

# The Lessons of Agincourt

Combined arms warfare and offset strategy in the 15th century  
by Maj Dan Mahoney

Carl von Clausewitz's *On War* claims that although the concept of war as an extension of a government's policy does not change, the means of waging war do change.<sup>1</sup> Stated another way, war will always result from a clash of irreconcilable political wills, but the way that these wills attempt to overcome one another will grow and evolve alongside the societies within which they reside.

If this is true, how might political bodies attempt to gain an advantage over opposing bodies 30 years from now? What systems or techniques will confer upon their owners a marked advantage over today's systems and techniques? More importantly, can military professionals predict the emergence of these dominant systems and techniques in order to think of ways to counter them?

The aim of this study is not to answer these questions decisively but rather to help frame the problem and ensure that our military profession as a whole takes into consideration the character of future war. In turn, it is the hope of the author that in considering the character of future war, today's decision makers incorporate the insights from this and other similar projects when pursuing doctrinal and materiel solutions intended to ensure that our military stands ready to fight and win when called upon to do so.

This article is the first in a series of three articles which explores the concept of an *offset*, which is to say a means of countering a military advantage. Specific to this study, the intended target of our offset strategy is an opponent's advantage in mass. To explore this concept, we begin with the study of

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**English "combined arms" during the 100-years war relied on the advantage of the longbow.**  
(Photo: D'Azincourt à Marignan; Chevaliers et bombardes, 1515, Paris, Musée de l'armée.)

a historical case where one belligerent achieved a successful offset to an opponent's advantage in mass in order to determine why the offset succeeded. The second article takes the lessons learned from the offset to mass and uses a decision game to test whether or not it might be possible to reproduce the same type of offset to an opponent's advantage in mass. Finally, armed with the insights gained from the decision game, the third article will suggest a system-based solution to future advantages in mass and associated paradigm shifts that might be necessary throughout the

military profession in order to counter other similar opponent advantages. But to go forward, we must first go back. This study begins over 600 years ago, just outside a small French town called Agincourt.

## Historical Context and Thesis

On 25 October 1415, King Henry V of England and his army of nearly 10,000 awoke to do battle on the 74th day of their campaign in France. His host, tired, sick, and malnourished following a 260-mile movement over the course of two and a half weeks, broke

their camp, heard mass, and assembled for the now unavoidable battle. Across the battlefield, less than a mile distant, sprawled the French camp. In contrast to the stark and solemn conditions in the English camp, the numerically superior French were loud and boisterous, drinking and preparing to claim certain glory. Yet, despite his disadvantages in numbers and wellness, Henry's host enjoyed tremendous familiarity and cohesion, having fought together for the duration of the campaign. Moreover, Henry's center of gravity was the longbowman, perhaps the most decisive combatant on the battlefield of the Hundred Years' War. The French army, composed primarily of chivalrous men-at-arms, drew its power from several different armies of lesser-lords, assembled for the purpose of denying Henry V a route back to England. Henry's army as a whole, and the men themselves, had everything to lose, while the French lords and nobles fought mostly for ransom and personal glory. As history shows, Henry capitalized on his strengths and minimized his weaknesses in order to win a tremendous victory.

The Battle of Agincourt is noteworthy in the study of western military history because a numerically inferior, demoralized, and malnourished force achieved a decisive victory against an opposing force with greater overall combat power. Careful study reveals several key qualities of the battle that likely tipped the scales in favor of the English. In applying these qualities to future warfare, patterns emerge that suggest how future force composition and employment might offset an advantage in overall combat power. *A force employing systems with high value for friendly forces and also low payoff for enemy targeting processes, reliant on complementary protection and long-range fire support, can win against a force with larger overall firepower.*

### Historical Review of Agincourt (1415)

Military historians may not agree on whether or not revolutions in military affairs exist, as some believe that development is merely incremental and evolutionary. Agincourt provides ample evidence in favor of the revolution hy-

pothesis. In Clifford Rogers' 1993 article "The Military Revolutions of the Hundred Years' War," he argues that the most dramatic of all European military revolutions took place during the Hundred Years' war. He describes armies prior to the Hundred Years' War as

composed primarily of feudal warrior-aristocrats ... heavily armored cavalry, shock combatants, relying on the muscle power of man and steed ... [who] fought more often to capture than to kill.<sup>2</sup>

He contrasts this with the armies that grew from their experiences in the Hundred Years' War, saying they differed from those before the war "on every single count."<sup>3</sup> The new armies were

drawn from the common population ... they served for pay; they fought primarily on foot, in close-order linear formations which relied more on missile fire than shock action; and they fought to kill.<sup>4</sup>

These descriptions are nearly perfect fits for Agincourt: France's army followed the old model, while Henry's the new model.

