A High Mobility Artillery Rocket System (HIMARS) fires during testing 11 January 2005 at White Sands Missile Range, New Mexico. The HIMARS is capable of firing a variety of munitions, and it provides Army forces with a valuable weapon to contribute to joint suppression of enemy air defenses. (Photo courtesy of Wikimedia Commons)

Shattering the Snow Dome

How Army Ground Forces can Meaningfully Contribute to Joint Suppression of Enemy Air Defenses

Brad Marvel

Spc. Evan Hanson, *center*, and Spc. Chris Baker, both from 3-27th Field Artillery Regiment, run through a simulated M142 High Mobility Artillery Rocket System (HIMARS) launch 10 June 2015 during Exercise Dragon Strike at Avon Park Air Force Range, Avon Park, Florida. The 3-27th FAR performed two real-world HIMARS launches during the eight-day exercise. (Photo by Airman 1st Class Dillian Bamman, U.S. Air Force)

Threat integrated air defense systems (IADSs) should be thought of as the initial operational center of gravity in any major combat operation against a peer opponent. Peer competitors have invested heavily in developing robust, resilient, and in-depth air defense capability. Every plan, every decision, every major capability that they develop is predicated on the assumption that such systems will offset overwhelming American and allied airpower.[1] In order to protect and enable this most critical asset, potential adversaries have developed a comprehensive, multi-domain set of capabilities intended to protect and enable their IADSs. They have, however, left open a window of opportunity: while a modern IADSs looks nearly impenetrable via its traditional avenue of approach (the air domain), it may be vulnerable to attack from the ground. As such, the Army will likely play a critical role in future suppression of enemy air defenses (SEAD). Instead of waiting patiently for friendly air forces to "set the conditions" prior to ground operations through traditional SEAD, the Army must take a proactive and aggressive role alongside the air component, enabling friendly air power and ensuring freedom of action in the air domain.

The timeline of the phrase "anti-access/area denial" (A2AD) followed a dramatically parabolic trajectory: sudden emergence, rise to popularity, abrupt transition to overexposure, and finally, outright rejection.[2] Seemingly overnight, this vogue phrase of 2011—the darling of theorists and the next big investment opportunity for industry—was badly out of fashion. This abrupt fall from grace was not unreasonable; the phrase had come to mean "whatever I want it to mean" to any number of parties, and as such, had lost any real utility.[3]

Though A2AD died a sudden death, its basic idea—do your best to prevent your opponent from concentrating combat power, then make it as irritating as possible to employ that power at critical times and places—remains a sound though not revolutionary approach to modern warfare. A2AD within the Department of Defense focused largely on the strategic level of war in the Pacific, and was so naturally focused on naval operations; it simply did not live long enough to evolve past that theater and that domain.[4] However, when analyzing the emerging

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approach to land warfare being adopted by peer adversaries, it is clear that they have taken the A2AD strategy and applied it to both operational and tactical echelons.[5] One phrase that emerged in the fires and Army capability development community to describe this approach is the "snow dome," referencing the tiny plastic souvenirs that encase a trinket in an air- and watertight plastic half-sphere. While this metaphor isn't entirely accurate, it is effective: it conjures an image of a Russian guard's tank regiment enjoying practical immunity from air or artillery attack as it sits beneath a powerful shield, waiting patiently for some unfortunate NATO formation to come and try to make it leave.

The snow dome represents a significant challenge for the Army, not just from a capability perspective, but also from a cultural perspective. Throughout the twentieth and now twenty-first centuries, commanders nearly always enjoyed the "Golden Hammer" of overwhelming airpower and artillery superiority. American strategy, tactics, leader, and capability development over the past century have all been largely influenced by, if not predicated on, an assumption of superior firepower. Fifteen years ago the idea of an Army formation facing a robust low-altitude air threat or destruction from massed artillery seemed preposterous. Today, it is very much a possibility.

The Army has recognized this trend with the development of multi-domain battle (MDB). The Army's emerging operational concept acknowledges for the first time in a generation that continuous and complete overmatch may not be possible.[6] MDB proposes instead "temporary windows of advantage," a far more realistic objective than those postulated by previous concepts, which generalized a strategy of overmatch everything, everywhere, all the time. Suppressing or destroying threat IADSs is likely the first step in opening any such window of advantage. Once the IADSs are neutralized, friendly aircraft can operate with relative freedom of action and the all-important Golden Hammer of air power is restored to ground commanders.

