SUCCEEDING AT INTEGRATED AIR AND MISSILE DEFENSE

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“Success no longer goes to the country that develops a new technology first, but rather to the one that better integrates it and adapts its way of fighting” – no words ring truer for defense against missile threats than these from the 2018 National Defense Strategy. The cost comparison of missiles to missile interceptors necessitates the Integrated Air and Missile Defense (IAMD) mission leverage technology and innovation to do more with this extraordinary capability. At its introduction, the performance and reliability of nascent hit-to-kill technology required a buildup to exceptional performance, particularly because interceptor employment and consequence of engagement effects had to be well understood to be included in operational planning. Now a well-established capability, a comprehensive approach should integrate functional capabilities and ensure integration takes place at technical, planning, policy, and mission support levels.

BACKGROUND
Warfighters recognized unmanned rocket propelled bombs as game changers with the advent of the German V-1 and V-2 during World War II. As guidance systems, payload, and rocket technology improved, the use of missiles as a force multiplier gained momentum. Today more than 30 countries and a growing number of non-state actors have some type of ballistic or cruise missile capability, making air and missile defense capabilities one of the key components to defending critical sites and forces.

The lethality and effectiveness of long range ballistic missiles elevated the importance of ballistic missile defense (BMD) for the U.S. homeland. Time was of the essence as North Korea made numerous advancements in long range ballistic missile technology. The former Ballistic Missile Defense Organization, now Missile Defense Agency (MDA), was granted special acquisition authorities to quickly get the Ground-based Midcourse Defense (GMD) operational, as well as get warfighter capabilities against shorter range ballistic missiles. The GMD system was rapidly developed and fielded during the early part of the 2000s, improving its reliability over time. MDA also drastically improved the success rate of the Army’s Terminal High Altitude Area Defense (THAAD) system, demonstrated numerous intercepts with the Standard Missile-3 (SM-3) interceptor under the Aegis BMD program and developed a fused BMD picture for command and control through the Command and Control, Battle Management, and Communications (C2BMC) program. Additionally, MDA has enabled allies and partners to develop missile defense capabilities: working with Israel on programs such as Arrow and David’s Sling, co-developing the SM-3 Block IIA with Japan, and engaging countries and alliances wishing to establish active defense capabilities. As time went on, the delivery platforms and flight characteristics of missiles began using new ways to challenge the performance parameters, which were likely envisioned at the developmental stages of missile defense technology. The Department invests heavily to ensure U.S. active defense systems are reliable and keep pace with threat missiles. Key to these investments is the ability to integrate and adapt their employment.

STRATEGIC CONTEXT
In contrast to the strict testing standards by the U.S. to ensure safety and dependability for the warfighter, North Korea’s test, evaluation, and fielding process for its ballistic missile program has used an insurgent-like strategy where small victories and perception constitute success. The ability to execute tests demonstrates political defiance to international pressure against developing their ballistic missile program and implies they are making significant technological and military progress. The effect of their approach is notable – North
Korea potentially has a ballistic missile arsenal which could lead the U.S. to treat North Korea as a peer competitor worthy of deterrence strategy. Their approach also imposes the need to build sufficient capacity and capability to defeat their mobile, fixed, and submarine-launched ballistic missile inventory. The former is a win for North Korean legitimacy and the latter places a significant economic burden on the Ballistic Missile Defense System (BMDS) which protects the homeland. This strategy is replicable by other countries that maintain an adversarial relationship with the U.S., seeking to deter the U.S. from military options. These countries are further empowered by potential suppliers such as Russia, which views military exports as a key component to its economic strategy. Proliferation of missile technology and capacity overmatch are exacerbated by payload lethality, reduced indications of launch, advanced maneuvering, penetration aids, and countermeasures. The U.S., its partners, and allies must take a comprehensive approach against missile threats, leveraging functional capabilities which provide military advantages pre- and post-launch.

Functional capabilities which may be used prior to launch begin with enabling offensive capability to prevent the launch from occurring. If the launch occurs, active defense systems take over, ideally using continuous tactical data (i.e. “birth to death” tracking) from the time it was located and targeted through launch and flight. Continuous tracking helps with attribution, threat assessment, and increases the probability of successfully defeating the threat missile’s lethal payload. If active defense systems are unsuccessful, the warfighting commander must use passive defense measures, such as cover, concealment, deception, and dispersion. If the threat missile(s) continue to their target the commander must rely on resiliency measures such as hardening, redundancy, and consequence management to ensure the missile’s intended effects are mitigated. When offensive strike, active defense, passive defense, or resiliency are deemed marginally effective the commander must be able to communicate gaps to national leadership. Improving awareness enables smarter resource allocation or elevates the importance of succeeding using diplomatic, informational, or economic effectors.