Rogers' thesis relies upon an explanation very similar to adaptive evolution in biology, which is to say that traits beneficial for survival are heritable and useful for future generations, while those which do not give a species an ecological advantage disappear over time as their hosts fail to survive long enough to pass them on.<sup>5</sup> The main difference is that while biological evolution is not controlled by its host (a frog cannot choose what color skin to pass on to its offspring), state armies can learn from defeats and victories, and emphasize those qualities, which provided an advantage in preparing for and executing future wars. France dominated the feudal battlefield of the early 14th century with men-at-arms, "widely regarded as the finest in the world."<sup>6</sup> As a result, France's opponents sought ways to offset the quality of France's men-at-arms by adjusting the composition and employment of their own forces. One such development was the emphasis on longbowmen, a relatively cheap and tactically effective counter to France's military advantage of men-at-arms. The rise of the longbowman's

importance in European warfare is one of the central aspects of what Rogers refers to as the infantry revolution, and Agincourt is a prime example of the revolution in practice.

While many studies of the Battle of Agincourt exist, most of them reach a similar conclusion: leadership and discipline on the part of King Henry V and his English army allowed for a smaller force to win against a larger French force while in France. This author's study and analysis identified four qualities of the English army and its actions which serve to explain why England won, and these qualities fit into the larger categories of leadership and discipline suggested by most historians. This analysis considers control of the battlefield, tactical employment of forces, target selection and discrimination, and the integration of protection and fire support in explaining why England won. These four qualities do not explain England's victory at Agincourt completely. However, they are the most applicable for the study of future warfare, specifically the integration of fires and protection, and are thus the most important qualities for this analysis.

Finally, this analysis acknowledges that competing interpretations of Agincourt exist regarding a wide range of topics from the number of combatants on each side to the reasons for English victory. Even contemporary authors provide widely varying numbers in their analysis of English and French strength. Curry puts the ratio at approximately 4:3 in favor of the French,<sup>7</sup> while Barker suggests that the French outnumbered the English "by at least four to one."<sup>8</sup> Both these authors published their works in 2005, but more outmoded analyses suggest both greater numbers on both sides and a larger relative advantage for the French.<sup>9</sup>

### Alternate Explanations for England's Victory

Regarding the analysis of England's victory, several modern analyses rely on mathematical models of human crowds in motion relative to one another. The authors of one study suggest that natural fluctuations along two fronts of disproportionate strength produced clusters

of French breakthroughs through the English line, which the English then capitalized on by surrounding these clusters and defeating them. As the battle progressed, these clusters turned into obstacles against the French as they continued to advance and slowly push back on the English.<sup>10</sup> However, the analysis assumes that density within the French and English formations was consistent throughout.<sup>11</sup> This assumption departs from historical analysis by other authors such as Keagan and Curry who suggest that the French naturally clustered toward the three English formations of men-at-arms, creating a non-uniform density in the French line at the point of contact and invalidating this assumption. Indeed, the author of the study even identifies that there were three mounds of French casualties in the historical records,<sup>12</sup> but attributes this to the model rather than to the pursuit of ransom opportunities and target selection on the part of the French.

Another study arrives at a similar conclusion but makes an even larger and more novel assumption when it asserts, “Neither archery nor mounted knights were crucially involved in this phase [clashing of men at arms] of the battle,”<sup>13</sup> again predicting a clustering effect of casualties which arose naturally from the interaction of two large crowds of disproportionate strength. The author provides no historical reference for his assumption that neither archers nor cavalry were crucially involved during the clash of men-at-arms, which contradicts many accounts that archers from the English flank fired into the French as they advanced and fought, even joining in the fray from the flanks with their own melee weapons. At a minimum, this gives rise to three linear surfaces of interaction (the main front and one along each flank of the French), which the study fails to consider.

