



(Photo courtesy of The Boeing Company)

A Boeing multimission Avenger turret mounted on a mine-resistant, ambush-protected, all-terrain vehicle stands on display at a defense symposium 28 September 2010. Boeing developed the weapon system as a cost-effective option to modernize existing U.S. Army Avenger weapon systems.

# Balancing Air and Missile Defense to Better Support Maneuver

Capt. Vincent R. Wiggins Jr., U.S. Army

*Thus it is that in war the victorious strategist only seeks battle after the victory has been won, whereas he who is destined to defeat first fights and afterwards looks for victory.*

—Sun Tzu

The U.S. Army is modernizing and cultivating specific echelons of air and missile defense (AMD) in response to evolving air and missile threats. According to Col. Robert Lyons, former director of the Department of the Army Military Operations Air Missile Defense, the projected threat force will be a sophisticated adversary consisting of multi-echeloned, asymmetric capabilities.<sup>1</sup> Upgrades and unit expansions in Army high-to-medium-altitude air defense (HIMAD) systems, such as Patriot and Terminal High Altitude Area Defense, defend critical assets and help the United States and its allies maintain a strategic advantage around the world; these assets—for the purposes of this paper, called *static-engagement-AMD*—enable AMD from stationary locations.<sup>2</sup> However, the Army prioritizes static-engagement-AMD assets at the expense of aggressive maneuver tempo, resulting in an unbalanced execution of the Army's AMD strategy. For example, Army air defense artillery (ADA) includes fifteen Patriot battalions, which provide static-engagement-AMD, but only four active Avenger batteries and seven Army National Guard Avenger battalions, as of August 2015. These eleven Avenger units are the air defense's only remaining *nonstatic-engagement-AMD* formations.<sup>3</sup> This situation reflects a gap in the force's protective capabilities, through degraded AMD support of maneuver.

The brigade combat team (BCT) is designed for operations encompassing the entire range of military operations; it is the primary close-combat force of the U.S. Army.<sup>4</sup> However, no AMD engagement assets are organic to the BCT, and this limits effectiveness because it limits integration. Maj. Gen. John G. Rossi, commanding general of the United States Army Fires Center of Excellence and Fort Sill, Oklahoma, offered a viable perspective during an Association of the U.S. Army "Transform the AMD Force" panel in February 2015. According to Army reporter David Vergun, Rossi explained that AMD elements should improve communication with other forces, including BCTs, because "there are threats out there not just to combatant commanders; it's also BCTs saying we need you back in the game."<sup>5</sup> The Army's AMD strategy emphasizes the development of static-engagement-AMD assets and formations, but the solution to bridging the growing gap between aerial threat exposure and air defense

for maneuver forces is to modernize, grow, and integrate nonstatic-engagement-AMD assets, such as the Avenger, into the BCT.

## Air Defense and Aggressive Maneuver Tempo

Short-range air defense protects units against threats such as unmanned aircraft systems (UASs), rotary-wing aircraft, fixed-wing aircraft, and cruise missiles. Traditionally, forces have accomplished short-range air defense through nonstatic-engagement-AMD. Some HIMAD assets also can defend against these kinds of threats, but their capability to support an aggressive maneuver tempo—through expedited tactical mobility and shooting on the move—is nonexistent. Army forces need AMD assets that help them maneuver faster than their enemies. According to Army Doctrine Reference Publication 3-0, *Unified Land Operations*, "during operations dominated by combined arms maneuver, commanders normally seek to maintain a higher tempo than the enemy does; a rapid tempo can overwhelm an enemy's ability to counter friendly actions. It is the key to achieving a temporal advantage during combined arms maneuver."<sup>6</sup> HIMAD weapon systems are static-engagement-AMD assets with extensive time requirements for emplacement. Maneuver commanders who depend on these assets need to assume risk in protection or initiative when operating outside the narrow protection zone they provide.

In addition, HIMAD weapon systems cannot identify, track, or engage targets without radar radiating into the operational area. In comparison, Avengers are enhanced by radar rather than reliant on it. Their operators can manually engage targets through visual acquisition (line of sight) or remotely through automated radar targeting. The Avenger's line-of-sight capability complements its ability to shoot on the move and enables the system to function throughout the maneuver area of operations.