The Snow Dome: Defining the Problem

The snow dome metaphor is, of course, not literal. It is a visual representation of a carefully organized set of threat capabilities: surface-to-surface fires, surface-to-air fires, maneuver forces, intelligence, targeting, electronic warfare (EW), even cyber forces arrayed using a mutually supporting, and defense in depth approach. The traditional name for this is "combined arms," and this idea is hardly revolutionary. The weaknesses or vulnerabilities of each individual capability is compensated for by the strengths of another, and each successive layer, if defeated or suppressed, gracefully gives way to a supporting capability. Maneuver and field artillery units are protected against air attack by a variety of air defense and EW systems. Long-range surface-to-air missile (SAM) systems are protected from air attack by smaller, mobile SAMs and from ground attack by field artillery and maneuver forces. Long-range surface-to-surface rockets are supported by fast-firing, mobile tube artillery. Everything is protected and enabled by a robust cyberwarfare capability. It is, in short, a very prickly and unpleasant situation for a commander to deal with.

The single most significant change between past efforts at a combined arms defense in depth and the snow dome is the emergence of highly effective, long-range SAMs. These systems have fundamentally changed the nature of ground-based air defense from being a reactive activity influencing only limited areas to being a viable form of power projection from the land domain into the air. This in turn has drastically reduced the ability of friendly aircraft to survive and operate over key areas of the battlefield. Additionally, long-range SAM systems of the past were typically observable and vulnerable, making suppressing or destroying them a relatively simple and straightforward enterprise. Modern systems are not only smaller and more mobile, but are also protected by a number of different capabilities (shorter range/more mobile SAMs, maneuver forces, artillery, EW, and cyber) that mitigate vulnerabilities from every domain. Most of these supporting capabilities focus on defeating traditional SEAD efforts: standoff air attack and EW. Cyber defense is also robust.

This leaves ground forces as an enticing alternative to more traditional SEAD. Ground forces have several significant advantages for this type of mission versus air assets: they are protected and numerous, use potentially less expensive and more readily available munitions, are relatively easy to conceal, and are capable of creating

North Korean leader Kim Jong Un reputedly watches the test of a new-type anti-aircraft missile in this undated photo released on 26 May 2017. (Photo courtesy of North Korea's Korean Central News Agency)

decisive effects on IADS targets, provided they can get within range. Ground forces also have limitations. Perhaps the most significant is that they will likely have to be moved long distances before they can actively participate in the fight. They move relatively slowly, and require sustainment and protection while moving. As such, this concept does not argue that ground forces should be the only SEAD option, or even the primary one: rather, they should meaningfully support and contribute to a joint theater-wide SEAD effort.

New and Old: Ideas to Enable SEAD

The problems the joint force faces when conducting SEAD against the snow dome are similar to those operational-level ground commanders experienced during the World War I. Firepower (in the case of World War I, indirect fire and automatic direct fire) suddenly and somewhat unexpectedly advanced, making other tasks on the battlefield (such as movement and sustainment) extremely difficult. The result then was a now legendary stalemate: for years, commanders simply could not solve the series of operational problems created by the lethal industrial-era battlefield.

It wasn't until mid-1916 that any real progress was made addressing the challenges faced by industrial armies. Ironically enough this progress began in what had long been Europe's most backwards and stubbornly traditionalist army, Russia. Instead of attempting to overwhelm that era's version of the snow dome with more men, more guns, more shells (as the British were doing simultaneously on the Somme), the Russian army instead used small, fast-moving formations to penetrate weak points along the enemy's line, then attack rear areas to disrupt command and control, reinforcement, and sustainment. This approach would later be famously used by both German and Allied forces throughout the later years of the war, restoring a modicum of operational mobility to the Western Front and finally breaking the stalemate. This fundamental approach should look familiar to any contemporary military

leader—this methodology would evolve into what we now know as blitzkrieg and, eventually, modern combined arms maneuver.

One of the most commonly heard refrains in the world of Army concepts is "this is nothing new." Very often this is true as original ideas are rare in any field, perhaps doubly so in a naturally conservative field such as the military. This concept falls squarely into "this is nothing new" category. Defeating the snow dome's IADSs doesn't require any sort of revolution in tactics or strategy, nor does it require new multi-billion dollar new war widgets. Instead, it requires rededication to a handful of basic principles, plus embracing some simple ideas. The following are the overarching ideas that support this concept.