Finally, another author suggests that it is fruitless to view Agincourt and the

Hundred Years’ War through the lens of modern strategy because it will inevitably lead to false conclusions. The author argues that while today’s strategy is largely defined by binaries (success or failure, attack or defend), strategy of the Hundred Years’ War revolved around a concept of divine justice and norms of the era wherein opposing sides communicated with one another regularly during a campaign. Divine justice explains why Henry elected to fight at Agincourt against a larger foe and provides an explanation for why Shakespeare’s famous speech in *Henry V* had such a galvanizing effect on his army, despite the persistent reminder of potential death. Norms of the era explain why Henry felt comfortable sailing to France with such a comparatively small army and why he felt comfortable sleeping within view of the French army on the eve of battle.<sup>14</sup> While this does not explain how a malnourished and sick English army won against a numerically superior French army, it allows the reader to speculate that perhaps a sense of honor informed France’s targeting decisions rather than a simple desire for ransom. On the other side of that same coin, perhaps Henry made a conscious decision to break these norms in order to win, conscious of the supposed divine ramifications of such a decision.

### Battlefield Control

At Agincourt, Henry V achieved victory over the French by better controlling the physical battlefield. Once both the English and French realized that battle was unavoidable, Henry V employed his forces and arrayed them in such a way so as to take full advantage of the space between his camp and that of the French, controlling the battlefield. Key to his control were leader placement and overall formation design, seizing the defensive by forcing the French to attack and ensuring that only one viable avenue of approach existed.

Henry’s formation was important because a Lord led each of his three formations of men-at-arms: Lord Camoys led the formation on the left of the line, Edward of York led the formation on the right, and Henry led the host in the center.<sup>15</sup> While he expected the French



Decisive battle in the high middle ages most often involved bloody close combat. (Photo: Vigiles du roi Charles VII. 1415, author unknown.)

to attack his formation head-on, the placement of key leaders at the head of each of his smaller formations provided the English with trusted decision-makers at multiple points on the battlefield, increasing flexibility and reducing the span of control for each leader. Archers formed up between (two groups) and to the sides of (two additional groups) these three main formations so as to provide fire support anywhere across the approximately 900-meter front of Henry's formation.<sup>16</sup> This formation is a departure from the formations of feudal armies, which relied on a line of infantry to provide a "shield wall" for shock cavalry as the knights mounted their steeds and prepared to ride against the opposing army.<sup>17</sup> Incorporation of archers into the formation secured his flanks and gave each subordinate commander indirect fire security for his portion of the formation. In contrast, the French divided themselves into three lines, or "battles," each of which spanned the battlefield from wood line to wood line with a single commander.<sup>18</sup> This arrangement precluded effective control across the entirety of the formation and essentially committed each battle to a single action once initiated.

Henry arrayed his forces in such a way that he forced the French into a

single avenue of approach, and thus a single engagement area for his formation. Thick wood lines bracketed the battlefield on either side, creating a natural lane within which both armies maneuvered.<sup>19</sup> While the French could have used the woods for maneuver, this would have induced significant command and control challenges on the part of the French, already a composite army built from separate commands.<sup>20</sup> Furthermore, the woods would have significantly slowed the French advance, giving the English plenty of time to adjust. Curry describes Henry's formation as a "squished horseshoe,"<sup>21</sup> which afforded his archers the ability to shoot at the French flanks as they advanced, driving them not only toward the English center but closer to one another as well. It is this influence of English archers, coupled with the French cavalry retreat, which led to the oft cited inability of French men-at-arms to raise their arms above their heads as they advanced, as a result of the lateral compression in their own formation.<sup>22</sup>

