

---

## SUMMARY

---

The future of war is fraught with uncertainty. Whether or not a revolution in military affairs (RMA) is about to occur, the rapid pace of technological innovation is dramatically enhancing the ability to see, track, and kill targets on the battlefield.<sup>1</sup> At the same time, the proliferation of weapons of mass destruction (WMD) and the increasing lethality of cluster and precision guided munitions make it imperative that future ground forces remain dispersed as much as possible. This requirement for dispersion begs the question of whether the traditional hierarchical organization and doctrine of the U.S. Army should change.

Current discussion about future doctrine for U.S. ground forces already involves concepts such as dispersed operations, networking, and greater autonomy for small units than has been customary. One important part of that doctrinal discussion relates to the feasibility and utility of “swarm tactics,” which would have such small, distributed units and maneuverable fires converge rapidly on particular targets. To help inform the debate over the potential relevance of swarming to U.S. military doctrine, this monograph analyzes swarming examples throughout military history. A close reading of those examples might reveal historical patterns and lessons that remain important today.

---

<sup>1</sup>An RMA occurs when the application of new technologies combines with innovative operational concepts and organizational change in a way that fundamentally alters the character and conduct of conflict.

## APPROACH

It is beyond the scope of this monograph to look at every swarming example in military history. Instead, the analysis uses a cross section of cases, each case having one or more unique critical characteristics. The goal is to cover the prototypical cases, not to exhaustively describe every case that ever occurred. Several research questions are explored, including the following:

- Are there any apparently dominant factors?
- How well do swarmers do against nonswarmers?
- Does swarming have particular advantages for offense rather than defense, or does it apply to both?
- How does swarming success vary according to terrain?
- How did swarmers satisfy their logistics demands?
- What have been the successful countermeasures to swarming?

For the purposes of this monograph, a *swarming case* is any historical example in which the scheme of maneuver involved the convergent attack of several (or more) semiautonomous (or autonomous) units on a target force in some particular place. The following list presents ten general cases between a swarming and a nonswarming force that are examined and compared in the monograph. For each of these cases, a preliminary discussion of the belligerents is followed by a focus on one or more particular battles. The general cases are listed below (assume year A.D. unless otherwise noted):

- Scythians versus Macedonians, Central Asian campaign including the Battle of Alexandria Eschate, 329–327 B.C.
- Parthians versus Romans, Battle of Carrhae, 53 B.C.
- Seljuk Turks versus Byzantines, Battle of Manzikert, 1071
- Turks versus Crusaders, Battle of Dorylaeum, 1097
- Mongols versus Eastern Europeans, Battle of Liegnitz, 1241
- Woodland Indians versus U.S. Army, St. Clair's Defeat, 1791
- Napoleonic Corps versus Austrians, Ulm Campaign, 1805

- Boers versus British, Battle of Majuba Hill, 1881
- German U-boats versus British convoys, Battle of the Atlantic, 1939–1945
- Somali insurgents versus U.S. Commandos, Battle of the Black Sea, 1993.

The cases cover two types of identified swarming maneuvers, various combinations of opposing-force types, and scale and spectrum of war.

Most examples of military swarming are tactical “Massed Swarm” cases from the ancient world and the Middle Ages, wherein a swarming army begins as a single massed body then disassembles and conducts a convergent attack.<sup>2</sup> Other swarming examples are “Dispersed Swarm” cases, such as those drawn from the history of guerrilla warfare, wherein the swarming army is initially dispersed but then converges on the battlefield without ever forming a single mass.

## **HISTORICAL FINDINGS**

Across the identified cases, at least three factors appear to play a role in whether or not swarming is successful: elusiveness (either through mobility or concealment), a longer range of firepower (standoff capability), and superior situational awareness. The actual source of these key advantages varied from case to case. Simple pattern-matching reveals that elusiveness and situational awareness appear to be more important than standoff capability. The combination of these three key advantages appears to have a synergistic effect.

Swarming offers several tactical advantages, including the following:

- For a swarming army to attack a defender from all sides appears to have an unnerving psychological effect, and it creates killing zones.

---

<sup>2</sup>In earlier swarming cases, command, control, and communications (C3) was too primitive to allow greater massing or dispersion. Without the benefit of wireless communication, it was difficult to coordinate many units without keeping them within sight of each other.

- Deceptive swarmer tactics such as feigned retreats and ambushes are very successful against undisciplined opponents.
- It can sever the nonswarming army's lines of communication.
- Networks are better at fighting other networks.<sup>3</sup>
- It gives the ability to choose the time and place of battle.

Swarming has not always worked, however. The historical record indicates several countermeasures to swarming. Swarmers could be defeated if their mobility advantage was negated. Past examples of this countermeasure include pinning more-elusive swarmers against a geographic obstacle such as a river or a fort, or using a friendly unit as bait to lure the swarmer into a trap. Terrain such as mountain passes and other obstacles were used to channel swarming armies and hinder their mobility. In other cases, the loss of standoff fire capability defeated the swarmer. Finally, attacking the logistics vulnerabilities of swarmers also proved successful in some cases.