Habitually build combined-arms teams at lower echelons. The basic strength of the snow dome is that it is able to detect and then exploit weaknesses or vulnerabilities in any domain. The Army has recognized that capabilities in certain domains are far less developed than others, and has embarked on a campaign to strengthen operations in some long-neglected areas.[7] At the operational level, this means increasing capabilities in the air and cyber domains as well as the EM spectrum. This requires a force able to assemble mutually supporting capabilities at the appropriate echelon, in essence creating miniature, mobile snow domes of our own.

At present, however, there are significant gaps in the friendly snow dome: insufficient numbers and capabilities of field artillery as well as cyber and EW capabilities that are often reserved at higher echelons. Perhaps most significantly, the Army lacks an effective mobile, protected air defense system. Army units operating underneath an enemy SAM umbrella will almost certainly not enjoy local air superiority; as such they must provide their own active air defense. As these gaps are closed, Army formations must adopt the idea that combined arms teams are a state of being, not a temporary or ad hoc solution. No maneuver unit should ever again train or operate without comprehensive fires, cyber, and EW support. These capabilities must be integrated habitually and constantly.

Deliberately attrite enemy ammunition. Stockpiles of high-end surface-to-air interceptors are just as rare and expensive for others as they are for us. The Army has rarely adopted an approach to deliberately attrite enemy ammunition stockpiles for obvious reasons, but this approach has an important role to play in SEAD. In recent years the joint force has largely eschewed pursuing inexpensive, less precise, or less capable munitions, preferring instead to procure only expensive, higher end systems. By dumping large numbers of numerous and relatively inexpensive munitions or other unmanned systems into the engagement areas of high-end SAMS, the Army can deplete threat IADSs of their high-end interceptors, accomplishing a SEAD effect without having to destroy or suppress the system itself.

Move rapidly and constantly. This is perhaps the most significant impact of recent counterinsurgency efforts on future operations: an entire generation of Army leaders grew up in an environment where operational movement was practically nonexistent.[8] On the future battlefield, however, constant and rapid movement will be an absolute necessity. Threat targeting and the responsiveness of artillery is simply too good. Any unit that remains stationary for too long is inviting destruction through indirect fire. Movement greatly complicates targeting, and is the simplest way to offset the ubiquitous threat of intelligence, surveillance, and reconnaissance efforts that feed artillery systems. Constant and rapid movement is a critical enabler in attacking a snow dome. Decisive maneuver through rear areas can put the major IADS components of the snow dome under threat, forcing the enemy to move or conceal said systems or accept their destruction.

Develop/redevelop passive countermeasures. It has been over sixty years since the Army faced a significant air and indirect fire threat in combat. In much the same way as counterinsurgency eroded the Army's focus on operational movement, the effects of over a half century of a very limited air and artillery threat has eroded the Army's focus on basic countermeasures to these kinds of systems.[9] In addition, the more recent rise of the cyber domain and the EMS offered enemies new pathways for attack and disruption.[10] The lessons of counterinsurgency also cast a shadow here: one of the key elements of a counterinsurgency operation is visibility. A large, highly visible security presence is important to bringing stability.[11] In major combat operations versus a peer, however, visibility is something to be avoided as much as possible.

Screen capture from a North Korean propaganda film of an S-125 surface-to-air missile being launched during a military exercise (circa November 2015). The North Korean military reportedly has a mix of old, but still capable, Soviet-era SAMS, including S-75, S-125, S-200, and Kvadrat models located in dense concentrations around the North Korean capital Pyongyang and key facilities, including nuclear test and storage sites, and submarine facilities. (Photo courtesy of North Korea's Korean Central News Agency)

Very basic measures such as camouflage and hardening can dramatically decrease the effectiveness of threat surveillance, targeting, and fires, allowing ground forces to close with threat IADSs. Visibility now extends into the cyber domain and the EMS: electromagnetic and cyber signatures can silhouette a unit just as clearly as visual or audio signatures. Noise and light discipline must today be accompanied by cyber and EMS discipline.

Rapid and effective targeting. One of the key features of the snow dome is the high proportion of fires systems, particularly medium- and long-range SAMs and rocket and missile artillery. The intent, in large part, is to make any major combat operation an artillery fight, rather than a close quarter one. As such, adversaries have invested heavily in targeting systems and processes designed to magnify the effectiveness of all fires systems. If conflict arose, Army forces will face this advanced targeting capability while simultaneously being outgunned and without constant air support. One of the best ways to mitigate this dangerous situation is with superior targeting, which merges surveillance assets and shooters into a seamless process of matching effects to targets. A focus on this kind of procedural and technical process can reduce the effects of numerical disadvantages and expand friendly capabilities without resorting to more tubes, rockets, or missiles.

