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14. ABSTRACT
England won the Battle of Agincourt (1415) because they used projected firepower, supported by complementary protection, to offset France's advantage in mass. This conclusion shaped the development of a future concept reliant on manned and unmanned teaming (MUM-T). The concept uses autonomously piloted HMMWVs with mounted howitzers that fire surveillance drones with swarm logic to conduct reconnaissance. This concept was tested using a decision game. Respondent feedback led to the addition of kinetic kill and signature management capabilities. The inclusion of this concept into future warfare might require a paradigm shift where commanders plan for attrition of friendly autonomous systems.

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THE LESSONS OF AGINCOURT AND THEIR APPLICATION TO THE FUTURE OF WARFARE

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Executive Summary

Title: The Lessons of Agincourt and their Application to the Future of Warfare

Author: MAJ Dan Mahoney, USA, AY2016-2017

Thesis: 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.

Discussion: The purpose of this project was to examine the nature of warfare and determine whether or not manned and unmanned teaming (MUM-T) has a place in a future operating environment. In this case, "useful" relates to the concept of an offset strategy, where military innovation marginalizes the effectiveness of another military capability. A case study of Agincourt determined that Henry's English army offset France's advantage in overall mass, defensive footing, and quality of men-at-arms primarily through the use of a well-protected firepower projection capability. Other supporting factors in England's victory were complementary protection, simultaneous effects, and an imbalance in effective target selection methods which favored England. When combined with MUM-T capabilities, the above principles helped to produce an initial concept for a combat system well-suited to a future operating environment. The initial concept was a blend of a HMMWV-mounted howitzer with 75% of vehicles autonomously piloted and operated per platoon, and a family of munitions which functioned as drone aircraft that operate with swarm AI logic. The purpose of the swarm was to provide surveillance and intelligence in support of other methods of target engagement. Feedback from decision game solutions added an organic kinetic kill capability, and electronic signature management, to the list of capabilities which would aid the advanced artillery concept in offsetting an advantage in enemy mass.

Conclusion: This advanced artillery system would work best in a contested environment with a gap in enemy IADS capability, in order to protect swarm integrity. The presence of a swarm presents the enemy with both an opposing force and a weapon system that it cannot ignore. The enemy must devote combat resources such as time, surveillance, and ordnance to address the swarm in some way, which takes away resources the enemy might have used against other high payoff targets. The advanced artillery concept could integrate into joint or multinational formations as a replacement for conventional artillery battalions, or into small, expeditionary elements such as a company team deployed to counter an opponent's A2/AD network. A review of the principles which predicted the success of this system suggests that an understanding of the nature of combat may require incremental changes to account for the inclusion of MUM-T into the paradigm of future warfare. Incorporation of MUM-T into the paradigm of future warfare may mean that strength is no longer the ultimate predictor of success, and that a successful defense is more a function of redundancy than it is of depth. Finally, the current preference to preserve sources of combat power may need to yield to comfort with the concept of machine attrition in order to fully reap the benefits of MUM-T. This may require leaders to view machines and systems not just as sources of combat power, but as possible means for achieving a more diverse range of ends.

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Introduction

Principles and rules are intended to provide a thinking man with a frame of reference.[1]

--Carl von Clausewitz, On War

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. How did Henry do this? More importantly, are there any lessons from Agincourt which might be applicable to the nature of combat or composition of forces more than 600 years later?

[1] Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1984).

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.

In battle, commanders are encouraged to use doctrine as a frame of reference in order to help them make decisions. When combined with situational and environmental factors, doctrine provides an initial point from which commanders adjust in order to make decisions and guide their formations. Does this same methodology apply to a meta-analysis of the nature of warfare? Might a student of war take the immutable principles of war and, given hypothetical conditions for future combat, adjust those same principles in order to make decisions about how best to prepare formations to meet the rigors of future war? This paper attempts to do just that.

Following an historical review, this analysis considers the modern warfighting functions of both protection and fires, and the synergistic nature gained by a combination of these two, in understanding how England won at Agincourt. Next, this analysis applies the principles of synergistic fire support and protection to the development of a future combat system concept which incorporates manned and unmanned teaming (MUM-T). A decision game tests this concept, and the results of the decision game help to modify the concept further. With a refined concept in mind, this paper concludes with an exploration of possible applications for the concept, and the nature of future warfare.

Manned and Unmanned Teaming

… seamless manned-unmanned teaming (MUM-T) will provide our MAGTF the means to obtain and maintain a new competitive advantage.[2]

--LtCol Kevin Murray, Manned/Unmanned Teaming to Transform the MAGTF

The concept of MUM-T is not new. In terms of military application, one of the most prominent historical examples is the Soviet Union's experimentation with teletanks, telecutters, and teleplanes in the 1930s and 1940s. These tele-machines were wirelessly controlled and unmanned vessels that fought alongside manned vessels in the same formation.[3] Incorporation of tele-machines into formations increased mass without exposing more soldiers to risk by virtue of generating more firepower and mass per soldier.

This type of teaming has continued in various forms since the 30s, and is ubiquitous in the modern world. From the Reaper unmanned aircraft[4] to unmanned vehicles still in development such as the tactical unmanned ground vehicle (TUGV),[5] unmanned systems abound not only in the US military, but in the militaries of many nations. Even outside the military, police

[2] LtCol Kevin Murray et al., "Manned/Unmanned Teaming to Transform the MAGTF," *Marine Corps Gazette* 100, no. 2 (February 2016), https://www.mca-marines.org/gazette/2016/02/mannedunmanned-teaming-transform-magtf.
[3] Erik Sofge, "Tale of the Teletank: The Brief Rise and Long Fall of Russia's Military Robots," *Popular Science*, March 7, 2014, http://www.popsci.com/blog-network/zero-moment/tale-teletank-brief-rise-and-long-fall-russia%E2%80%99s-military-robots.
[4] U.S. Air Force, "MQ-9 Reaper," *U.S. Air Force*, September 23, 2015, http://www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104470/mq-9-reaper.aspx.
[5] National Robotics Engineering Center, "Infantry Support (TUGV)," *Carnegie Mellon University*, 2017, http://www.nrec.ri.cmu.edu/projects/TUGV/.

departments use unmanned robots to assist in bomb disposal,[6] and companies like Amazon are researching ways to incorporate fleets of drones into the delivery arm of their supply chain.[7]

While the methods and systems used to achieve MUM-T are important, the purpose for pursuing MUM-T is what truly matters. The Marine Corps Operating Concepts suggests that incorporation of unmanned systems into future unit formations will provide an advantage in developing situational awareness, reducing the signature of friendly forces, and assisting in overcoming mobility challenges associated with certain types of terrain.[8] The Army Operating Concept justifies the pursuit of MUM-T on the belief that it "extends the operational reach and increases the capability and agility of units."[9] The Army Operating Concept also suggests that incorporating artificial intelligences into formations will reduce the cognitive load on humans by assisting in the control of autonomous systems and by augmenting certain decision making processes.[10]

Stated more plainly, both the Marine Corps and the Army believe that MUM-T will help achieve an offset. Broadly defined, an offset is a way to counter a military advantage.[11] In the case of the teletank, the Soviet Union increased the ratio between firepower and number of soldiers on the battlefield by automating the control of some of its tanks. The Soviet Union recognized

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[6] Andy Beale, "A New Weapon for SWAT Teams: Bomb-Squad Robots," *Vice*, May 24, 2015, https://www.vice.com/en_us/article/a-new-weapon-for-swat-teams-bomb-squad-robots-522.