Developed in the 1990s, the Avenger is a light-weight, shoot-on-the-move, rocket-launcher system that provides critical short-range nonstatic-engagement-AMD. Similarly, the Army developed the Bradley Stinger Fighting Vehicle, or Linebacker, to accompany its mechanized formations. According to Bradley manufacturer Raytheon, the "Stinger maintains a greater



than 90 percent success rate in reliability and training tests against advanced threat targets.<sup>7</sup> The Avenger weapon system, which can fire Stingers, enables air defenders to protect from a mounted, motorized configuration or download shoulder-fired Stingers for dismounted operations.

## Constraining the Force

Nonstatic-engagement-AMD units are disappearing from the Active Army. Based on the ongoing unit drawdown, implementation of the AMD strategy is increasing the Avenger's reduction from circulation, instead of increasing its employment to support maneuver.<sup>8</sup> The strategy emphasizes HIMAD and static-engagement-AMD counterfire assets such as the counterrocket, artillery, and mortar (C-RAM) program.<sup>9</sup> According to the strategy, "air and missile defense remains an Army core function, vital to the Army's core competencies of combined arms maneuver and wide area security."<sup>10</sup> Ironically, the Avenger is the essence of the air defense's ability to enable maneuver commanders to seize, retain, and exploit the initiative with on-the-move protection—no other Army air defense asset has this capability. Without the Avenger, air defense cannot effectively facilitate maneuver.

## Transitional Air Defense Capabilities

The transitional virtuosity of nonstatic-engagement-AMD interconnects air defense to maneuver forces through the most fundamental aspect of war—combat. While HIMAD elements defend and deter, they are statically positioned and restricted to executing conventional air defense. They lack rapid deployability, and they operate separately from the combined arms force. According to Carl Von Clausewitz, "A sudden powerful transition to the offensive ... is the greatest moment for the defense."<sup>11</sup> In the absence of a traditional air defense mission, nonstatic-engagement-AMD forces

transition their capabilities to support maneuver, serving as a "dual-hatted" combat multiplier. In 2005, Stanley Davis, then command sergeant major of the Army ADA branch, expertly summarized the transformation of nonstatic-engagement-AMD forces in Iraq and Afghanistan:

Our Bradley Linebacker and Avenger soldiers fought their way to Baghdad and Kabul alongside our infantry and armored divisions. Following the redeployment of the Patriot force from the combat zone, our Romeos [Linebacker crewmembers] and Sierras [Avenger crewmembers] stayed on to battle insurgents and Taliban rebels, laying the foundations for Iraqi and Afghan democracy. They bore the brunt of battle and convincingly demonstrated the fighting qualities of ADA soldiers to the combined arms team.<sup>12</sup>

The Avenger is combat proven. Since the Army first began using it in the 1990s, upgrades have added supplemental capabilities to diversify and enhance its



(Photo courtesy of the Joint Readiness Training Center)

An Avenger gunner from Battery E, 3rd Battalion, 4th Air Defense Artillery Regiment, provides aerial and ground security from a deliberate fighting position in support of a 1st Brigade Combat Team, 82nd Airborne Division training exercise 20 April 2015 at Fort Polk, Louisiana.

effectiveness. In addition to the Stinger, the Avenger has an automated .50 caliber machine gun (M3P) and a forward-looking infrared (FLIR) optics system. According to Lt. Col. Rick Starkey, former director of the Office of the Chief of the ADA School, air defenders took advantage of these capabilities in Iraq to conduct combat patrols, such as convoy security, raids, armored reconnaissance, and cordon and search.<sup>13</sup>

The combination of the M3P and FLIR allows air defenders to acquire and engage aerial and ground targets. In many instances, maneuver commanders have requested air defense support to enhance their operations due to these capabilities. Capt. Scott Dellinger effectively describes his relevant combat experience in Iraq:

Air defense artillery soldiers became so proficient at identifying enemy positions and IEDs [improvised explosive devices] with the

FLIR that ADA vehicles were sent ahead of convoys to clear routes and identify IEDs or other threats along routes throughout the entire 1st Armored Division zone.<sup>14</sup>

## Misperceptions of Air Defense

There is a clear disconnect between the maneuver and air defense communities. Students attending the Maneuver Captain's Career Course (MCCC) are taught a false conceptual application of protection from aerial threats because the curriculum incorporates legacy doctrine for air defense. MCCC scenarios include air threats that require students to receive nonstatic-engagement-AMD assets, such as Linebackers, which are no longer fielded, and Avengers, which are available in very limited quantity. In addition, the current platform of the Avenger is the high-mobility multipurpose wheeled vehicle, which no longer meets protection standards, thus rendering the system obsolete and unusable for combat operations without deliberate modernization efforts. As a result, maneuver leaders are being taught the employment of nonexistent air defense enablers.

