of POL storage
- Location, type, and number of enemy troop concentrations
- Location of civilian population centers within commander's area of operation and area of interest
- Number and types of electronic lines of communication within area of interest
- Number and types of roads, rail lines, rivers, or other lines of physical communication within area of interest
- Maximum time for self-sustainment while deployed
- Inventory of high replacement rate parts manufactured internally
- Inventory of high replacement rate parts manufactured abroad
- Primary exporters of high replacement rate parts
- Identify lines of communication from external source of high replacement rate parts to supply depot
- Identify lines of communication from domestic source of high replacement rate parts to supply depot
- Identify lines of communication from depot to garrison
- Identify replenishment times for parts to arrive to supply depot
- Identify lead times or events required to trigger supply system into replenishment

Command and Control

- Define the command structure under which the ballistic missile units are subordinated
- Define the number, type, and capability of command and control nodes in this structure

include: optimized engagement areas, most effective interceptor launch timing, most effective

- Define indications of unusual activity within the command and control structure
- Identify enemy High Value Targets (those enemy units/assets which are his low density/high demand)
- Set of indicators for ambiguous warning of impending hostilities
- Set of indicators for unambiguous warning of impending hostilities

Leadership

- Define the leadership's strategic objective
- Define the leadership's operational objective
- Define under what internally-triggered circumstances military or civilian leadership would use its ballistic missile forces. In this last circumstance, define which missiles would be used first, in what quantity, using what doctrine
- Define under what externally-triggered circumstances military or civilian leadership would use its ballistic missile forces. In this last circumstance, define which missiles would be used first, in what quantity, using what doctrine
- Define under what U.S.-triggered circumstances military or civilian leadership would use its ballistic missile forces. In this last circumstance, define which missiles would be used first, in what quantity, using what doctrine
- Define under what circumstances the military or civilian leadership would use chemical warheads on its ballistic missile force
- Define under what circumstances the military or civilian leadership would use biological warheads on its ballistic missile force

numbers of interceptors in salvos, etc.

- Define under what circumstances the military or civilian leadership would use nuclear warheads on its ballistic missile force
- Define the enemy planning time and decision time for any of its courses of action.

Integrated Air Defense System (IADS)

- Range capabilities of threat aircraft (unrefueled, refueled, one way)
- Altitude capabilities of threat aircraft
- Commercial airways within area of operations
- Commercial operating schedules
- Known threat combat air patrol orbits
- Potential, likely threat combat air patrol orbits
- Surveillance radar installations within area of operations
- Air defense radar systems location and types
- Air defense artillery location and types
- Air defense missile systems location and types
- Configurations of air defense artillery sites
- Number of weapons associated with each type of site
- Range capabilities of threat air defense artillery
- Altitude capabilities of threat air defense artillery
- Shell burst or contact profile of threat air defense artillery
- Minimum engagement times for air defense artillery
- Maximum and minimum artillery engagement altitudes
- Type of associated air defense artillery radars and their characteristics

- Number of guns per radar
- Range capability, parametrics of radar system
- Ability of friendly ESM to detect associated radars
- Configurations of air defense missile sites
- Number of launchers associated with each type of site
- Number of missiles per launcher
- Range capabilities of threat missiles
- Altitude capabilities of threat missiles
- Burst or contact profile of threat missiles
- Minimum engagement times for missile units
- Maximum and minimum missile engagement altitudes
- Type of associated air defense missile radars and their characteristics
- Number of launchers per radar
- Range capability, parametrics of air defense missile radar system
- Ability of friendly ESM to detect air defense missile radars
- Determine where threat radar systems are masked by terrain
- Determine where threat weapon systems are masked by terrain

Air Threat

- Likely air avenues of approach (Do they provide ease of navigation? Do they provide protection to threat aircraft from radar and weapons? Do they allow evasive maneuvers? Do they allow for full use of aircraft speed? Do they support ground force operation?)
- Determine helicopter types, numbers, basing, range, pilot training, C2