Successful countermeasures to swarming highlight the limitations of and constraints on a swarming doctrine. Some of the historical limitations to swarming include the following:

- Swarmers were sometimes incapable of a quick knockout blow.
- The mobility and/or concealment of past swarmers depended on the terrain. Various swarmers have relied on heavy woodlands, urban areas, oceans, and grasslands capable of supporting many horses.
- Logistics was a significant challenge. Even when insurgent swarmers were able to rely on the support of indigenous populations and the countryside, they rarely fielded major forces for any sustained campaigning. For the operational-level swarmers such as the Mongols and *La Grande Armée*, a logistics breakthrough was necessary.
- Swarming attacks on fixed defenses yielded mixed results. The siege trains necessary to breach heavily fortified towns and cities

---

<sup>3</sup>This point is argued in John Arquilla and David Ronfeldt, *The Advent of Netwar*, Santa Monica, CA: RAND, MR-789-OSD, 1996.

generally were available only after a decision was reached in the field. Among the horse-archer cases, only the Mongols were successful at reducing strongholds, because of their Chinese siegecraft engineers and the calculated use of terror.

### **IS A SWARMING DOCTRINE FEASIBLE?**

Ultimately, a swarming doctrine's feasibility will depend on the benefits emerging from the information and communication revolutions. Many benefits are already being realized. Eventually, the computers and wireless radios that are currently being installed on every vehicle, plane, and ship will communicate digitally with each other across interoperable battle command and control systems. Sensors and shooters will share a near-real-time common picture of the battlefield. Several governmental research and development efforts under way may be relevant to a discussion of swarming, including the U.S. Army's Army XXI and Army After Next (AAN) work and the Marine Corps' Urban Warrior program.

Even though no major military power has ever tried swarming on land in the modern age of mechanized war, many of the historical limitations and countermeasures from the past appear tractable given technological or doctrinal development in the future. For example, the occasional limitation of swarmers in the past—an inability to deliver a knockout blow quickly—may be overcome in the future by joint, indirect fire assets such as fighter/bombers, C-130 and helicopter gunships, the multiple-launch rocket system (MLRS)-fired Army Tactical Missile System (ATACMS), offshore Naval fire support, and even space-based kinetic-energy weapons. The command and control limitations of the past may be erased by the advent of future wireless communication systems—such as mobile mesh networks—capable of supporting a tactical internet anywhere in the world.

Given the radical force-structure changes a swarming doctrine would require, this study recommends that a portion of the U.S. light or medium force adopt swarming as an operational concept, if swarming proves to be feasible during field experiments. History suggests that swarming armies were successful when they were able to elude their opponent, possessed standoff firepower, and enjoyed

superior situational awareness. It is reasonable to assume that swarming can work again if future forces enjoy these same advantages. Ongoing technological development suggests that light Army units may soon enjoy them.

Since a future swarming doctrine is still very much a concept in progress, additional detail is offered here on the tactics, logistics, command, and organization of a possible swarming doctrine. This speculative discussion is based as much as possible on the historical conclusions from the ten cases.

Tactically, swarming can be conceptually broken into four stages: locate, converge, attack, and disperse. Swarming forces must be capable of *sustainable pulsing*, coalescing rapidly and stealthily on a target, then redispersing and recombining for a new pulse. Because of the increasing vulnerability of massed formations on the ground to airpower and WMD, the Dispersed Swarm maneuver is more appropriate than the Massed Swarm maneuver for the future. Operations that are more dispersed are a natural response to the growing lethality of modern munitions.

The logistics problem of supplying widely dispersed units is a difficult one and will probably need to be addressed by a package of fixes, such as reducing the demand for fuel and ammunition by using lighter vehicles and more indirect-fire assets; streamlining the logistics process with information-processing techniques such as focused logistics;<sup>4</sup> using precise aerial resupply when possible; and prepositioning supply depots.

As to command, a swarming doctrine must take into account the coordination of many small units. To be sure, the complexity of the

---

<sup>4</sup>Focused logistics uses a Velocity Management approach to battlefield distribution, wherein the speed and control of logistics material is more important than the mass of stockpiles. By re-engineering logistics processes, Velocity Management can reduce the long material flows that help create massive stocks of supplies. Eliminating non-value-added activity and maintaining in-transit visibility (or knowing where every logistics item is at all times) decreases the logistician's response time to warfighter demands. In the past, U.S. inventories have typically been large because warfighters hoarded supplies "just in case" the items they ordered either took too long to arrive or never showed up. Rather than "just-in-case," focused logistics seeks to respond to real-time battlefield demand and move in the direction of a "just-in-time" philosophy. Rapid response to the needs of dispersed maneuver units will provide logistics support in hours and days rather than weeks.

command grows with the number of units, the power and range of their weapons, the speed at which they move, and the space over which they operate. To handle this complexity, both the supply and demand of command must be addressed. Improved command, control, communication, computers, and intelligence (C4I) technologies may provide part of the answer by increasing the supply of command, but a doctrine based on swarming will have to provide other ways to reduce the demand for command. One way to coordinate many small units is to use a decentralized network organization. A decentralized network calls for semiautonomous units to follow the mission-order system of command—what the Germans called *Auftragstaktik*—whereby small-unit commanders have the freedom to deal with the local tactical situation on the spot while following the overall commander's intent. Swarming would be difficult for a hierarchical command structure, because the extremely flat organization of a dispersed network would place too much demand on mid-level and higher commanders.