According to the AMD strategy, "AMD capabilities are critical to the future force and the Army mission."<sup>15</sup> When a force maneuvers, and when gaining access requires seizing key terrain, how can air defenders enable the maneuver commander without nonstatic-engagement-AMD capabilities? In a 2013 issue of *Fires*, Brig. Gen. Donald Fryc, commander of the 32nd Army Air and Missile Defense Corps, said the C-RAM system "is not suited to move and [cannot] protect the support elements of a brigade combat team when not in that [BCT's] fixed location."<sup>16</sup> This statement applies to all HIMAD assets—the priorities of the AMD strategy.

The Army AMD strategy has emphasized the reduction of nonstatic-engagement-AMD for more than ten years. As part of Army transformation in 2005, the air defense branch announced the inactivation of divisional ADA battalions, the removal of the Bradley Linebacker, and the downsizing of the Avenger force.<sup>17</sup>

Meanwhile, maneuver forces continue to request Avenger assets to support global response force packages and to augment their exercises at the Joint Readiness Training Center (JRTC) and the National Training Center (NTC). In 2013, an ADA battery provided nine Avenger teams to augment JRTC rotation 13-

01.<sup>18</sup> Another battery provided three Avenger teams in April 2015 to augment JRTC rotation 15-06 while simultaneously being attached to the 82nd Airborne Division global response force.

During JRTC and NTC rotations, training scenarios incorporate unmanned air assets, such as the Raven—a lightweight, high-mobility UAS designed for low-altitude surveillance and reconnaissance, to simulate the growing UAS threat.<sup>19</sup> In a 2013 *Infantry* magazine article, Capt. Jeremy Phillips provides an insightful perspective of an infantryman's concern for units needing counter-UAS enablers. The



(Photo by Sgt. Christopher Kaufmann, Joint Combat Camera Afghanistan)

Sgt. Aubrey Caplinger and Spc. Gabriel Vega, Battery B, 3rd Battalion, 62nd Air Defense Artillery Regiment, pull security atop an Avenger 4 March 2004 during the opening ceremony of the Ghazni Provincial Reconstruction Team facility, Ghazni, Afghanistan.

article, “Training for the Enemy UAV [unmanned aerial vehicle] Threat,” articulates an interesting conclusion:

Being able to destroy the enemy’s capability to control unmanned platforms either by jamming the signals to and from a UAS, disabling the cameras onboard, or physically destroying them will be an invaluable asset for ground combat commanders.<sup>20</sup>

Ironically, Capt. Phillips made this deduction after completing an NTC rotation with a combined arms battalion that was augmented with an Avenger team.

According to Field Manual 3-01, *U.S. Army Air and Missile Defense Operations*, “Avenger is designed to counter low-altitude unmanned aircraft systems, high-speed fixed-wing, and rotary-wing aircraft, [and] reconnaissance, intelligence, surveillance and target acquisition assets.”<sup>21</sup>

However, maneuver leaders are not familiar with Avenger capabilities due to fewer formations being available. In 2013, Shirley Dismuke, then editor-in-chief of *Fires* magazine, wrote, “the Avenger system ... will be phased into National Guard units ... [even though] it is currently the only system viable against unmanned aerial surveillance.”<sup>22</sup> Nonetheless, Chief Warrant Officer 3 Wes Dohogn (Brigade Mission Command, JRTC Operations Group) emphasizes the idiosyncratic capabilities of Stinger and Avenger in “Airspace Management with SHORAD [short-range air defense] Integration”:

Stingers and Avenger are the Army’s defense against this enemy air threat [referring to UASs]. They have a unique ability that no other ADA asset has. They provide quicker response to the threat and are able to be inserted early on the modern battlefield, providing freedom of maneuver for the BCT while they expand and enlarge the lodgment.<sup>23</sup>

Since Avengers are not organic to the BCT, maneuver commanders rarely have access to their capabilities before a JRTC or NTC rotation or a combat deployment. Army modernization, expansion, and integration of updated Avenger formations into maneuver forces would resolve this tactical shortcoming and better support maneuver leaders like Capt. Phillips. Dohogn supplements this point by analyzing the benefit of nonstatic-engagement-AMD assets incorporated into the maneuver structure. He offers practical applications learned from JRTC rotation 13-01:

The goal is to put ADA fire units strategically between the threat and the defended asset;

that simple formula is the best way to increase the probability of engaging an aircraft before it can attack or see a defended asset. This deliberate planning effort can result in Stinger teams conducting Stinger ambushes on known avenues of approach or Avengers moving forward with other mounted elements.<sup>24</sup>