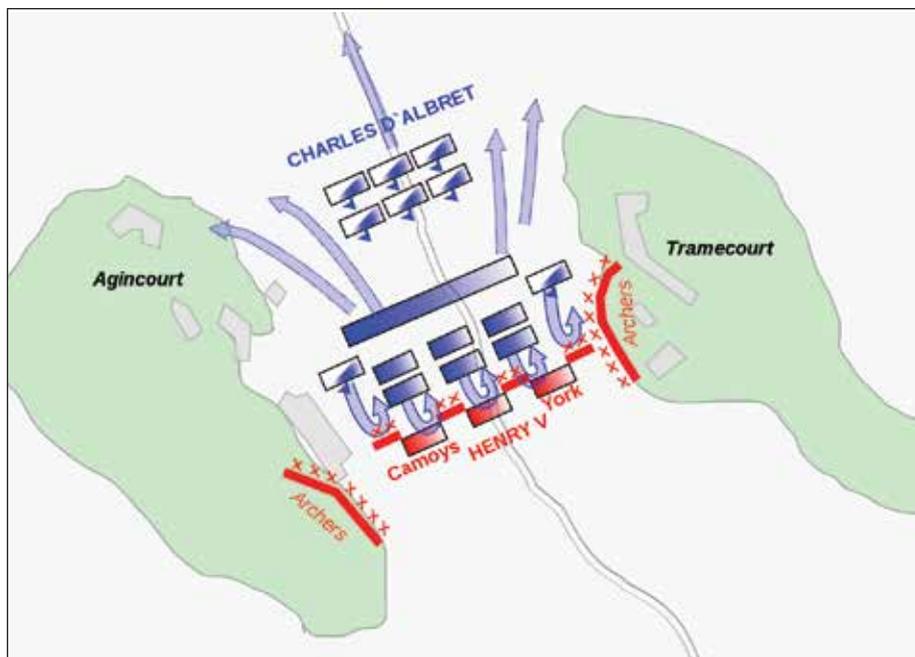
Finally, Henry's deployment and use of the terrain goaded the French into attacking, thus affording Henry the chance to both defend against and canalize the French. Henry forced the French into a pre-planned engagement

area between the wood lines where he could mass his combat power while the French still moved to initiate battle. Henry's own archers outranged the French crossbowmen,<sup>25</sup> allowing Henry to initiate the battle with indirect fire and forcing the French to either retreat to avoid casualties or advance and attempt to regain the initiative. The French chose the latter option. While Henry's initial longbow volleys do constitute an offensive action, the action was localized and allowed for him to fight a defense for the remainder of the battle—affording him advantages that the French sacrificed by advancing.

### Tactical Employment

Another contributing factor to Henry's victory was his tactical employment of troops. While there is certainly overlap between battlefield control and tactical employment of troops, this analysis shall consider battlefield control to be largely terrain focused, while tactical employment is enemy focused. At Agincourt, Henry achieved an offset over French numerical and firepower superiority by fielding a larger ratio of archers to men-at-arms than did the French, employing all forces so as to achieve the complementary benefits of combined arms warfare, and finally, by finding a way to get the most soldiers into the fight at the same time as possible.

The arrival of the longbow to the battlefield in 14th century Europe marked the beginning of an era in military history where infantry, not cavalry, reigned as the dominant combat arm.<sup>24</sup> While many factors contributed to the longbow's rise, some of the more important aspects were its higher rate of fire and longer range when compared to the crossbow.<sup>25</sup> Additionally, longbowmen were cheap when compared to other soldiers in the English army (50 percent the pay of a man-at-arms, 25 percent the pay of a knight bachelor, and about 8 percent the pay of an Earl).<sup>26</sup> While sources vary on the exact composition of Henry's army at Agincourt, Anne Curry provides the most contemporary and rigorous estimate of 8,680, approximately 7,000 of which were longbowmen, yielding a ratio of nearly 5:1 for longbowmen to men-at-



**The Battle of Agincourt 25 October, 1415. French forces in blue; English forces in red.** (Source: Andre Nacu; public domain.)

arms. As a rough comparison, a modern infantry brigade combat team in the U.S. Army is designed to have fifteen companies or troops, which represent the preponderance of its maneuver combat power. One composite field artillery battalion of three batteries supports the infantry brigade combat team with indirect fires provided by a total of 18 tubes of artillery (six 155mm and twelve 105mm howitzers). Assuming an average of 100 soldiers per combat company or troop, this is a ratio of 1:68 for howitzers to soldiers.<sup>27</sup> While the longbow and a howitzer are not equivalent in terms of their relative combat power, the starkly inverse ratio between Agincourt and today provides further support for Rogers' revolution hypothesis. Modern armies now rely on maneuver for firepower, as did the feudal armies of 13th century Europe. Curry also estimates that the French fielded approximately 12,000 total troops, 10,000 of which were men-at-arms, putting their ratio of crossbowmen to men-at-arms at 1:5.<sup>28</sup> Even if the French brought all their forces to bear against the English simultaneously (which they did not), they would have suffered a tremendous disadvantage with respect to both range and number of missile infantry.