[7] Nick Wingfield and Mark Scott, "In Major Step for Drone Delivery, Amazon Flies Package to Customer in England," *New York Times*, December 14, 2016, https://www.nytimes.com/2016/12/14/technology/amazon-drone-england-delivery.html?_r=0.

[8] Headquarters US Marine Corps, *Marine Corps Operating Concept: How an Expeditionary Force Operates in the 21st Century*, (Washington, DC: Headquarters US Marine Corps, September, 2016), 19-21.

[9] Headquarters US Army, *The U.S. Army Operating Concept: Win in a Complex Word, 2020-2040*, TRADOC Pamphlet 525-3-1, (Washington, DC: Headquarters US Army, October 31, 2014), 37.

[10] *Army Operating Concept*, 38-39.

[11] Robert Martinage, *Toward a New Offset Strategy: Exploiting U.S. Long-Term Advantages to Restore U.S. Global Power Projection Capability* (Washington, DC: Center for Strategic and Budgetary Assessments, 2014), i.

that Germany's tanks were superior to their own when it came to firepower, protection, and mobility, and sought to offset these disadvantages with an advantage in mass. On the modern battlefield, the US military employs remotely piloted aircraft (RPAs) as a way to offset, among other capabilities, the effectiveness of enemy IEDs. While there are some tasks that a patrol of soldiers can perform and an aircraft cannot (such as meeting with a village elder), RPAs with long station times and low signatures can gather observational intelligence, employ munitions against enemy combatants, and are immune to the effectiveness of IEDs. These two examples highlight the versatility of MUM-T. The employment of teletanks is a supplementary measure, while the employment of RPAs is a substitutional measure, each aimed at achieving an offset.

Like the concept of MUM-T, the desire to offset an enemy's military capability is not new. Militaries have always pursued means of achieving an advantage over their opponents at all levels of war. In most cases, the means were either technological or tactical. At Agincourt, one finds evidence of both.

Historical Review of Agincourt (1415)

> *In terms of military history, Agincourt is significant for the leadership which Henry gave, the discipline he instilled in his troops, and his skillful exploitation of resources.*[12]
>
> *--Anne Curry, Great Battles: Agincourt*

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

[12] Anne Curry, *Great Battles: Agincourt*, (Oxford, UK: Oxford University Press, 2015), 214.

evidence in favor of the revolution hypothesis. 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."[13] 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*."[14] 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."[15] 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 beneficial 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.[16] 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."[17]

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[13] Clifford J. Rogers, "The Military Revolutions of the Hundred Years' War," *The Journal of Military History* 57, no. 2 (04, 1993): 243, https://search-proquest-com.lomc.idm.oclc.org/docview/195651108?accountid=14746.
[14] *Ibid.*
[15] Rogers, "The Military Revolutions of the Hundred Years' War," 243.
[16] Boundless, "Natural Selection and Adaptive Evolution," *Boundless Biology*, last modified August 8, 2016, https://www.boundless.com/biology/textbooks/boundless-biology-textbook/the-evolution-of-populations-19/adaptive-evolution-132/natural-selection-and-adaptive-evolution-534-11741/.
[17] Rogers, "The Military Revolutions of the Hundred Years' War," 247.

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 MUM-T in 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,[18]

[18] Curry, *Great Battles: Agincourt*, 31-32.

while Barker suggests that the French outnumbered the English "by at least four to one."[19] Both these authors published their works in 2005. More outmoded analyses suggest both greater numbers on both sides and a larger relative advantage for the French.[20]

Regarding the analysis of England's victory, several modern analyses relies 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.[21] However, the analysis assumes that density within the French and English formations was consistent throughout.[22] This assumption departs from historical analysis by other authors such as Keagan and Curry who suggest that the French naturally clustered towards 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,[23] 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 that "Neither archery nor mounted knights were crucially involved in

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[19] Juliet Barker, *Agincourt: Henry V and the Battle That Made England,* (New York: Little, Brown and Company, 2005), x.
[20] Curry, *Great Battles: Agincourt*, 12.
[21] Richard R. Clements and Roger L. Hughes, "Mathematical modelling of a medieval battle: the Battle of Agincourt, 1415," *Mathematics and Computers in Simulation* 64 (2004): 267, www.elseviermathematics.com.
[22] *Ibid*, 263.
[23] *Ibid*, 268.

this phase [clashing of men at arms] of the battle,"[24] 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 as they fought, and even joined 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 Henry felt comfortable sleeping within view of the French army on the eve of battle.[25] 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

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[24] Roger L. Hughes, "The Flow of Human Crowds," *Annual Review of Fluid Mechanics* 35 (2003): 178, www.ProQuest.com.

[25] Jan Willem Honig, "Reappraising Late Medieval Strategy: The Example of the 1415 Agincourt Campaign," *War in History* 19, no. 2 (04, 2012): 149-151. doi:http://dx.doi.org.lomc.idm.oclc.org/10.1177/0968344511432975. https://search-proquest-com.lomc.idm.oclc.org/docview/1010255870?accountid=14746.

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.[26] While he expected the French 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.[27] 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

[26] 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), 79.
[27] John Keegan, *The Face of Battle* (New York: Viking Press, 1976), 83.

against the opposing army.[28] 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, and each had a single commander.[29] 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.[30] 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.[31] 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,"[32] which afforded his archers the ability to shoot at the French flanks as they advanced, driving them not only towards 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.[33]

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[28] Rogers, "The Military Revolutions of the Hundred Years' War," 245.
[29] Keegan, *The Face of Battle*, 98.
[30] Keegan, *The Face of Battle*, 87.
[31] Curry, *Great Battles: Agincourt*, 24.
[32] *Ibid*, 27.
[33] Burne, *The Agincourt War*, 82.

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,[34] 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, and not cavalry, reigned as the dominant combat arm.[35] While many factors contributed to the longbow's rise, some of the more important aspects were

[34] Curry, *Great Battles: Agincourt*, 30.
[35] Trevor Dupuy, *The Evolution of Weapons and Warfare*, 3rd print (Indianapolis: Bobbs-Merrill Company, Inc., 1980), 82.

its higher rate of fire and longer range when compared to the crossbow.[36] Additionally, longbowmen were cheap when compared to other soldiers in the English army (50% the pay of a man-at-arms, 25% the pay of a knight bachelor, and about 8% the pay of an Earl).[37] 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-arms. As a rough comparison, a modern Infantry Brigade Combat Team (IBCT) in the US Army is designed to have 15 companies or troops, which represent the preponderance of its maneuver combat power. One field artillery battalion of three batteries supports the IBCT with indirect fires provided by a total of 22 tubes of artillery (six 155mm and sixteen 105mm howitzers). Assuming an average of 100 soldiers per combat company or troop, this is a ratio of 1:68 for howitzers to soldiers.[38] While the longbow and a howitzer are not equivalent in terms of their relative combat power, the starkly inverse ratio between Agincourt and now 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.[39] Even if the French brought all their forces to bear against the English (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

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[36] Dupuy, *The Evolution of Weapons and Warfare*, 82.
[37] Curry, *Great Battles: Agincourt*, 11.
[38] Headquarters US Army, *Brigade Combat Team*, FM 3-96, (Washington DC: Headquarters US Army, October, 2015), 1-10-1-11.
[39] Curry, *Great Battles: Agincourt*, 32.