## Modernizing the Avenger for Future Fights

The Army modernization strategy, as described in the 2015 *Army Posture Statement*, states, “While resource constraints will force the Army to delay new system development and investment in the next generation of capabilities, we will execute incremental upgrades to increase capabilities and modernize existing systems.”<sup>25</sup> Consistent with this strategy, Boeing offers a low-cost and operationally sound option for modernizing the currently fielded Avenger as a “multimission” weapon that would ensure air defenders and maneuver commanders remain on the cutting edge of aerial threat protection for several generations of conflict to come.<sup>26</sup>

The innovations to the Avenger multimission rocket launcher reduce fielding time and cost by modifying the existing Avenger with new capabilities: interchangeable Stinger missiles, Longbow Hellfire missiles, guided and unguided rockets, Accelerated Improved Interceptor Initiative (AI3) missiles, high-energy lasers, a 25 mm gun, and other weapons. The updated Avenger can be mounted on the Army’s primary mobility systems, in addition to high-mobility multipurpose wheeled vehicles.<sup>27</sup>

The AI3 provides enhanced protection capabilities to the Avenger because it detects and destroys rockets, mortars, UASs, and cruise missiles in flight.<sup>28</sup> On 19 August 2013, the AI3 “successfully intercepted and destroyed a low quadrant elevation 107 mm rocket” during a capabilities flight test.<sup>29</sup>

The air defense’s response to advancing short-range air defense coverage is the developing static-engagement-AMD program called the Indirect Fire Protection Capability Increment 2–Intercept (IFPC Inc 2-I) system. According to a 2012 Program Executive Office Missiles and Space public release brief, the mission of the IFPC Inc 2-I system “is to provide a mobile, robust protection capability to critical assets within fixed and semifixed locations against UASs, CMs [cruise missiles] and RAMs [rockets, artillery, and mortars].”<sup>30</sup> This system includes



an application that “will replace Avenger” with a multimission launcher—not to be confused with Boeing’s multimission Avenger. Once developed and fielded, the new IFPC Inc 2-I launcher will be mount-restricted to a 10-ton utility truck, and it will have the capability to load a series of interceptors.<sup>31</sup>

Unlike the Avenger, the proposed launcher is not suited for aggressive maneuver tempo—primarily because it lacks immediate tactical employment capability, does not shoot on the move, and lacks a self-guiding missile engagement feature. Instead, like static-engagement HIMAD systems, the proposed weapon system relies solely on radar identification and intercept guidance from a fixed location. In addition, the proposed launcher does not incorporate organic ground-based defense weaponry. Therefore, it will rely on extensive force protection packages to provide security for its operations, and it will not enable air defenders to transition capabilities in support of maneuver commanders.

## Enhancing the Brigade Combat Team with Air Defense Assets

Currently, BCTs only have air defense and airspace management cells allocated to them. These liaisons assist in planning but possess no intercept assets. To integrate nonstatic-engagement-AMD enablers effectively, maneuver commanders need organic upgraded Avenger units to incorporate into their training so units can learn and develop integrated tactics, techniques, and procedures before the next conflict. Capt. Winston Marbella masterfully articulates the importance of educating the maneuver commander on Avenger capabilities to enhance operations:

On night combat patrols, the Avenger is primarily assigned in the [over-watch] or support-by-fire role. With its enhanced FLIR, it’s the best night vision available to a light infantry task force. We educate task force leaders on the incredible capability the Avenger’s M3P .50 caliber machine gun—when combined with the FLIR and Avenger’s 360-degree turret—brings to the fight. The M3P’s longer barrel gives it increased range, and soldiers can fire the M3P mounted on the Avenger platform from a remote position. With [its] advanced target acquisition system, the

[M3P] machine gun’s combined capabilities are superior to the infantry’s M-2 .50 caliber machine gun. Highlighting the Avenger’s capability to the task force leadership greatly enhanced our platoon’s contribution to the task force’s success.<sup>32</sup>

BCTs consist of a wide range of organic combat enablers from virtually every branch of the Army except air defense. However, the Army vision for the Force 2025 Maneuvers offers an opportunity to resolve the problem by anticipating an increase in capabilities of the future BCT, including effective counter anti-access/area denial (A2/AD).<sup>33</sup>