While Henry's deployment of troops took advantage of the available terrain and leveraged the strength of subordinate leaders, it also helped him to reap the benefits of combined arms warfare. His infantry stood shoulder to shoulder with his longbowmen, allowing each formation to secure the flank of the next, and providing him the ability to fire onto any point along the width of his formation with arrows, the primary form of indirect fire at the time and thus the way to achieve combined arms warfare with melee forces. His men-at-arms enjoyed French advances of limited effectiveness thanks to the harassing fires of his archers, and his archers enjoyed relatively little threat or interference on the battlefield thanks to the protection afforded to them by nearby infantry, allowing them to fire continually. In contrast, the French launched a purely mounted attack first, followed next by a battle comprised entirely of men-at-arms after the mounted wave was

turned back.<sup>29</sup> France's crossbowmen, although limited in number compared to the English longbowmen, were unable to support either the French cavalry or main battle as they advanced, thus sacrificing any potential advantage gained by combined arms warfare on the part of the French.<sup>30</sup>

France's failure to incorporate its crossbowmen into either of its attacks and the distinct nature of the two attacks led to Henry's third advantage with respect to tactical employment: finding a way to maximize potential firepower. As previously mentioned,

and survive drove England's decision to target France's men at arms with their longbowmen and to target French cavalry mounts when they could.

France's first bad decision was to target England's men-at-arms while ignoring England's longbowmen during the advance of the French dismounted battle. The longbowmen were the center of gravity of Henry's army and represented the portion of his force that contributed most decisively to the victory at Agincourt. Although France's cavalry assault did target the longbowmen, they were ineffective because of

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Henry's formation looked like a squished horseshoe with its opening toward the French. As a result, the overall width of his formation actually exceeded the width of the battlefield, providing him with a larger surface with which to strike against the French. In contrast, the French advanced one combat arm at a time. Although they enjoyed an overall numerical advantage of 4:3 over the English, with an advantage of nearly 7:1 with respect to men-at-arms, the French fought the battle in successive iterations of relative numerical disadvantage because of the nature of their separate and distinct actions.

#### **Target Selection and Discrimination**

Although it is unclear whether or not either England or France conducted a formal center of gravity analysis at Agincourt, both sides likely discussed their intended scheme of battle during some type of war council prior to the battle. What is clear is that Henry's army had a better understanding of the enemy's center of gravity and how to target it than did France's army. France's decision to target English men-at-arms makes this apparent and arises from the prospect of greater ransom coming from knights than from archers. On the other hand, a desire to win the battle

the volume of arrow fire and the effectiveness of the protection afforded by the six-foot stakes placed in and around the longbowmen's positions.<sup>31</sup> French men-at-arms, on the other hand, would have suffered casualties in assaulting the English longbowmen, but the protective stakes would have had a much smaller negative impact against a dismounted and slow moving force. Had they been able to close the distance with the English longbowmen, the heavily armed and armored French men-at-arms would have enjoyed a significant advantage in combat, denying the English men-at-arms the previously identified protection afforded by combined arms warfare.

Although France only attacked English men-at-arms with their own men-at-arms because that was the appropriate target for men-at-arms, the reason behind this axiom reveals more about the discipline of both armies. Henry's army fought for its survival, caught in enemy territory and denied a route to retreat home to England.<sup>32</sup> His forces fought to survive. The French believed they would win decisively against Henry's smaller army, and individual knights yearned for the prospect of a good ransom. The French fought for personal glory and prosperity. Thus,

many French knights failed to consider an attack against English longbowmen as an option since they would fetch such a paltry ransom.<sup>33</sup> Other evidence of a lack of discipline amongst the French is that several knights declined to participate in the cavalry attack when called upon to do so and that several knights set it as their goal to personally capture King Henry.<sup>34</sup> This is a prime example of Roger's infantry revolution: French nobles were so disinterested in the potential ransom of longbowmen that they declined to participate in a major phase of the French battle. This focus on glory over victory led the French to make several costly tactical decisions.