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.[40] 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.[41]

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, Henry's formation looked like a squished horseshoe with its opening towards the French. As a result, the 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 due to the nature of their separate and distinct actions.

[40] Keegan, *The Face of Battle*, 98.
[41] Curry, *Great Battles: Agincourt*, 30.

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 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 due to 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.[42] 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.

[42] Keegan, *The Face of Battle*, 91.

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.[43] 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.[44] 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.[45] 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 lack of focus on winning the battle 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.[46] He was right, and the cavalry advance turned back, denying the French their only attempt to target Henry's longbowmen.

[43] Keegan, *The Face of Battle*, 81.
[44] *Ibid*, 98.
[45] Curry, *Great Battles: Agincourt*, 29.
[46] Keegan, *The Face of Battle*, 93.

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.[47] 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.[48] 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.[49] 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 due to the relatively low number of men-at-arms in his army. Henry's strength, therefore, was his ability to emphasize his army's

[47] Keegan, *The Face of Battle*, 98.
[48] Burne, *The Agincourt War*, 87.
[49] Keegan, *The Face of Battle*, 104.

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.[50] 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.[51] The other occasion was when Henry's archers picked up their melee weapons and maneuvered from their well-defended positions on the flanks towards 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

[50] Robert Hardy, *Longbow: A social and military history* (New York: Arco Publishing Company, Inc., 1976), 119.
[51] Curry*, Great Battles: Agincourt*, 26.

front of his firing position.[52] 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, 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 towards the center of England's

[52] Keegan, *The Face of Battle*, 91.

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 remainder of this analysis 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 due to 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.

Initial Concept Development

[The Army Operating Concept] envisions the simultaneous employment of forces and capabilities from and into multiple locations, contested spaces, and domains, presenting multiple dilemmas to an enemy, limiting options, and avoiding strengths.[53]

--The U.S. Army Operating Concept – Win in a Complex World

Stated in terms of an offset, Agincourt demonstrates how ranged and protected firepower can offset an advantage in mass. While Henry's leadership and understanding of the battlefield were important, those tactical and leadership aspects of the battle are supplementary efforts in achieving the offset itself. With this in mind, the author researched current doctrine and future operating concepts regarding protection and firepower projection, in order to explore ways to achieve a 15th-century-longbow type of offset against a near-future overmatch of mass.

Protection

Broadly defined, protection is the preservation of a military force's means of fighting.[54] Protection can apply to large formations, or to individual soldiers. It can focus on physical systems which contribute directly to combat power or digital systems which support the mission. This analysis will use the Army's five principles of protection in order to evaluate protection at Agincourt and to develop an initial concept for a future system.

According to the Army, effective protection is integrated, layered, redundant, enduring, and has a full-dimension approach.[55] See the tables below for definitions of these principles, and an analysis of England's effectiveness in achieving these principles at Agincourt. Table 1

[53] US Army, *Army Operating Concept*, 25.
[54] Headquarters US Army, *Protection*, FM 3-37, (Washington, DC: Headquarters US Army, September, 2009), 1-1.
[55] US Army, *Protection*, 1-8.

considers the longbow system (weapon, archer, and other equipment) by itself, and Table 2 considers the entirety of the English force, and how each element of the combined arms team worked with other elements. This analysis is relative to the English and French armies at Agincourt. It is objective when possible, but requires some subjective judgement based on prevailing tactics and norms of the era.

Table 1: Comparative Analysis of Protection Between English Longbowmen and French Crossbowmen

		Longbowman System	**Initial Concept**	**Refined Concept**
Principle	**Definition**	Archer, yew longbow, leather jerk and skull cap, 6-foot wood stake		
Integrated	Protection is integrated with all other activities, systems, efforts, and capabilities associate with military operations to provide strength and structure to the overall protection effort.	Worse than crossbowmen. Crossbowmen were much more heavily armored, owing to the weapon's shorter range and a desire to protect against missile attacks.		
Layered	Protection capabilities should be arranged using a layered approach to provide strength and depth to the overall protection system.	Equal to crossbowmen. A crossbowmen's armor was more robust, but crossbowmen did not employ wooden stakes at Agincourt.		
Redundant	Redundancy ensures that specific activities, systems, efforts, and capabilities critical for the success of the overall protection effort have a secondary or auxiliary effort of equal or greater capability.	Worse than crossbowmen. At Agincourt, France's crossbowmen had shields, which provided a redundant protection to their plate armor.		
Enduring	Protection has an enduring quality that differentiates it from defense and specific security operations.	Worse than crossbowmen. A crossbowman could take advantage of a shield much more quickly than a longbowman could take advantage of his wooden stake.		
Full-Dimension	Protection is not a linear activity - it is a continuing and enduring activity. Protection efforts and activities must consider and account for threats and hazards in all directions, at all times, and in all environments.	Equal to crossbowmen. Crossbowmen are better suited to immediate reaction and under a wider variety of situations, but England's Longbowmen were better suited to their specific opponent at Agincourt. Wooden stakes offset France's cavalry advantage.		

Regarding individual systems, English longbowmen achieved two of the principles of protection as well as French crossbowmen did, but were less well protected according to the other

three principles. Where longbowmen and crossbowmen were equal (layered and full-dimension protection), the case for the longbowmen is highly contextual. In both instances, the English wooden stake provides protection against a different threat source (mounted cavalry), whereas the French shield reinforces an existing degree of protection against a source for which protection already exists (missile or melee attack) in the form of plate armor. Since these differences depend entirely on the nature of the threat, an analysis of how these systems integrate into the entire army is necessary in order to draw further conclusions about protection.

Table 2: Comparative Analysis of Protection Between English Army and French Army

		English Army	**Initial Concept**	**Refined Concept**
Principle	**Definition**	Henry's Army as deployed and employed at Agincourt		
Integrated	Protection is integrated with all other activities, systems, efforts, and capabilities associate with military operations to provide strength and structure to the overall protection effort.	Better than France. All forces employed to achieve a complementary protection effect		
Layered	Protection capabilities should be arranged using a layered approach to provide strength and depth to the overall protection system.	Better than France. Complementary nature of protection achieved a somewhat layered quality (enemy targeted with missile fire before melee combat with men at arms)		
Redundant	Redundancy ensures that specific activities, systems, efforts, and capabilities critical for the success of the overall protection effort have a secondary or auxiliary effort of equal or greater capability.	Worse than France. Because of the disparity in number of men at arms, England had no redundancy (no forces held in reserve).		
Enduring	Protection has an enduring quality that differentiates it from defense and specific security operations.	Worse than France. England relied upon complementary effects to achieve integrated protection, which is not an enduring quality.		
Full-Dimension	Protection is not a linear activity - it is a continuing and enduring activity. Protection efforts and activities must consider and account for threats and hazards in all directions, at all times, and in all environments.	Worse than France. Although longbowmen had a range advantage over crossbowmen, this advantage would quickly disappear if the commander with longbow did not have time to deliberately deploy his army.		