The U.S., its partners, and allies have considerable military capabilities which support a comprehensive approach against air and missile threats. Maximizing the value of their capabilities requires integration which extends beyond the technical level; it must also occur in planning, policy, and supporting efforts.

TECHNICAL CAPABILITY

Systems must be integrated, not just interoperable. Two systems could be considered interoperable if two operators can coordinate the employment of their stand-alone systems through simple voice coordination. However, the efficiency at which this occurs deteriorates rapidly as threats multiply in quantity, approach azimuths, and adversarial actions disrupt the warfighter (e.g., cyberattack, electronic jamming or the use of an improvised explosive device). Systems that share data, especially if the system treats the data the same as its own organically developed data, enable greater efficiency for assessing the tactical situations and enabling appropriate follow-on actions. The ubiquity of data also helps autonomous systems, artificial intelligence, and other advanced computing to significantly improve the warfighter’s ability to make battle management decisions pre- and post-launch.

The U.S. Department of Defense (DoD) has long endeavored to build toward a single integrated air picture (SIAP) which enables networked fire control and has found some success in systems like the Cooperative
Engagement Capability (CEC), managed by the Navy’s Program Executive Office for Integrated Warfare Systems, and MDA’s C2BMC program. The Army’s IAMD Program is working toward incorporating capabilities from various sources in a “plug and fight” configuration, and is central to Army’s efforts to bolster IAMD.

However, integration should not stop at U.S. systems – incorporating allied and partner systems is a force multiplier and potentially provides overlapping capabilities which, when combined, maximizes the kinetic capability of available sensors, interceptors, and strike assets. Co-development of systems and policies which improve foreign military sales have helped get capabilities, particularly active defense systems, to partner nations, however, the compatibility of these systems must be examined closely. While undoubtedly interoperable, the version sold to another country is inevitably tailored to the needs of that country. Technical requirements such as cybersecurity or human-machine interface configurations may differ from U.S. systems. These differences require engineers help warfighters understand the extent to which they can leverage partner capabilities and identify cross domain solutions which allow warfighters to gain the maximum benefit allowed by policy. This assessment is key to accurate planning and synchronizing operational or developmental efforts among U.S. and partner nations.

PLANNING
As the technical capability of new systems materialize and existing systems improve, the warfighter must have a firm understanding of IAMD issues from a combined arms perspective. Integrating offensive and defensive capabilities requires almost a campaign-level analysis with a focus on the IAMD mission area. Synthesizing disparate modeling and simulation (M&S) data from U.S. and possibly allied and partner systems is necessary so that operational planners may explore the potential outcome of various scenarios for a given force laydown and epoch. Planners will need M&S tools that have the flexibility to incorporate legacy M&S tools as well as inject new parameters based on developing knowledge of, or planning assumptions for, threat performance, offensive and defensive capabilities. Having a means to conduct low to medium fidelity constructive analysis enables planners to better assess the value of various current and near-term capabilities in providing risk mitigation. This type of feedback is valuable to both operational planners and in establishing warfighter requirements from “fight tonight” to the Future Years Defense Program (FYDP) and beyond. This level of analysis is also useful by DoD staff in providing feedback to U.S. and non-U.S. national security leaders, industry, and other solution sources, who at times require these types of studies and assessments relatively quickly.

Understanding the outcome of planning scenarios based on synthesized technical data is no easy challenge – many M&S tools were designed with a narrow field of tasks in mind with asset performance parameters based on threats which were not as robust. Modifications of two different systems, especially if the material sponsor is of a single Military Department or Agency, may not occur in tandem or could increase cost or time due to the potential need for sharing intellectual capital. Consequently, integration across planning tools may require a “hub-and-spoke” approach which takes various M&S systems into a usable form for operational planners. While IAMD may be the focus of a given study, the M&S system should be able to impose assumed benefits from other functional capabilities such as offensive and defensive cyber operations. M&S tools should help the planner discern aspects of the threat which allowed it to evade offensive strike, defeat active, passive defense systems, and marginalize resiliency and consequence management measures. This type of integrated planning analysis empowers the warfighter to prioritize gaps and make recommendations for material and non-material solutions with greater specificity.