Recommendations for Army Contribution to SEAD

This section presents a five-part solution for how future Army forces can effectively contribute to SEAD against an entrenched, peer opponent during an expeditionary operation. Each part should be thought of as an interdependent but distinct line of effort.

Perform joint, integrated intelligence preparation of the battlefield (IPB). IPB has not routinely accounted for threat air defense systems for decades. SEAD was usually considered a "box check," if considered at all. The Army must begin a dedicated effort to reenergize the knowledge base about threat air defense systems if there is to be any hope of effectively suppressing them. Intelligence personnel from sister services are the best sources for this type of knowledge. Performing SEAD IPB as a joint function

at operational echelons is an ideal way to begin this process. Intelligence products supporting localized SEAD must contain several products: threat system capabilities and limitations, threat system weaknesses to be exploited, or strengths to be avoided, and threat most likely and most dangerous courses of action. Intelligence products must be synchronized with the scheme of maneuver, and thus template potential target areas based on an understanding of threat behavior. Limited resources must be prioritized and employed according to the commander's intent. Intelligence products must clearly lay out high payoff targets. Most importantly, IPB must account for all threat vulnerabilities and Army capabilities. Firing a shell or launching a missile may not be the most effective way to suppress a threat system.

Develop a comprehensive, synchronized plan to conduct SEAD through targeting. Targeting for a SEAD mission is inherently the same as any other mission. What is unique in a SEAD mission is the target set and the reason for targeting. While synchronization is critical in any targeting environment, a SEAD mission running within the context of a major combat operation puts a premium on it. Not only must fires be synched with the scheme of maneuver, but they must also be synched with friendly aircraft, Army and joint intelligence platforms, and multinational partners. SEAD targeting places special emphasis on the use of massed fires through multiple domains. It must be thought of as a mission set where joint capabilities are just as important as the Army's.

Massed fires must be planned to achieve combined arms effect on threat air defenses through mutually supporting capabilities, properly synchronized to create far more comprehensive effects than capabilities employed unilaterally. Planners must account for the use of fires from the land (tube and rocket artillery, employing multiple warhead types), maritime (naval gunfire and ship/submarine-launched cruise missiles), and air (air-launched standoff weapons). "Fires" (or better put—effects) through cyberspace, targeting threat information and cellular networks should be planned as well. All fires must be coordinated through airspace and the EMS, avoiding both physical and spectrum fratricide.

Set the conditions for successful suppression. As with any military operation, a SEAD effort will be more successful if enabled by meticulous and thoughtful preparation. Target detection and location as laid out during IPB and targeting begins in earnest, using sensors and other intelligence assets from every domain. Once identified, efforts to reduce, compromise, or otherwise inhibit high value targets should commence immediately. The use of mass inexpensive munitions or other unmanned platforms to attrit high-end enemy interceptors, the use of cyber and EW assets to degrade sensors or communications, and the use of special operations forces or other land-based options to influence threat systems must be employed simultaneously to open windows of advantage. These actions should avoid tipping off the enemy that their IADS is the primary target, but rather, should encourage him to think that the IADS is functioning as expected and no immediate reaction is necessary.

Mass fires through multiple domains to close with and defeat threat IADSs. Once a plan to achieve SEAD is put into action, coordination between different elements becomes critical. Timelines for the delivery of fires are laid out during planning, but agility and flexibility during this process is a necessity. Flexibility must be supported by both personnel and systems. Personnel must have the mental agility to rapidly respond to changes on the battlefield. Systems must be able to rapidly and accurately adapt to changes in the environment, in their targets, or in their assigned tasks. Of particular note during a SEAD mission: opportune suppression, or the dynamic targeting of air defense systems in a reactive manner (e.g., when a radar goes active, or when a launcher has fired), is a critical enabler. At present, only friendly aircraft are truly capable of performing opportune suppression. In order to maximize the massing of fires versus SEAD targets, every sensor possible must be able to rapidly pass targeting information to joint shooters. Efforts in every domain must be synchronized. Maneuver forces in combined arms teams use rapid movement to close with threat systems. Fires forces engage threat systems at standoff ranges. Cyber and EW forces continue to suppress and degrade threat systems through exposed mission command networks.

Assess effects and begin follow-on operations. Assessment of a SEAD mission is challenging. Targets are difficult to detect, getting clear assessments of

effects on them—particularly cyberspace and EMS effects—is even more challenging. However, assessment is a critical step in the SEAD process. Without continuous, accurate assessment of effects, correctly assessing risk to friendly aircraft and crews is impossible. Assessment of effects must be broken down into three areas: shooters (man-portable systems, short-range systems, and long-range launchers); sensors (radars, other EMS sensors, visual); and information/mission command systems. Measures of performance and measures of effectiveness, established in concert with air component personnel during planning are continuously assessed and targeting revised.