The English army was better protected than the French army according to two principles of protection, and worse protected according to the other three. England is only adjudged superior according to the layered principle because France chose to attack in waves consisting of a single combat arm at a time, so this is more of a French loss than an English victory. As a result, England only won decisively with respect to one principle: integrated protection. Recalling that the definition of protection concerns protecting combat power, it is clear that England achieved a higher degree of protection at Agincourt than did France due to the relative number of casualties on each side. With that in mind, one must conclude that England's ability to achieve integrated protection offset its deficiencies in the other principles of protection. Although FM 3-37 (*Protection*) does not weigh any one principle more highly than the others, this analysis suggests that integration was the most important principle for the English army at Agincourt.

Although this analysis does not consider other means of evaluating protection, it is important to consider survivability, one of the twelve critical tasks of protection.[56] Survivability concerns protecting sources of combat power and deceiving the enemy for the purpose of "mitigating friendly losses to hostile actions or environments."[57] The author selected this critical task from the FM's list of 12, as opposed to any of the other 11, because of its relevance to the specific context of Agincourt. The four areas of survivability are mobility; situational understanding; hardening; and camouflage, concealment, and deception. Of these four areas, mobility and situational understanding are the most relevant.

England's use of wooden stakes to disrupt France's cavalry charge evidences Henry's understanding of the tactical situation. He ordered that all longbowmen carry and employ these

[56] US Army, *Protection*, 2-12.
[57] *Ibid*

stakes earlier in the campaign due to his knowledge of French tactics and methods of employment, and wanted to offset this potential source of French overmatch.

The relatively low degree of protection afforded England's longbowmen at Agincourt enhanced their mobility. This in turn made it easier for them to maneuver through the woods and harass the French position with missile fire at the onset of the battle, and also permitted the longbowmen to quickly join in the melee battle with hatchets near the battle's end. While neither of these actions enhanced the protection of the longbowmen themselves, the actions contributed to England's overall degree of integrated protection, and England's eventual victory.

Firepower Projection

Stated in terms of an overmatch capability, projected firepower is an offset to melee firepower. FM 3-09 (*Field Artillery Operations and Fire Support*) describes projected firepower's contribution to warfare as the ability to mass "fires in space and time on single or multiple targets with precision, near-precision, and area fire capabilities."[58] Projected firepower fits into the conception of battle through 8 effects: deceive, defeat, delay, destroy, disrupt, divert, neutralize, and suppress.[59]

The "protection" section of this analysis used a relative comparison between England and France due to the importance of protection on both sides of the battlefield, and because of the different means by which each army sought to protect itself. With respect to firepower projection, a relative comparison would convey little since France's crossbowmen did not contribute to the

[58] Headquarters US Army, *Field Artillery Operations and Fire Support*, FM 3-09, (Washington, DC: Headquarters US Army, September, 2009), 1-1.
[59] US Army, *Field Artillery Operations*, 1-2 – 1-4.

outcome of the battle.[60] As a result, this analysis considers the longbow and the English army from an absolute, rather than relative, point of view.

Table 3: Analysis of the English Longbow's Ability to Achieve the Effects of Fires

		Longbowman System	Initial Concept	Refined Concept
Effect	**Definition**	Archer, yew longbow, leather jerk and skull cap, 6-foot wood stake		
Deceive	Deliberately mislead an adversary, thereby causing the adversary to take specific actions that will contribute to the accomplishment of the friendly mission.	A longbow formation's place on the battlefield, relative to other friendly or enemy formations, could deceive an opponent. However, longbowmen did not possess organic capabilities to aid deception.		
Defeat	Occurs when an enemy force has temporarily or permanently lost the means or the will to fight.	Very adept at defeating opponents, especially those without sufficient protection.		
Delay	Slow the time of arrival of enemy forces or capabilities or alter the ability of the enemy to project forces or capabilities.	Volleys can force an enemy commander to make a decision which he would not otherwise make.		
Destroy	Physically render an enemy force combat-ineffective until it is reconstituted.	Unlikely to achieve destruction independently due to the protective effects of armor.		
Disrupt	Upset an enemy's formation or tempo, interrupt the enemy's timetable, or cause enemy forces to commit prematurely or attack in a piecemeal fashion.	Most applicable effect to what England's longbowmen achieved at Agincourt.		
Divert	Draw the attention and forces of an enemy from the point of the principal operation.	Not possible through offensive action alone. Required complicity on the part of the enemy to avoid targeting longbowmen.		
Neutralize	Render enemy personnel or materiel incapable of interfering with a particular operation.	Certainly possible, given the right set of battlefield conditions.		
Suppress	Temporarily degrade the performance of a force or weapon system below the level needed to accomplish the mission.	Certainly possible, given the right set of battlefield conditions.		

[60] England may have accounted for the presence of France's crossbowmen on the battlefield in deploying its forces or issuing orders. However, since France's crossbowmen did not target England's formation, and since they were not targeted by England, their influence is not considered in this analysis.

It is difficult to separate some of these effects from one another in the context of Agincourt given the limited range of missions available to units in that era. For example, the effects of defeat, delay, disrupt, neutralize, and suppress all apply to the interaction between England's longbowmen and France's cavalry. Some effects might be more applicable than others, but none is inapplicable. With that said, the most notable conclusions from this table involve defeat, disruption, and diversion.

English longbowmen were adept at defeating formations. The combined effects of arrow volleys and a field of wooden stakes defeated France's cavalry advance. During other battles of the 100 Years War, England's armies defeated entire enemy formations by virtue of their longbow fires, with little to no contact between men at arms from either side.

Perhaps the most applicable mission for English longbowmen was disruption. England disrupted France's formation at Agincourt by goading them into attacking (because of England's harassing arrow fire), disrupted the French cavalry advance with arrow fire, and disrupted the formation of French men at arms with yet more arrow fire.

One mission for which England's longbowmen were not well suited was deception. Although arrows were indirect fire weapons, they were usually also line-of-sight weapons. It was difficult for a formation of longbowmen to achieve any type of deception regarding the impact of their arrows and the future intentions of other friendly forces. The modern example of firing smoke on a false landing zone in order to deceive an enemy regarding the point of friendly arrival would not work on a 15th century battlefield. That modern example only works because it takes advantage of enemy capabilities in observation and communication, and friendly capabilities in mobility and munition effects, which did not exist at the time of Agincourt.

With the capabilities of individual formations of longbowmen in mind, this analysis next considers whether or not Henry achieved those effects at Agincourt.