- Determine helicopter standoff attack orbits
- Determine helicopter air-ground ordnance, tactics, training, quantity
- Determine fixed wing types, numbers, basing, range, pilot training, C2
- Determine fixed wing standoff attack orbits
- Determine fixed wing air-ground ordnance, tactics, training, quantity
- Determine ordnance delivery techniques (standoff ranges, release speeds and altitudes, guidance systems)
- Determine technical capabilities of aircraft such as all-weather, night capability, infrared acquisition and targeting devices, radar characteristics and capabilities, maximum/minimum speeds, ceilings, range, payloads (ordnance, passengers/aircrew, types or equipment), aerial refueling capability
- Air strike allocation procedures (aircraft type and number)
- Air strike target selection priorities
- Likely timing for air strikes
- Likely targets and objectives
- C3 procedures and techniques
- Determine type, number, and capability of unmanned aerial vehicles
- Determine unmanned aerial vehicles operating bases
- Location of airfields
- Location of weapon depots
- Location of POL
- Location of aids to navigation

Threat Intelligence Collection

- Types, number, storage, capabilities, and operational locations of mobile ELINT capability
- Types, number, storage, capabilities, and operational locations of mobile COMINT capability
- Location of visual observation posts
- Location of population centers in area of operations, area of interest, and within ingress corridors from friendly locations to area of operations
- Location of farms or civilian outposts within area of operations and area of interest

Environmental

- Environmental constraints placed on enemy ballistic missile systems (launch constraints due to wind, temperature, lighting, visibility)
- Environmental trends for the area of interest throughout the year
- Probability of icing
- Average wind speeds and direction for area of interest
- Environmental constraints placed on enemy TELs (ability to traverse in rain, snow, mud)
- Environmental constraints placed on enemy command and control (visibility ground temperature, rain, snow,
- Geographic constraints placed on TELs and ballistic missiles (ground inclination and hardness, ground composition, minimum clearing area required)
- METOC conditions at enemy garrisons
- METOC conditions at enemy launch sites

- METOC conditions on lines of transportation between garrison and deployed launch sites
- Define topography which may delay launch acquisition or affect tracking by space, naval, or ground surveillance assets
- Environmental conditions on and over the assessed intended targets (prevailing winds, precipitation, temperature, humidity, etc.)

Bibliography

Carnegie Panel on U.S. Security and the Future of Arms Control. Challenges for U.S. National Security : Nuclear Strategy Issues of the 1980s : Strategic Vulnerabilities, Command, Control, Communications, and Intelligence, Theater Nuclear Forces : a Third Report. Washington, D.C.: Carnegie Endowment for International Peace, 1982.

Castelli, Christopher J. Navy Examines Ramifications of Missile Defense for Surface Fleet. Inside the Navy. December 22, 2003.

FM 34-130, Intelligence Preparation of the Battlefield. Headquarters, Department of the Army. Washington, D.C. 1994.

Folker, Robert D. Intelligence Analysis in Theater Joint Intelligence Centers: An Experiment in Applying Structured Methods. Washington, D.C.: Joint Military Intelligence College, 2000.

Johnson, Kevin D. Intelligence Preparation of the Theater. Fort Leavenworth: School of Advanced Military Studies, U.S. Army Command and General Staff College, 1991.

Lindsay, James M; O'Hanlon, Michael E. Defending America: the Case for Limited National Missile Defense. Washington, D.C.: Brookings Institution Press, c2001.

Rumsfeld, Donald H., et al. Commission to Assess the Ballistic Missile Threat to The United States. July 1998. Pursuant to Public Law 201, 104th Congress.

Ruse, Mark A. Reflections on the 1972 Antiballistic Missile Treaty and National Missile Defense. *Aerospace Power Journal*. Spring, 2002.

Shotwell, Dhillin, Pollard. Ballistic Missile Defense for the Twenty-First Century. *Aerospace Power Journal-Special Edition*. 1994.

Sprowls, Laura J. Strategic Vision for Theater Intelligence: Supporting the Requirements of the 21st Century Warfighter. Carlisle Barracks, Pa.: U.S. Army War College, 1996.

Swicker, Charles. Theater Ballistic Missile Defense from the Sea. Newport Paper 14. Naval War College, Newport. 1998.

Tjunn, Lim Chern. Exploiting C2I to Enhance TMD Attack Operations/Exploiting C2I to Enhance Theater Missile Defense Attack Operations. 1997.