On the other side of the battlefield, Henry's forces made much more appropriate targeting decisions. First amongst these was the decision to loose volleys of arrows against the French cavalry advance. Henry knew that he might inflict a few casualties from well-placed arrows and hoped that the cacophony created by arrowheads impacting plate armor, and the disruption caused by horses felled by arrows, would be sufficient to disrupt the charge.<sup>35</sup> He was right, and the cavalry advance turned back, denying the French their only attempt to target Henry's longbowmen.

Henry's next tactically sound decision was to target the French men-at-arms with his longbowmen both during their advance and during melee combat with England's men-at-arms. The retreat of France's cavalry through the center of the battlefield coupled with both the advance of French men-at-arms and continued harassment by Henry's longbowmen disrupted the advance of the French men-at-arms in general and canalized them to the center of the battlefield.<sup>36</sup> Since the French did not target Henry's longbowmen on the flanks, they naturally clumped together closer to the center of Henry's line, producing the well-documented effect of a press of knights so intense that many could not raise their arms to fight or slow the advance of those behind them. The result was disastrous for the French, who lost a majority of their soldiers in the battle, along with over 1,000 nobles.<sup>37</sup> But the English longbowmen did not simply fire from

their static positions. Once the French made contact with the main English battle lines, the longbowmen on the flanks drew their melee combat weapons (knives, hatchets, and axes) and attacked the flanks of the French formations.<sup>38</sup> England's previous numerical disadvantage in melee combat was now an advantage as nearly all of Henry's formation fought at once against only one battle from the French formation, or approximately 4,000 French men-at-arms.

### Fires and Protection

Henry understood that the composition of his army carried with it certain capabilities and limitations. While he had the capability to outrange his opponents, he was limited in his capacity to win a battle, which relied upon the outcome of melee combat because of the relatively low number of men-at-arms in his army. Henry's strength, therefore, was his ability to emphasize his army's capabilities while at the same time minimizing its limitations. Specific to his longbow archers, Henry's capability to provide fires was dependent upon both the longbowmen's degree of protection and their ability to fire at the highest rate possible and achieve the longest range possible.

Compared to general knights, archers possessed much less personal protection. While most knights in Henry's army wore plate or chain mail, archers were generally unprotected save for a leather cap with crossed metal braces and a loose-fitting jack.<sup>39</sup> This allowed them to move around the battlefield more quickly and also allowed them to fire their weapons free of the restrictions naturally imposed on the human body by plate or chain armor. This mobility conferred upon Henry several opportunities. Two such occasions were a detachment of longbowmen who snuck through the woods and harassed the French host with flanking fire from the rear, prodding the French to attack.<sup>40</sup> The other occasion was when Henry's archers picked up their melee weapons and maneuvered from their well-defended positions on the flanks toward the French host in order to assist the English men-at-arms before it was too

late to make a difference. As a result of the English emphasis of mobility and unencumbered employment amongst its longbowmen, the longbowmen relied upon external sources for personal protection.

In addition to the flank security afforded the English longbowmen by nearby men-at-arms, the archers also placed six-foot pikes into the ground in and around their firing positions. John Keegan provides the most likely description of what this looked like when he suggests that archers formed up in standard formations several rows deep, with each man placing his pike directly in front of his firing position.<sup>41</sup> This created an area protected by pikes, rather than a line that might be avoided simply by going around it. Thus, the French cavalry charge, while already disrupted by longbow fire, was ineffective in dispersing Henry's longbow formations prior to the advance of the first dismounted French battle. This protection from cavalry advance, combined with France's reluctance to attack longbowmen with its own knights and the lack of participation on the part of France's crossbowmen, meant that England's longbowmen, their center of gravity, were virtually untargeted and unmolested for the whole of the battle.

### Summary

At Agincourt, two armies met on a battlefield with only a minor difference in key terrain, the slight narrowing of the distance between wood lines, which favored the English. The English, likely outnumbered by something between 3:2 and 4:3, possessed far greater indirect fire capability than did their French opponents but were outnumbered nearly 6:1 when it came to primary maneuver forces. The English initiated the battle by using their range advantage to invite the French into England's desired engagement area. France tried to neutralize England's indirect fire capability through mounted maneuver and firepower but failed to achieve a temporal advantage due to English suppression and protection, thus defeating the first French attack. France next commenced its attack against England's primary maneuver force concentrations, using the

same avenue of approach along which the French cavalry retreated, disrupting the French foot advance. This dismounted advance, absent support from either mounted maneuver or indirect fire, met virtually the entirety of the English army in a fixed defensive position, which attacked the French simultaneously from three sides. This further canalized the French toward the center of England's engagement area, denied France the ability to use its firepower in such close quarters, and ultimately led to France's defeat.