Table 4: Analysis of the English Army's Ability to Achieve the Effects of Fires at Agincourt

		English Army	Initial Concept	Refined Concept
Effect	**Definition**	Henry's Army as deployed and employed at Agincourt		
Deceive	Deliberately mislead an adversary, thereby causing the adversary to take specific actions that will contribute to the accomplishment of the friendly mission.	Not achieved. Henry's deployment was very straightforward. If France could not see the longbowmens' wooden stakes from far away, then that would be a type of deception.		
Defeat	Occurs when an enemy force has temporarily or permanently lost the means or the will to fight.	Achieved. France's cavalry lost the will to fight against England's archers before the charge even began, and the rest of France's formation lost the means to fight after sustaining heavy casualties.		
Delay	Slow the time of arrival of enemy forces or capabilities or alter the ability of the enemy to project forces or capabilities.	Achieved, but because of France's decision to send individual battles forward, and not because of any English firepower projection action.		
Destroy	Physically render an enemy force combat-ineffective until it is reconstituted.	Not achieved by firepower projection.		
Disrupt	Upset an enemy's formation or tempo, interrupt the enemy's timetable, or cause enemy forces to commit prematurely or attack in a piecemeal fashion.	Achieved by England's longbowmen throughout the entire battle.		
Divert	Draw the attention and forces of an enemy from the point of the principal operation.	Unclear. France elected not to target England's longbowmen, despite the impact of the longbowmen on the battle.		
Neutralize	Render enemy personnel or materiel incapable of interfering with a particular operation.	Achieved. Helped to compress France's formation so much that it was unable to fight effectively.		
Suppress	Temporarily degrade the performance of a force or weapon system below the level needed to accomplish the mission.	Achieved because of the same compression outcome identified above.		

A direct comparison of the longbow's potential (Table 3) and the achievements of Henry's army at Agincourt (Table 4) shows that Henry used his longbowmen to maximum effect. When

it was possible to achieve a certain effect, his longbowmen did so. This is a testament to the training of his forces, and his own ability to employ them in battle.

Future Operating Concepts

The purpose of this section of analysis is to identify those aspects of protection and firepower projection applicable to Agincourt. Once identified, these advantages will help to inform the development of a future capability intended to provide an offset to an overmatch of enemy mass. Before researching physical manifestations of these advantages, the design characteristics must also consider the input of existing operating concepts.

With respect to the Marine Operating Concept, there is little mention of protection or survivability. The most noteworthy example is in a section titled "Battle of Signatures" which says that in the future, "our units will need to adapt how they fight, emphasizing emissions control and other means of signature management to increase their survivability."[61] In general, the document's tone is far more offensive than it is defensive, asserting that the best way to operate in a contested environment is through power projection. However, the document does little to address how those projected forms of power could protect themselves, or whether or not they should.[62]

The Marine Corps Operating Concept is very descriptive regarding its vision of fires in the future. In general, the document says that the fires enterprise must shorten the kill chain, develop

[61] Marine Corps, *Marine Corps Operating Concept*, 6.
[62] Marine Corps, *Marine Corps Operating Concept*, 7.

a mix of precision and saturation effects, increase mobility and range, develop multiple layers of unmanned aerial sensors, and defend against enemy fires through both active and passive means.[63]

Unlike the Marine Corps Operating Concept, the Army Operating Concept places a much larger emphasis on protection and survivability. For example, the section on "Technologies with military application" suggests that "new materials may deliver greater protection at lighter weights" and that "autonomous and semi-autonomous operational capabilities may increase lethality, improve protection, and extend Soldiers' and units' reach."[64] In other sections not dedicated to technology, the importance of achieving protection and survivability through the combination of multiple arms is woven into the text.

With respect to fires, the Army's emphasis is on range. The document states that "fires with extended range and enhanced precision [will] enable the Joint Force to overcome anti-access and area denial threats and project power from land into the air, maritime, and space domains."[65] The Army's concept believes that five characteristics will have a significant impact on future operating environments, one of which is the "Potential for overmatch." In this section, the document states that potential overmatch technologies include "long-range precision fires, air defense systems, electric fires, and unmanned aerial systems (UAS)."[66]

Finally, there is a section in the Army concept titled "Mobile protected precision firepower," which is of particular importance to this analysis. In this section, the document advocates for lighter, smaller, faster, and less logistically reliant systems. New systems with these attributes would reduce deployment timelines, increase the size of security areas, and improve

[63] Marine Corps, *Marine Corps Operating Concept*, 18.
[64] US Army, *Army Operating Concept*, 15.
[65] *Ibid*, 37.
[66] *Ibid*, 11.

survivability for the systems themselves. The section goes on to discuss the integration of these systems into formations with both manned and unmanned options, and concludes with a mention of the importance of better sensor technology, key to detecting enemy actions.[67]

Initial Concept

Taken together, the conclusions of the protection and firepower projection analyses, and the review of existing operating concepts, create something like an operational needs statement. In order to offset an advantage in enemy mass, a future firepower projection system need not be well protected so long as it is part of a larger formation which affords it a type of complementary protection. This system can have a unique method of protection, but if it is unique, it will only work against a narrow set of threats. The effects of its fires must be diverse, and must also aid in self-preservation when needed. A destructive capability is necessary in the absence of a defeat capability. The system must be mobile and rapidly deployable in order to project combat power effectively, thus negating enemy A2-AD capabilities. It should have a long-range precision capability, and it should be small, light, potentially autonomous, and have a low logistical requirement.

With these design specifications in mind, the author researched existing systems and emerging technologies to determine whether or not existing programs could meet the systems' needs. Ultimately, a blend of an existing program in development and a non-existent system coalesced in the form of an initial concept. The existing program is the Hawkeye Howitzer program, and the non-existent system is an artillery delivered swarm UAV concept.

[67] US Army, *Army Operating Concept*, 37.

AM General demonstrated its Hawkeye Howitzer at the 2016 AUSA conference in Washington DC. At its core, this system is a HMMWV with a 105mm howitzer mounted in the bed of the vehicle. The howitzer can traverse on a 360-degree turret, and the HMMWV has stabilizing legs which descend and provide a steady base from which to fire, negating the requirement to dig-in spades during occupation of the piece. The system is light (2,400 pounds), requires user-level maintenance for most issues, and has electronically controlled traverse and elevation for the tube. The system currently requires a crew to load rounds, like a conventional howitzer.[68]

The delivery platform for this initial concept is based primarily on the Hawkeye Howitzer, with some slight modifications. The firing mechanism on all vehicles will be fully automated, requiring no crew intervention for loading rounds or selecting types of munitions, fuze settings, or charges. A future platoon will have 4 howitzer trucks, 3 of which will be fully autonomous and slaved to the movement patterns of the single manned HMMWV in the platoon. Each howitzer section will work with an associated ammo truck, which will be fully automated for all 4 sections. Thus, in a platoon of 8 vehicles, only 1 will have a crew.

The second part of the initial concept is the family of munitions. The initial concept is a blend of the Fire Shadow loitering munition, the Excalibur howitzer munition, and the Perdix drone swarm program, with other capabilities added.