The next-generation BCTs should integrate a modernized Avenger battery, configured to match the structure of each BCT—which would enable BCTs to counter A2/AD while maintaining unique combat advantages. Heavy BCTs should have a Bradley or medium tactical vehicle Avenger battery to defeat aerial threats while continuing to operate with “shock and speed.”<sup>34</sup> Infantry BCTs should have a mine-resistant, ambush-protected, all-terrain vehicle Avenger battery to eliminate aerial threats while operating in their optimal environment: close terrain.<sup>35</sup> Finally, Stryker BCTs should have a Stryker family of vehicles Avenger battery, to extend its intended protection and firepower to counter aerial threats while maintaining “operational and tactical mobility.”<sup>36</sup>

Integrating modernized Avenger assets would enable BCTs to defeat the aerial threat and simultaneously gain forced access into an area of operations without sacrificing momentum. In the spirit of an analysis published in 2011 by Gen. Robert Cone, then commander of the U.S. Army Training and Doctrine Command, upgraded Avenger units would enable the “artful execution of combined arms maneuver” that “surprises the enemy by attacking from an unexpected direction and time or by employing combat power in unforeseen ways.”<sup>37</sup>

Avenger formations have proven their battle-adaptive capability to provide air defense while simultaneously supporting ground forces. Without upgraded Avengers integrated into the BCT, maneuver units will remain unnecessarily exposed to aerial attack, especially by the rapidly expanding threat of UAS technology throughout the world, under the pretense that nonstatic-engagement-AMD enablers are postured to defeat them.

## Money and Modernization

Common arguments for phasing out nonstatic-engagement-AMD have been based on military budget cuts and a lack of mission. The Army is downsizing in response to a combination of political requirements and the near completion of two wars—no question.<sup>38</sup> Recent budget cuts have undoubtedly created some friction between the traditional force structure and modernization of the military. However, history shows that the air defense began phasing out nonstatic-engagement-AMD assets as early as 2005—long before drastic reductions in military spending.

Ironically, regardless of the current fiscal challenges, the AMD strategy introduces the production of the IFPC Inc 2-I, which will be far less cost-efficient than upgrading the combat-proven Avenger. An upgraded Avenger would exceed the capabilities of the IFPC Inc 2-I, further enhance maneuver, maintain rapid deployability, and become available to the force more quickly and at a fraction of the cost.

The mission of nonstatic-engagement-AMD remains nested with the Army of the future. The force design of the Army beyond 2025 “will be fundamentally changed, uniquely enabled, and organized to conduct expeditionary maneuver of operationally significant forces.”<sup>39</sup> In the past, nonstatic-engagement-AMD formations simultaneously enhanced maneuver and diminished air threat exposure. The Army should balance the execution of the AMD strategy by reversing the trend toward static-engagement-AMD development at the expense of aggressive maneuver tempo.

## Air and Missile Defense Resolve

In order to establish balance in the AMD strategy, the Army should develop a priority and timeline to upgrade each Avenger formation into the

Avenger multimission and embed them into the BCT. According to Maj. Gen. Rossi, “Air and Missile defense needs to be better incorporated into the maneuver scheme of warfighting.”<sup>40</sup> This approach would further enhance the combat readiness, capability, and lethality of BCTs while reducing costs. Historical accounts of nonstatic-engagement-AMD units provide a sound basis for projecting the full range of increased combat power that the Avenger multimission would bring to the fight.

Imagine an air defense component that could counter and defeat advanced threats such as UASs, cruise missiles, fixed-wing aircraft, rotary-wing aircraft, rockets, artillery, and mortars, and simultaneously employ capabilities such as FLIR optics, an automated .50 caliber gun,

and an automated 25 mm gun—all on a 360-degree turret—to contribute to a BCT’s ground maneuver combat capabilities. The prospect of providing these enhanced capabilities makes the BCT-embedded Avenger multimission a next-level combat multiplier that would be critical to the agility, readiness, and direction of the modernized Army.

## Conclusion

Maneuver is a fundamental priority of the Army. However, air defense is not organized to facilitate aggressive maneuver tempo. With minimal active and no upgraded Avenger units available, the aerial threat may eventually restrict maneuver on the battlefield and constrain operating forces. Without a modernized nonstatic-engagement-AMD capability in the BCT, the shrewd and opportunistic asymmetrically inclined adversary that the Army anticipates would expose combat forces unnecessarily to grave and lethal challenges, which prudence and common-sense planning now could preclude. ■



(Photo by Spc. Brian Barbour, 123rd Mobile Public Affairs Detachment)

Spc. Jamael O. Turner, Battery A, 2nd Battalion, 44th Air Defense Artillery Regiment, shows one of the first rockets his unit shot down with the counterrocket, artillery, and mortar (C-RAM) 4 March 2009 at Joint Base Balad, Iraq. Turner operates the C-RAM, which can identify, track, and shoot mortar rounds and rockets out of the sky before they detonate.