England won because of its advantages in leadership and discipline. These advantages manifested in several ways. First, Henry understood the terrain and how to gain an advantage from his position in the area of operations, thus creating an engagement area. Next, his employment of forces took advantage of the benefits of combined arms warfare and also forced France's hand by prodding them to attack, preserving his advantageous defensive position. Henry also won the battle based on target selection since he focused on France's center of gravity while France failed to focus on his. Finally, Henry's archers, his own center of gravity, achieved an appropriate balance of protection and mobility. This allowed them to target multiple portions of the French army while themselves avoiding major attack for the duration of the battle.

It is the last of Henry's advantages upon which the final two articles in this series will focus while also giving consideration to the first three advantages. England's longbowmen, the army's center of gravity, effectively targeted both the French cavalry and the French men-at-arms. Had the French crossbowmen entered the fray, it is likely that the English longbowmen would have effectively targeted them as well because of the longbow's greater range and higher rate of fire, and the numerical advantage of English longbowmen to French crossbowmen. More impressively, this same force received relatively low attention from French targeting, especially compared to how much the longbowmen influenced the battle. As this analysis transitions to future combat, it considers how to achieve such an

advantage in effectively targeting the enemy without being targeted by them.

#### Notes

1. Carl von Clausewitz, *On War*, edited and translated by Michael Howard, Peter Paret, (Princeton, N.J.: Princeton University Press, 1984).
2. Clifford J. Rogers, "The Military Revolutions of the Hundred Years' War," *The Journal of Military History*, (Lexington, VA: Society for Military History, March 1993).
3. Ibid.
4. "The Military Revolutions of the Hundred Years' War."
5. Boundless, "Natural Selection and Adaptive Evolution," *Boundless Biology*, (last modified August 2016), available at <https://www.boundless.com>.
6. "The Military Revolutions of the Hundred Years' War."
7. Anne Curry, *Great Battles: Agincourt*, (Oxford, UK: Oxford University Press, 2015).
8. Juliet Barker, *Agincourt: Henry V and the Battle That Made England*, (New York, NY: Little, Brown and Company, 2005).
9. *Great Battles*.
10. Richard R. Clements and Roger L. Hughes, "Mathematical Modelling of a Medieval Battle: The Battle of Agincourt, 1415," *Mathematics and Computers in Simulation*, (Amsterdam: Elsevier, 2004).
11. Ibid.
12. Ibid.
13. Roger L. Hughes, "The Flow of Human Crowds," *Annual Review of Fluid Mechanics*, (Palo Alto, CA: Annual Reviews, 2003).
14. Jan Willem Honig, "Reappraising Late Medieval Strategy: The Example of the 1415 Agincourt Campaign," *War in History*, 19, no. 2, (Thousand Oaks, CAL March 2012).
15. Alfred H. Burne, *The Agincourt War: A military history of the latter part of the Hundred Years War from 1369 to 1453*, (New Jersey: Essential Books, Inc., 1956).

16. John Keegan, *The Face of Battle*, (New York, NY: Viking Press, 1976).

17. "The Military Revolutions of the Hundred Years' War."

18. *The Face of Battle*.

19. Ibid.

20. *Great Battles*.

21. Ibid.

22. *The Agincourt War*.

23. *Great Battles*.

24. Trevor Dupuy, *The Evolution of Weapons and Warfare*, 3rd print, (Indianapolis, IN: Bobbs-Merrill Company, Inc., 1980).

25. Ibid.

26. *Great Battles*.

27. Headquarters U.S. Army, *Brigade Combat Team, FM 3-96*, (Washington DC: October, 2015).

28. *Great Battles*.

29. *The Face of Battle*.

30. *Great Battles*.

31. *The Face of Battle*.

32. Ibid.

33. Ibid.

34. *Great Battles*.

35. *The Face of Battle*.

36. Ibid.

37. *The Agincourt War*.

38. *The Face of Battle*.

39. Robert Hardy, *Longbow: A Social and Military History*, (New York, NY: Arco Publishing Company, Inc., 1976).

40. *Great Battles*.

41. *The Face of Battle*.