Fire Shadow is a rail launched, folding fin missile with long range, high endurance, and the ability to loiter in a target area prior to transitioning to a terminal guidance phase. The missiles

[68] Defence Blog, "AM General displays new Hawkeye lightweight 105 mm howitzer at AUSA 2016," *Defence Blog*, October 3, 2016, http://defence-blog.com/army/am-general-display-new-hawkeye-lightweight-105-mm-howitzer-at-ausa-2016.html.

are billed as high precision and low collateral damage, with the ability to retarget in flight. This means that they are either capable of terminal guidance using coded laser energy, or that they can receive updated GPS coordinates for a target while in flight. Based on the stated ability to engage mobile targets, it is likely that the munition has the capability for either GPS or laser guidance in the terminal attack phase.[69]

The Excalibur munition is a howitzer launched precision munition with GPS guidance. The munition has fins which fold out from the body after launch, which allow for course corrections in flight. This helps to shape the munition's trajectory and minimizes the circular error of the munition at the target. The munition is GPS guided only.[70]

The final piece of existing technology which contributes to this paper's initial concept is the Perdix drone swarm. A pod attached to an aircraft delivers these drones at a designated operating altitude. Once deployed, the drones communicate with one another to dictate flight paths and altitudes in order to accomplish a set of pre-determined missions. The swarm requires no human input to accomplish its mission, and when members of the swarm cease functioning in flight, or break apart from the swarm, the drones remaining in the swarm communicate with one another to change their flight patterns, compensate for the gap, and still accomplish the mission.[71]

The author combined all these ideas together to come up with the Artillery Delivered Swarm System (ADSS) concept. The ADSS is a family of two munition types, a visual sensor

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[69] Lockheed Martin, "Fire Shadow Loitering Munition," *Lockheed Martin*, 2017, http://www.lockheedmartin.com/us/products/cdl-systems/about-us/projects/fire-shadow-loitering-munition.html.
[70] Raytheon, "Excalibur," *Raytheon*, 2017, http://www.raytheon.com/capabilities/products/excalibur/.
[71] Kyle Mizokami, "The Pentagon's Autonomous Swarming Drones Are the Most Unsettling Thing You'll See Today," *Popular Mechanics*, January 9, 2017, http://www.popularmechanics.com/military/aviation/a24675/pentagon-autonomous-swarming-drones/.

platform, and a platform with a visual sensor and a laser target designator. The author envisioned a munition fired from a howitzer which deploys folding-fin wings at a designated altitude. Once the wings deploy, an onboard propeller keeps the munition in flight, and a camera rotates down from the body, protected during launch, in order to view the battlefield. The first drone to deploy takes commands in real-time from an operations center, and coordinates the efforts of all other deployed drones in order to accomplish a given mission. Since none of the drones are armed (they are ISR platforms only), the author also envisioned a recovery capability wherein they could return to a firing point for refueling and basic maintenance.

The combination of autonomous platoons of the Hawkeye Howitzer, together with the ADSS concept, comprise this project's initial concept. Once developed, the author sought to develop a scenario which would test this initial concept in a near-future Agincourt.

Operational Decision Game

The ADSS capability would be important to provide the real-time intel required to execute the kind of mobile, forward based defense in depth I have planned.[72]

--Respondent 10, Kaliningrad Transit: US Future vs. Russia Current

The purpose of the case study portion of this project was to determine how to offset a military capability. With respect to Agincourt, France's military capability was mass, and England's offset to mass was its employment of protected fires as a way to achieve an antiquated version of air land battle. In this instance, the "why" of the offset is more important than the

[72] *Kaliningrad Transit*, Future Version, Respondent 14, Field Grade Officer, February 22, 2017.

"what." England's offset strategy succeeded because it maximized the effectiveness of its projected firepower while protecting its firepower projection through systems with integrated and collaborative protection. This created an imbalance in targeting efforts between the French and the English, which minimized the contribution of France's mass to a relative combat power analysis, while boosting the contribution of England's archers to the same metric.

Next, this project explored the "how" of this imbalance. Through an analysis of relative protection abilities, and absolute firepower project capability, a picture of required qualities emerged. Coupled with existing operating concepts, these qualities formed the basis of a design framework. After matching this design framework with existing and emerging technologies, the author developed an initial concept for the modern analogue to England's 15th century longbow.

With this concept defined, the author developed a decision game set in the modern or near-future era which sought to reproduce the dynamics of Agincourt, but not the battle itself. This is a key distinction.[73] Modern doctrine and technology render moot the tactics of Agincourt, so the decision game was intended to produce a situation where the same type of overmatch found at Agincourt might work, even if the composition of forces and battlefield layout differed.

[73] There are many reasons why a modern recreation of Agincourt, with tanks taking the place of cavalry, howitzers replacing longbowmen, and infantry fighting vehicles (IFV) replacing men-at-arms, would not make sense. An attempt to recreate the "squishing" effect which rendered the French men-at-arms unable to raise their arms is not realistic because IFVs do not fight like knights. Another example is that with modern advances in maximum ranges of all weapon systems, employing artillery along the flanks of maneuver forces does not help to achieve the same kind of combined arms benefit that the English enjoyed at Agincourt. An employment like this would fail to take advantage of a howitzer's range advantage when compared to a tank or IFV, and would expose this relatively exposed portion of a friendly formation to an enemy envelopment. Furthermore, envelopment is more likely now than it was in 1415 due to advances in methods for command and control such as radios, increasing dispersion and the number of possible sub-formations without sacrificing an inordinate amount of control.

Design

With the intended overmatch condition in mind (mass versus multiple forms of protected and integrated firepower), the author developed a Baltic scenario where an American light infantry battalion with artillery and attack aviation support must defend against a Russian mechanized and armored force with limited organic indirect fire, and no aerial fires (see Appendices A and B for more details). The author presented respondents with two games: one where both America and Russia have extant technologies, and another in which America employs the future artillery concept described in the "Initial Concept Design" section of this paper.

With Agincourt in mind, the author thought that the initial concept's capabilities would allow the defenders to place an engagement area on the enemy, (as opposed to waiting for the enemy to drive into a pre-planned engagement area), thus controlling the terrain and forcing the enemy to choose certain routes of advance which would provide an advantage to the defending force. Furthermore, the author thought that the automated nature of the artillery delivery systems would provide protection, in the form of survivability, through speed: rapid occupation and displacement between fire missions would reduce the effectiveness of both counterbattery fire and direct fire counterattack against friendly artillery. Finally, the author thought that having autonomous delivery systems would give the decision game respondent more flexibility in methods of employment, or proximity to enemy forces, because of the mitigated hazard of friendly human casualties.

To test these assumptions, the author chose a section of terrain with many natural obstacles (rivers and tree lines) designed to favor the defense. The author thought that the presence of the Neman River to the north of the decision game's play area, coupled with Russia's stated mission

to seize control of the town of Sakiai, came as close as possible to replicating the effect of canalization between tree lines at Agincourt. Based on Russia's starting position, lack of aerial support, and available routes, their avenues of approach to Sakiai were limited.

Responses and Anonymity

The author distributed the decision game, "Kaliningrad Transit," during the month of February 2017, and received all responses by 2 March 2017. In total, the author received 21 completed games from 16 different respondents (5 respondents played both the "US current" and "US future" versions). The author received 10 responses to the "US current" version, and 11 responses to the "US future" version. Responses varied in depth from text-only answers to a portion of the questions, to complete responses with a graphic COA.

The level of pertinent experience varied across the pool of respondents. Two of the respondents were O-5s (one of whom is retired), one of the respondents was the author's instructor, and the remaining 13 respondents were the author's peers. Many of the respondents have extensive professional experience in the realm of combined arms warfare, while others have only a peripheral relationship to the subject. The author kept the experience levels of respondents in mind when considering their feedback.