Capt. Vince R. Wiggins Jr., U.S. Army, commands Headquarters and Headquarters Battery, 108th Air Defense Artillery Brigade, Fort Bragg, North Carolina. He holds a BA from the U.S. Military Academy and is a graduate of the Air Defense Officer Basic Course and the Maneuver Captains Career Course. He deployed to Afghanistan in support of Operation Enduring Freedom from 2010 to 2011.

## Notes

**Epigraph.** Sun Tzu, *The Art of War*, trans. Lionel Giles (London: Arcturus, 2008), 44.

1. Robert W. Lyons, "2012 Army Air and Missile Defense Strategy," *Fires: Fires 2020*, (March–April 2013): 59–63, accessed 17 July 2015, [http://sill-www.army.mil/firesbulletin/2013/Mar-Apr/mar\\_apr.pdf](http://sill-www.army.mil/firesbulletin/2013/Mar-Apr/mar_apr.pdf).
2. Field Manual (FM) 3-01, *U.S. Army Air and Missile Defense Operations* (Washington, DC: U.S. Government Printing Office [GPO], 15 April 2014), 1-3, accessed 17 August 2015, available only to U.S. government agencies and their contractors with login at <http://armypubs/army.mil>, "Terminal High Altitude Area Defense (THAAD) ... provides a capability to engage and shoot down short-, medium-, and intermediate-range ballistic missiles within and outside the atmosphere. ... Patriot is a guided missile system with long-range, medium- to high-altitude, all-weather capabilities designed to counter tactical ballistic missiles, cruise missiles, large-caliber rockets, unmanned aircraft systems, and fixed-wing and rotary-wing aircraft."
3. Force Management System Web Site (FMSWeb), modified table of organization and equipment (MTOE), accessed 4 August 2015, <https://fmsweb.army.mil> (requires common access card [CAC]).
4. FM 3-90.6, *Brigade Combat Team* (Washington, DC: U.S. GPO, September 2010), 1-6.
5. Maj. Gen. John G. Rossi, paraphrased and quoted in David Vergun, "Air, Missile Defense Effectiveness Transcends Materiel Solutions," U.S. Army website, 13 February 2015, accessed 17 July 2015, <http://www.army.mil/article/142901>.
6. Army Doctrine Reference Publication (ADRP) 3-0, *Unified Land Operations* (Washington, DC: U.S. GPO, May 2012), 4-7.
7. Raytheon, "Stinger Weapon System," Raytheon Company website, accessed 17 July 2015, <http://www.raytheon.com/capabilities/products/stinger/>.
8. Air and Missile Defense Directorate, *2012 Air and Missile Defense Strategy*, 2012, 21, accessed 17 July 2015, <https://www.us.army.mil/suite/doc/44668368>. The AMD strategy establishes a line of effort to identify a replacement for the Avenger by 2020 (requires CAC).
9. FM 3-01, *U.S. Army Air and Missile Defense Operations* (Washington, DC: U.S. GPO, 2014) (requires CAC) 1-4, "The C-RAM [counterrocket, artillery, and mortar] system is used to detect and destroy incoming rockets and mortar rounds in the air before they hit their ground targets, or simply provide early warning."
10. Air and Missile Defense Directorate, *2012 Air and Missile Defense Strategy*, 5.
11. Carl Von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1989), 370.
12. Stanley L. Davis, "Stripes," *Air Defense Artillery Magazine* (April–June 2005): 6, accessed 17 July 2015, [http://sill-www.army.mil/ada-online/pb-44/\\_docs/2005/4-6/ADA\\_MAG%20April-June%202005.pdf](http://sill-www.army.mil/ada-online/pb-44/_docs/2005/4-6/ADA_MAG%20April-June%202005.pdf).
13. Rick Starkey, "Divisional Air Defense Artillery Units Learn Keys to Survival and Victory in Iraq and Afghanistan," *Air Defense Artillery Magazine* (April–June 2005): 12, accessed 17 July 2015, [http://sill-www.army.mil/ada-online/pb-44/\\_docs/2005/4-6/ADA\\_MAG%20April-June%202005.pdf](http://sill-www.army.mil/ada-online/pb-44/_docs/2005/4-6/ADA_MAG%20April-June%202005.pdf).
14. Scott Dellinger, "Task Force 1-4: 1-4 ADA Soldiers Defend Bagdad International Airport," *Air Defense Artillery Magazine* (April–June 2005): 22, accessed 7 July 2015, [http://sill-www.army.mil/ada-online/pb-44/\\_docs/2005/4-6/ADA\\_MAG%20April-June%202005.pdf](http://sill-www.army.mil/ada-online/pb-44/_docs/2005/4-6/ADA_MAG%20April-June%202005.pdf). Capt. Dellinger commanded Battery B, 1st Battalion 4th Air Defense Artillery, 1st Armored Division, in Iraq. He also served as a small-group instructor at the U.S. Army Air Defense Artillery School.
15. Air and Missile Defense Directorate, *2012 Air and Missile Defense Strategy*, 10. The AMD strategy outlines ends (*defend the homeland, defend the force and protect critical assets, and assure access*), ways, and means.
16. Don Fryc, "Air Defense Artillery: Fires 2020" *Fires: Fires 2020* (July–August 2013): 11, accessed 17 July 2015, <http://sill-www.army.mil/firesbulletin/2013/Jul-Aug/July-August.pdf>. Brig. Gen. Fryc is the former chief of Air Defense Artillery and commandant of the U.S. Army Air Defense Artillery School.
17. "Air Defense Artillery School/Fort Bliss Updates: Office, Chief of Air Defense Artillery," *Air Defense Artillery* (April–June 2005): 44–45.
18. Wes Dohogn, "Airspace Management with SHORAD Integration," in Center for Army Lessons Learned (CALL) Lessons and Best Practices newsletter no. 13-13, *Operations in the Decisive Action Training Environment at the JRTC, Volume I: The Brigade Combat Team*, (Fort Leavenworth, KS: CALL, May 2013): 115 (requires CAC).
19. "UAS: RQ-11B Raven," AeroVirnonment Incorporated website, accessed 17 July 2015, [http://www.avinc.com/uas/small\\_uas/raven/](http://www.avinc.com/uas/small_uas/raven/).
20. Jeremy M. Phillips, "Training for the Enemy UAV Threat," *Infantry* (May–June 2013): 47, accessed 17 July 2015, <http://www.benning.army.mil/infantry/magazine/issues/2013/May-June/pdfs/May-June.pdf>.