With many smaller SEAD targets, unless visible results are achieved (an unlikely occurrence), the only conclusive measure of effectiveness is whether or not friendly aircraft are fired upon. Clearly, this is an insufficient measure of performance. As such, measuring effectiveness and performance of a localized SEAD mission must take on a more statistical/probability-based form. Army information systems can aid operators in determining the probability of successful suppression by performing dynamic, automated operational research. In other words, a system should be able to account for factors like terrain, threat systems, and friendly capabilities, then provide an operator with an assessment of the likelihood that threat systems have been suppressed for a given geographic area and period of time. This process provides commanders with a consistent, quantifiable risk assessment to both friendly aircraft and other joint fires platforms.

Conclusion

Breaking down the snow dome is a difficult military problem. It is something of a game of rock-paper-scissors, and it seems that nearly any friendly course of action is met with an enthusiastic and effective threat response. However, defeating threat snow dome capabilities does not require massive spending or revolutionary new ideas. By simply throwing out some old assumptions, reinvigorating some basic competencies, and repurposing or developing relatively simple capabilities, the joint force can effectively suppress or destroy the snow dome with Army operational-level formations as a critical contributor. ■

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Notes

1. Two examples illustrate the peer emphasis on air defense capabilities. First, every single Russian and Chinese motorized or mechanized brigade has, at a minimum, an entire air defense battalion organic to it, most containing a mix of medium-range surface-to-air missiles (SAMs), short-range SAMs, man-portable air defense system, and anti-aircraft artillery. Some brigades, such as the Russian guards tank regiments, have a second organic air defense battalion. The second is the proliferation of long-range SAMs: despite having a defense budget a fraction the size of the United States, both Russia and China have between three and four times the number of heavy SAM battalions. For data on Chinese brigades, see "40th Light Combined-Arms Mechanized Infantry Brigade, 14th Group Army, Southern Theater Command," China Defense Blog, last updated January 2017, accessed 7 June 2017, http://china-defense.blogspot.com/2017/02/40th-light-combined-arms-infantry.html; Carlo Kopp, "Self Propelled Air Defence System," Technical Report APA-TR-2009-1103 (Perth, Australia: Air Power Australia, November 2009), accessed 7 June 2017, http://www.ausairpower.net/APA-HQ-9-FD-FT-2000.html#mozTocId509832; and "HQ-9," GlobalSecurity.org website, last updated 24 February 2016, accessed 7 June 2017, http://www.globalsecurity.org/military/world/china/hq-9.htm. For information on Russian brigades, see Guy Plopsky, "Russia's Capitol is Stacked with Super Powerful S-400 Missile Defense Systems (But It's No Shield)" The National Interest website, 24 February 2017, accessed 7 June 2017, http://nationalinterest.org/blog/the-buzz/why-moscows-lethal-missile-umbrella-has-fatal-flaw-19569; and International Institute for Strategic Studies (IISS), "Comparative Defence Statistics," chap. 2 in *The Military Balance 2017* (London: IISS, 14 February 2017).

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7. Sydney J. Freedberg Jr., "Army Races To Rebuild Short-Range Air Defense: New Lasers, Vehicles, Units," *Breaking Defense*, 21 February 2017, accessed 23 May 2017, http://breakingdefense.com/2017/02/army-races-to-rebuild-short-range-air-defense-new-lasers-vehicles-units/.

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10. Ibid.

11. Field Manual 3-24, *Insurgencies and Countering Insurgencies* (Washington, DC: U.S. Government Publishing Office, May 2014), 5-18, accessed 28 March 2017, http://www.apd.army.mil/epubs/DR_pubs/DR_a/pdf/web/fm3_24.pdf. The field manual articulates that "COIN [counterinsurgency] efforts should begin by controlling key areas. Security and influence then spread out from secured areas. The pattern of this approach is to clear, hold, and build one village, area, or city—and then reinforce success by expanding to other areas. This approach aims to develop a long-term, effective HN government framework and presence that secures the people and facilitates meeting their basic needs." See also Phillip Karber and Joshua Thibeault, "Russia's New Generation Warfare," The Potomac Foundation website, 13 May 2016, accessed 17 May 2017, http://www.thepotomacfoundation.org/russias-new-generation-warfare-2/.

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