After receiving all responses, the author compiled the results in a spreadsheet for ease of longitudinal analysis across respondents for a single question, as well as to protect the anonymity of respondents (see Appendix C).[74] With all this in mind, the author sought to answer three questions through analysis of the responses:

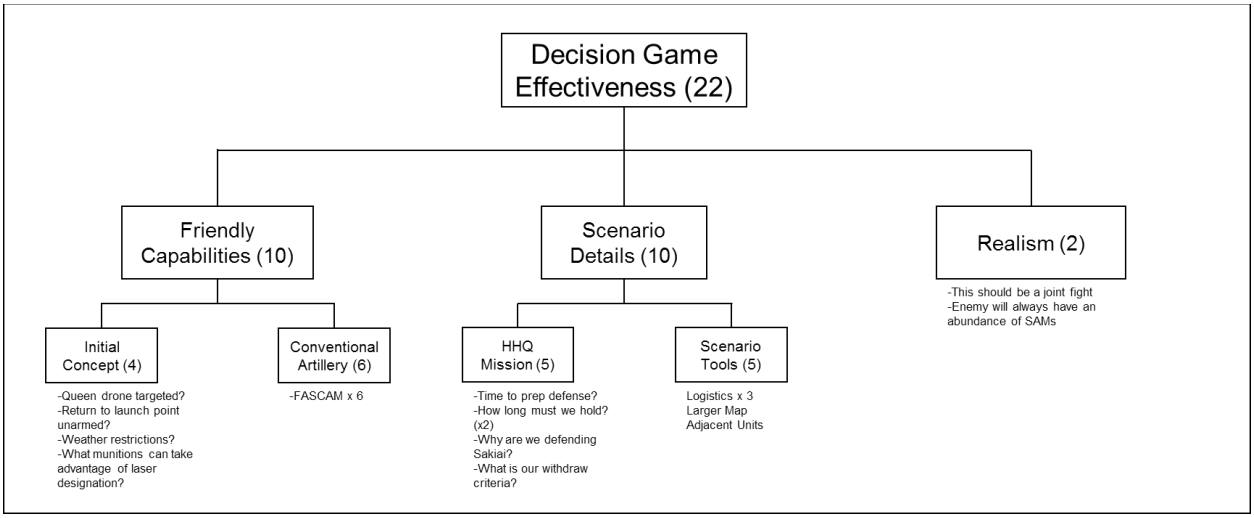
[74] Each respondent name was replaced with a reference number. The only portion of retained data with any connection to the original authors is any hand drawn graphics. With the exception of forensic handwriting

1. Was the decision game an effective method for evaluating the initial concept?
2. Did the initial concept provide an advantage in achieving an offset to enemy mass when compared to a baseline artillery capability?
3. With all other conditions of the decision game remaining the same, how could the initial concept change in order to provide a more effective offset to enemy mass?

Decision Game Effectiveness

Based on responses regarding the composition of the decision game, the game served as an effective tool to evaluate the initial concept. In general, the largest categories of feedback for the decision game fall into three categories: friendly capabilities, scenario and mission details, and realism. See Figure 1 for a summary of responses related to the game itself.

Figure 1: Responses Related to Decision Game Effectiveness



With respect to friendly capabilities, the decision game failed to clarify a sufficient amount of detail regarding either the initial artillery concept or existing friendly systems. Respondents

analysis, the author believes that this will preclude identification of respondents based on given responses, thus preserving anonymity.

came from a wide variety of backgrounds, which may explain why six solutions included the use of FASCAM, which is not an existing family of munitions for the 105mm howitzer. While the game was intended to encourage ingenuity on the part of the respondents, relying upon them to come up with capabilities for the initial concept to make it more effective, some of the feedback in this regard reveals that there was insufficient information to begin with. For example, speculation that the queen would be shot down immediately reveals that the description of the initial concept failed to sufficiently explain the difference between the queen drone and other drones, namely that there is none.[75]

Beyond a deficiency in technical details, many respondents also identified shortcomings in the scenario itself. Many were unclear on the higher headquarters mission as it concerns a time-dimension for the defense, or whether or not friendly forces could withdraw. Other questions regarded the availability of logistics and the location of adjacent units with respect to the scenario's battlespace. While logistics was not a focus of this project, it is certainly an important aspect of modern warfare.

This relates to the final category of critique: realism. Two respondents identified that this scenario is not realistic in that it ignored several tenants of modern warfare, which are that any NATO fight will be joint,[76] and that SAMs proliferate the modern battlefield.[77] To assume away these conditions is unrealistic, which may invalidate feedback for this scenario.[78]

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[75] *Kaliningrad Transit*, Future Version, Respondent 14, Field Grade Officer, February 23, 2017.
[76] *Kaliningrad Transit*, Future Version, Respondent 12, Field Grade Officer, February 23, 2017.
[77] *Kaliningrad Transit*, Future Version, Respondent 14, Field Grade Officer, February 23, 2017.
[78] The author's response to this assertion is that while a NATO fight will certainly be joint, there is always an echelon below which the fight is not joint. In this decision game, the overall fight was joint, but the small portion for which respondents were responsible was US only, and was limited to the identified systems and forces based on intelligence estimations.

Finally, trends in decision game solutions suggest that the game effectively captured the dynamics of Agincourt. Using a subjective assessment of respondent confidence, with pessimism and optimism at opposing ends, there is a wide variance in responses. At the most pessimistic end of the spectrum, respondent 14's central idea (from the theory of victory slide) was "Your drones are going to get shot down,"[79] and respondent 12's central idea was "Any NATO fight is a joint battle with a heavy show of force."[80] Slightly more confident than these "don't bother playing" responses was respondent 4's solution to the current version of the scenario. This respondent's solution was to delay the enemy through purely retrograde action for at least 2 hours until other NATO reinforcements could arrive and reinforce the friendly mission.[81]

Interestingly, respondent 4's solution to the future scenario fell at the polar opposite end of the confidence spectrum. The respondent's friendly mission was to "block" the advancing Russian force while friendly artillery and aviation destroyed key assets and killed tanks.[82] Another very confident solution came from respondent 3 in the current scenario. Respondent 3 believed that there was enough friendly combat power to conduct a mobile defense, hold a company of infantry in reserve, and mount a successful counterattack once the enemy reached a culminating point.[83]

Aside from these outlier responses, the vast majority of solutions fell near the center of an imagined confidence continuum. Specific to the future scenario, some respondents were bold. They relied upon the initial artillery concept working with the unironically named Apache Longbow to destroy enough enemy combat power that a static enemy defense could successfully repel the enemy advance. Others were more cautious, executing an elaborate defense in depth

[79] *Kaliningrad Transit*, Future Version, Respondent 14, Field Grade Officer, February 23, 2017.
[80] *Kaliningrad Transit*, Future Version, Respondent 12, Field Grade Officer, February 23, 2017.
[81] *Kaliningrad Transit*, Current Version, Respondent 4, Field Grade Officer, February 16, 2017.
[82] *Kaliningrad Transit*, Future Version, Respondent 4, Field Grade Officer, February 16, 2017.
[83] *Kaliningrad Transit*, Current Version, Respondent 3, Field Grade Officer, February 23, 2017.

with the goal of disaggregating the enemy enough to allow for a defeat in detail of enemy sub-formations. The average solution to the future scenario relied heavily upon the advanced artillery initial concept to degrade enemy combat power prior to contact with friendly maneuver forces.