21. FM 3-01, *U.S. Army Air and Missile Defense Operations*, 5-1.
22. Shirley Dismuke, "The 2013 State of Fires," *Fires: Fires 2020* (July–August 2013): 14.
23. Wes Dohogn, "Airspace Management with SHORAD Integration," 120.
24. *Ibid.*, 117.
25. John M. McHugh and Raymond T. Odierno, *U.S. Army Posture Statement 2015*, submitted to the Committees and Subcommittees of the United States Senate and the United States House of Representatives, March 2015, 25, accessed 4 August 2015, [http://usarmy.vo.llnwd.net/e2/rv5\\_downloads/aps/aps\\_2015.pdf](http://usarmy.vo.llnwd.net/e2/rv5_downloads/aps/aps_2015.pdf).
26. Boeing Defense, Space, & Security, "Backgrounder: Avenger Derivatives," June 2013, accessed 31 August 2015, [http://www.boeing.com/assets/pdf/defense-space/space/avenger/docs/Avenger\\_overview.pdf](http://www.boeing.com/assets/pdf/defense-space/space/avenger/docs/Avenger_overview.pdf).
27. *Ibid.*
28. "Accelerated Improved Interceptor Initiative (AI3)," Raytheon Company website, accessed 17 July 2015, <http://www.raytheon.com/capabilities/products/ai3/>.
29. News Release, "US Army, Raytheon Achieve First Inflight Lethal Intercept of Low Quadrant Elevation Rocket," Raytheon Company website, 19 August 2013, accessed 17 July 2015, <http://investor.raytheon.com/phoenix.zhtml?c=84193&p=irol-newsArticle&iD=1848385&highlight=>.
30. Program Executive Office Missiles and Space, "IFPC Inc 2-I" (Public Release Capability Briefing, Redstone Arsenal, AL, 2013), 1–6, accessed 17 July 2015, [http://www.msl.army.mil/Documents/Briefings/CMDS/CMDS%20Public%20Release%20Brief\\_27%20Aug%202013\\_IFPC%20Inc%202-I.pdf](http://www.msl.army.mil/Documents/Briefings/CMDS/CMDS%20Public%20Release%20Brief_27%20Aug%202013_IFPC%20Inc%202-I.pdf).
31. *Ibid.* Program Executive Office Missiles and Space released an additional overview brief of the IFPC Increment 2–Intercept Block 1 program on 1 April 2014, accessed 17 July 2015, [http://www.msl.army.mil/Documents/Briefings/CMDS/CMDS%20SS%20198%20IFPC%20Inc%202-I%20Product%20Overview\\_25%20Mar%202014.pdf](http://www.msl.army.mil/Documents/Briefings/CMDS/CMDS%20SS%20198%20IFPC%20Inc%202-I%20Product%20Overview_25%20Mar%202014.pdf). See also Aviation and Missile Research Development Engineering Center (AMRDEC), "Multi-mission launcher preliminary design review successful," [www.army.mil](http://www.army.mil), 16 July 2015, accessed 31 August 2015, [http://www.army.mil/article/152399/Multi\\_Mission\\_Launcher\\_Preliminary\\_Design\\_Review\\_successful/?from=RSS](http://www.army.mil/article/152399/Multi_Mission_Launcher_Preliminary_Design_Review_successful/?from=RSS).
32. Winston M. Marbella and Benjamin Quesada, "A Maneuver Air and Missile Defense Battery Adapts to Ground Combat in Iraq: Tropic Lightning Air Defenders Learn to Fight, Survive and Win in the Contemporary Operational Environment," *Air Defense Artillery* (April–June 2005): 32.