POLICY
Integrating policy discussions means DoD staff and the warfighter must enable policymakers with common equities to approach challenges within the IAMD mission
under a common frame of reference. Communicating the benefits of integrating allied missile defense capability, for instance, should offer a unified perspective of what constitutes progress in integration so that Congress, the State Department, the Defense Security Cooperation Agency, and a partner nation may institute supportive policies. Similarly, the need to incorporate use of the space domain to further military capabilities, even if defensive in nature, is another area which possesses sensitive policy issues. However, policy discussions are potentially furthered when policymakers have a clear understanding of the extent and manner being explored for using outer space. The need for integrated policy discussions is significant for IAMD as its political and diplomatic dimensions necessitate an interagency approach.

Effective communication among key enablers of policy requires organizations preserve IAMD expertise with knowledge of the underpinning discussions that went into strategic planning. Many of these entities, even within DoD organizations, lack IAMD expertise longevity due to the natural transition of personnel. Maintaining expertise helps preserve the message and intent behind strategic decisions, as well as, challenge alternative approaches which may not address the rationale of the current approach.

The value of policy discussions informed by constructive analysis cannot be understated. Many of the policy and programmatic recommendations for IAMD are rooted in the series of Joint Capability Mix studies by the Joint Staff. One of the strengths of the study is that it takes a joint perspective and places solutions sponsors from Military Departments, MDA, and other organizations on a level playing field by an “honest broker.” Such an approach is even more important when holding policy discussions with allies and partners.

Integration of U.S. and allied partner capabilities requires more than foreign military sales. It also requires mutual agreements in security cooperation and concept of employment, such as responsibility for action or conditions which warrant using various levels of military power. The European Phased Adaptive Approach as the U.S. Voluntary National Contribution continues to be a major component of the North Atlantic Treaty Organization (NATO) BMD, however understanding the potential consequence of engagement effects, as well as mutual agreements on the IAMD Concept of Operations, had to be established through M&S-heavy practical application during Exercise Steadfast Alliance. This exercise involved both civil and military elements for missile warning. Demonstrating that a holistic approach to missile threats may necessitate leveraging non-military assets, such as civilian air traffic control radars, civilian hosting of military assets, and communication paths. Civil-military cooperation is key to BMD and the greater set of IAMD. For example, NATO’s Air Policing mission must, at some point, transition to Air Defense.

In addition to the legal and political ramifications of IAMD, a comprehensive approach which uses offensive strike options must be discussed and national positions understood for various circumstances. Enhancing discussions with the support of wargames, exercises, and other experiments ensures parties clearly understand the circumstances of policy scenarios. Nimble Titan, for example, is a biennial multinational exercise with a missile defense focus. Held at the unclassified level and supported by M&S, it enables policy discussions and provides allied and partner nations a better understanding of how to execute IAMD.

**SUPPORTING EFFORTS**

Communicating the impact of threat missiles and adversary operations must be widely understood for supporting efforts, such as training, logistics, and force structure. Training is central to military operations and planning. Consequently, integrating M&S training tools across functional warfare areas, especially if it requires incorporating allied and partner capabilities, becomes a tough but necessary task. Countries have varying versions of U.S. and foreign air and missile defense systems with varying levels of proficiency and operational procedures. Imposing M&S tools which integrate...
training tools forces solution requirements and temporary work-arounds to the surface. Although primarily a function of planning, force structure issues, such as command and personnel composition, as well as requisite training, extend beyond operators of IAMD capabilities. If, for instance, capability requirements for airborne assets exceed projected availability, especially in an anti-access area denial (A2AD) environment, this shortfall is discoverable through scenario-based analysis. Relying on offensive strike “left of launch” options may not be as extensive as originally anticipated but discovery of this fact should be substantiated with constructive analysis.

One of the key functional warfare areas which require integrated analysis supported by M&S is logistics. Integrated planning and training must be able to extract logistic demands that may not be met. A2AD measures make it essential that leadership and planners fully grasp the impact of A2AD-induced shortfalls and the affect on other available measures, such as strike or passive defense. The current “high demand, low density” nature of IAMD may require a change in how a combatant commander uses active defense. Leadership must be able to convey the impacts of these support functions to their respective resource allocation forums.

Deliberate analysis which allows the IAMD community of interest to identify gaps, discuss solutions, and communicate those needs to a variety of inter-, intra- and non-government entities advances a holistic effort for mitigating the risk from air and missile threats. Technical integration is a significant component, but collaboration tools - which account for capability changes by the threat or friendly assets, as well as facilitate planning and policy discussions for functional warfare areas including mission support – will enable the implementation of holistic solutions.

NOTES


*These statements reflect the views of the author, and do not reflect an official position by the Department of Defense.
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