The extent to which a future swarming doctrine depends on superior technology is a key question. History demonstrates that technological advantage is *always* temporary. That said, there are several key functions that new weapons and technology must provide. Real-time situational awareness will require the integration of command and control systems, communications systems, and intelligence, surveillance, and reconnaissance (ISR) systems. The communications system for a dispersed tactical formation would have to be a mobile mesh communications network with high data throughput and survivability. Rapidly responsive indirect precision fires delivered by rockets, missiles, naval gunfire, or tactical air must be available for swarming to deliver enough firepower. And a next-generation Light Strike Vehicle will be needed to provide swarming units the mobility they need to remain elusive.

Battles are won by the careful meshing of one side's advantages with the other side's weaknesses. Swarming is no exception. As with any tactic or strategy, swarming will not work against all types of opponents in all situations. It is posited here that network organizations that use a dispersed formation to swarm are more relevant than AirLand Battle divisions for four particular missions:

- Power-projection missions
- Dispersed operations
- Counterinsurgency operations
- Peace operations.

The Army recognizes the need for a light force that can deploy rapidly and halt enemy armored movements. The mobile yet lethal nature of the swarm unit lends itself well to the missions of light expeditionary forces—such as the “Halt Phase” mission<sup>5</sup>—because swarm units are light enough to be air-transported and mobile enough to remain elusive. Today’s traditional light airborne and air assault units are composed of dismounted infantry and are incapable of stopping enemy armor threats.

The dispersion of swarming units on the battlefield will reduce their vulnerability to weapons of mass destruction. In addition, if adversaries of the United States adopt dispersion themselves as a tactical countermeasure to the increasing lethality of U.S. air-delivered weapons, swarm units will be needed to flush out the enemy and facilitate target acquisition for U.S. air forces.

A network of swarm units dispersed over an area can perform counterinsurgency (COIN) missions well, because a highly mobile network of nodes can detect dismounted enemy personnel more effectively than can standard U.S. reconnaissance assets. A swarm force can physically “cover down”<sup>6</sup> over a geographic area and pick up battlefield intelligence missed by friendly airborne and spaceborne sensors.

Swarm units may be more effective at performing peace operations than are traditional combat divisions. They have the advantage over hierarchical divisions when organized for peace operations, an

---

<sup>5</sup>A Halt Phase mission is aimed at halting an enemy invasion short of its objectives in major theater wars. During the initial stages of an enemy armored offensive, the only U.S. forces available are joint forces deployed in the theater during peacetime, air forces, and rapidly deployable light forces. The heavy ground forces that are needed to evict enemy forces from captured territory must be sea-lifted to the theater, a lengthy process that takes at least several weeks.

<sup>6</sup>To *cover down* is to blanket or cover an area with numerous personnel. Units physically deploy in enough local areas so that no area is left uninvestigated.

ability to shape the environment, and an ability to minimize command problems on urban terrain.

### **A FINAL NOTE**

Swarming is not new. During the pre-gunpowder age (i.e., before the fourteenth century), swarming armies enjoyed quite a bit of success on the Eurasian steppe and elsewhere; more recently, light infantry insurgents have fared well against conventional armies. The question is, Does a role exist for swarming today or in the future? History strongly suggests the answer is yes, if three capabilities can be achieved: superior situational awareness, elusiveness, and standoff fire. If emerging technology provides these capabilities, the U.S. military could enter a watershed era of modern swarming that involves dispersed but integrated operations. Any doctrine of the future that relies on dispersed operations, such as AAN or Urban Warrior, could benefit from a sustained research effort on swarming.

The patterns and conclusions presented in this study are preliminary. They are based on a carefully chosen yet limited sample; further research on additional cases would help validate or complete the analysis begun here. Many other historical candidates remain, both from other battles between the belligerents surveyed in this study and possible new cases such as the Battle of Britain in 1940; the defensive *Luftwaffe* tactics used over Germany late in World War II; the Chinese infantry tactics used in the Korean War, 1950–1952; the North American Indian Wars of the nineteenth century; and, more recently, the ongoing guerrilla war in southern Lebanon. A closer look at battles between swarmers themselves, such as at the thirteenth-century Battle of Ayn Jalut in what is modern-day Syria between Egyptian Mamluks and the Mongols, would explore how elusive forces fight equally elusive opponents. An analysis of all these additional cases would lead to stronger conclusions about what factors correlate with successful swarming.