33. U.S. Army Capabilities Integration Center, *Force 2025 Maneuvers*, White Paper (23 January 2014), 2, accessed 17 July 2015, [http://www.arcic.army.mil/app\\_Documents/USArmy\\_WhitePaper\\_Force-2025-Maneuvers\\_23JAN2014.pdf](http://www.arcic.army.mil/app_Documents/USArmy_WhitePaper_Force-2025-Maneuvers_23JAN2014.pdf).
34. "Medium Tactical Vehicles," Oshkosh Defense LLC website, accessed 17 July 2015, <http://oshkoshdefense.com/products/medium-tactical-vehicles/>.
35. FM 3-90.6, *Brigade Combat Team*, 1-10; "Mine Resistant Ambush Protected (MRAP)," Oshkosh Defense LLC website, accessed 17 July 2015, <http://oshkoshdefense.com/products/mine-resistant-ambush-protected-mrap/>.
36. "Stryker Family of Vehicles," Program Executive Office Ground Combat Systems website, accessed 17 July 2015, <http://www.peogcs.army.mil/documents/FMS-Stryker.pdf>.
37. Robert W. Cone, "Shaping the Army of 2020," *Army*, October 2011, 72, accessed 17 July 2015, [http://www.ansa.org/publications/armymagazine/archive/2011/10/documents/cone\\_1011.pdf](http://www.ansa.org/publications/armymagazine/archive/2011/10/documents/cone_1011.pdf).
38. Nick Simeone, "Hagel Outlines Budget Reducing Troop Strength, Force Structure," Department of Defense News website, 24 February 2014, accessed 17 July 2015, <http://www.defense.gov/news/newsarticle.aspx?id=121703>.
39. U.S. Army Capabilities Integration Center, *Army Vision—Force 2025*, White Paper (23 January 2014), 2, accessed 27 August 2015, [http://www.arcic.army.mil/app\\_Documents/USArmy\\_WhitePaper\\_Army-Vision-Force-2025\\_23JAN2014.pdf](http://www.arcic.army.mil/app_Documents/USArmy_WhitePaper_Army-Vision-Force-2025_23JAN2014.pdf).
40. Vergun, "Air, Missile Defense Effectiveness."

## Military Review is seeking volunteer book review authors to join its group of distinguished book reviewers.

The purpose of "MR Book Reviews" is to inform our readers of the publication of books of professional interest. A review briefly tells what a book is about and provides a concise evaluation of the book by a qualified observer. *Military Review* provides a listing of the books available for review. Reviews are between 450 and 500 words.

Those interested in joining *Military Review's* group of book review authors are invited to read the MR Book Reviewer Submission Guide online at <http://usacac.army.mil/CAC2/MilitaryReview/resources/book-reviews.asp>. Then email a copy of your curriculum vitae, along with a message indicating your specific areas of interest, to [usarmy.leavenworth.tradoc.mbx.military-review-public-email@mail.mil](mailto:usarmy.leavenworth.tradoc.mbx.military-review-public-email@mail.mil).