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DISSERTATION

Swarming and the Future of Warfare

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ABSTRACT

Whenever military operations are non-linear, dispersed, and decentralized, swarming is an effective tactic. Today insurgents are employing swarming as a form of asymmetric warfare against superior conventional armies from the mountains of Afghanistan to the cities of Iraq. In the future, friendly forces may employ swarming tactics themselves if several technological promises are fulfilled. Whether we want to defeat enemy swarms or emulate them, our defense planners need to understand how military swarming works. In this dissertation the author uses case studies, comparative analysis, and common sense to derive a simple theory that explains the phenomenology of swarming.

Swarming occurs when several units conduct a convergent attack on a target from multiple axes. Attacks can be either long range fires or close range fire and hit-and-run attacks. Swarming can be pre-planned or opportunistic. Swarming usually involves pulsing where units converge rapidly on a target, attack and then re-disperse.

The author researches 23 case studies of swarming, ranging from Scythian horse archers in the 4th century BC to Iraqi and Syrian paramilitaries in Baghdad in 2003 in order to understand swarm tactics and formations, the importance of pulsing, and the general characteristics of past swarms. He considers command and control, communications, home field advantage, surprise, fratricide, and training. He also divides past swarming into two general groups: 1) "cloud swarms," where units arrive on a battlefield as a single mass, then disassemble and conduct a convergent attack upon the enemy from many directions and 2) "vapor swarms", where the units are initially dispersed across the area of operations, then converge on the battlefield and attack without ever forming a single mass.

Five primary variables most important to successful swarming are identified: (1) superior situational awareness, (2) elusiveness, (3) standoff capability, (4) encirclement, and (5) simultaneity. The author presents an influence diagram to visually summarize the relationships between these variables and hypothesizes a simple theory of how they interact. Treating the five variables as binary - either they are absent or present in a case – he derives 32 possible combinations of these variables that together comprise a "model" that predicts swarming outcomes based on his theory. He predicts that only six combinations lead to swarm success. The model is tested using a qualitative technique called the comparative method (by Charles Ragin) to find

patterns of multiple and conjunctural causation. The resulting inconsistencies turn out to be few.

In the final two chapters the author addresses the two policy questions:

1. How can swarms be defeated?
2. Is swarming relevant for future friendly forces?

The first question required a relatively straightforward answer based on his theory of swarming and the historical lessons of past swarm defeats. In order to defeat swarms he suggests:

- Undermining their "enablers"
- Adopting a combined arms 360° formation capable of fighting on the run.
- Using maneuver to deny vapor swarms the time they require to converge towards a target.
- Using "bait" tactics.

The second question - Is swarming relevant for future friendly forces? – called for a much more speculative answer, based as it must be on the uncertainty of both the future operating environment and technological change. This question required an analysis of some of the broad trends in warfare and the introduction of what the author refers to as non-linear, dispersed operations (NLDOs), military operations in which units move and fight in multiple directions (i.e., are non-linear), are widely separated (i.e., are dispersed), and are capable of supporting each other by concentrating mass or fires (i.e., are dynamic). Indeed, the author suggests that vapor swarming is just one form of NLDO and that the more important question to ask is: how relevant are NLDOs to future friendly forces?

To answer this question he compares offensive NLDOs to defensive NLDOs and recommends that the principles of war should be reinterpreted for NLDOs (*Disperse/Mass* should replace *Mass*, *Economy of Force* should be replaced by *Simultaneity*, and *Unity of Command* should change to *Unity of Effort).* Finally, the author finishes his discussion of future friendly swarming with a general consideration of fires, command and control, communications, training, intelligence, surveillance, and reconnaissance, logistics, terrain, and reserves.