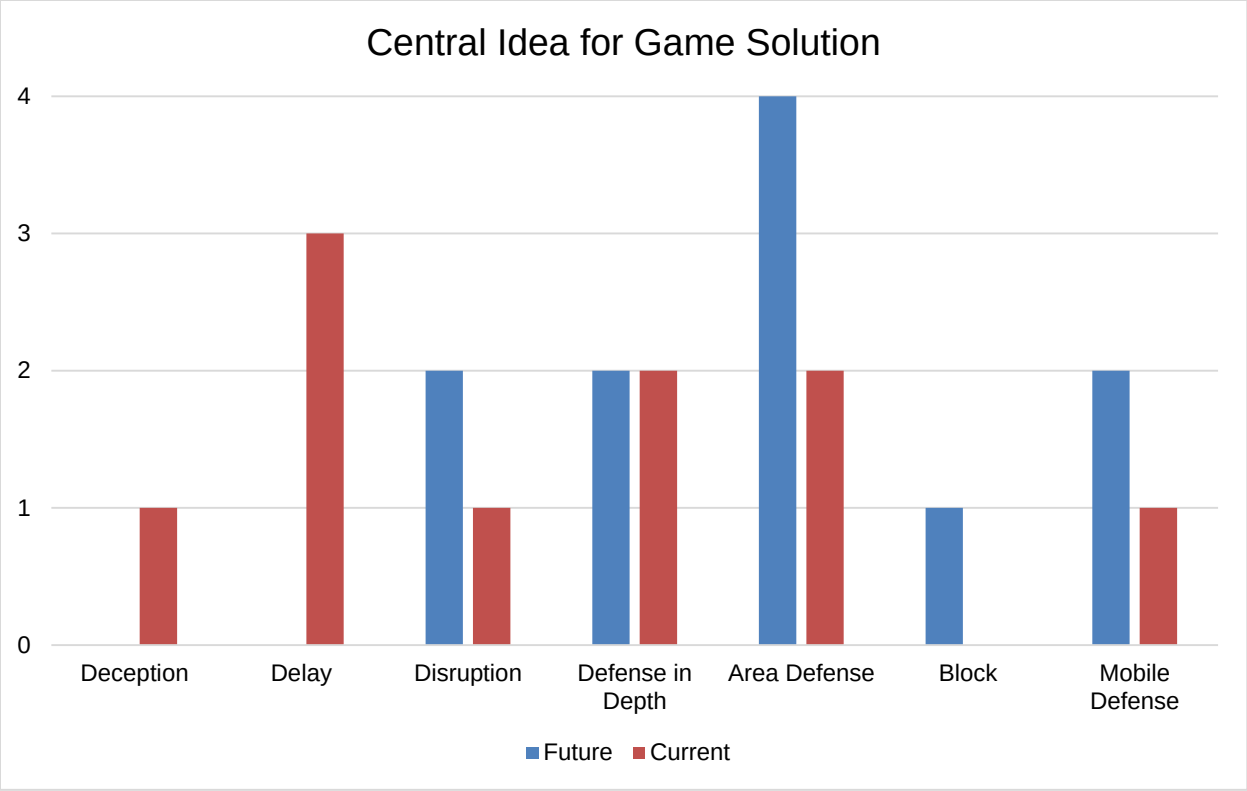
Additionally, none of the solutions anticipated the enemy enveloping friendly defenses. Some suggested the possibility of bypass, but the vast majority envisioned an enemy course of action reliant upon speed to close the distance with friendly forces and offset the range advantage provided by friendly artillery. This envisioned course of action, coupled with friendly reliance upon the artillery concept, closely mirrors the dynamics of Agincourt. For this reason, the decision game appears to have successfully captured the spirit of Agincourt, validating the usefulness of the responses.

Effectiveness of the Initial Concept

Based on solution trends, the respondents believed that the advanced artillery initial concept would assist in overmatching Russia's advantage in mass. This is clear from overall trends from all respondents, and from an analysis of solutions from respondents who played both versions of the game.

Regarding overall trends, the largest indicators for confidence in the system are a willingness to pursue more aggressive tactics in general, and a wider range of perceived of options available to friendly forces. See Figure 2, below, for a graphical representation of central ideas across all solutions.

Figure 2: Central Idea for Decision Game Solution Amongst All Respondents[84]



The categories are arrayed from least aggressive on the left to most aggressive on the right. The chart demonstrates that respondents were more conservative in their responses for the current scenario, and more aggressive in their responses for the future scenario. The mean response for the current scenario fell half way between "Disrupt" and "Defense in Depth," while the mean response for the future scenario fell half way between "Defense in Depth" and "Area Defense."

With respect to a wider range of perceived options in the future scenario, Figure 2 appears to suggest that this is not the case. There were 6 central ideas employed for the current scenario, and only 5 for the future scenario. This does not account for the variety amongst schemes of

[84] There was a degree of subjectivity in this portion of the analysis. Because responses in the solution portion of the game were open-ended and left to the discretion and interpretation of the respondent, results varied. Sometimes respondents stated their central idea very clearly, and in other cases the author needed to interpret a central idea based on a respondent's answers to other questions in their solution.

maneuver for future scenario respondents compared to current scenario respondents. In general, current scenario solutions had similar analytical approaches even though the central ideas varied. Most respondents focused on the enemy's mobility as their primary target, and most friendly courses of action involved methods to limit the enemy's mobility in some way.

This is not the case for responses to the future scenario. These responses exhibit a broader range of problem frames, and a larger variety in friendly courses of action. Some respondents focused on terrain, and solutions which were enemy focused varied in their approaches. Some focused on limiting enemy mobility, while others focused on destroying enemy combat power.

Finally, it is instructive to note how the five respondents who played both games adjusted their strategy when given the advanced artillery system. Four out of five respondents who played both versions demonstrated a much more aggressive attitude in the future scenario.[85] Respondent 2's future scenario solution did not require the destruction of local infrastructure in order to delay the enemy, instead relying on the advanced artillery system to destroy key enemy systems prior to contact with friendly forces.[86] Respondent 3 planned a mobile defense with a deliberate counterattack in the future scenario, whereas the Respondent's solution to the current scenario relied upon a defense in depth.[87] Respondent 4 switched from a delay tactic to a block tactic once given the advanced artillery system, choosing to focus on eliminating enemy capabilities rather than trading space for time.[88] Finally, Respondent 5 viewed the advanced artillery initial concept, paired with attack aviation, as a modified deep air support (DAS) capability in the future scenario,

[85] *Kaliningrad Transit*, Current and Future Versions, Respondent 1, Field Grade Officer, February 16, 2017. The only significant difference between Respondent 1's solution to the current and future versions of the game was that the respondent intended to use the swarm to assist with target identification. All other aspects of the response were virtually indistinguishable.
[86] *Kaliningrad Transit*, Current and Future Versions, Respondent 2, Field Grade Officer, February 23, 2017.
[87] *Kaliningrad Transit*, Current and Future Versions, Respondent 3, Field Grade Officer, February 23, 2017.
[88] *Kaliningrad Transit*, Current and Future Versions, Respondent 4, Field Grade Officer, February 16, 2017.

a marked departure from the respondent's elastic defense approach in the current scenario. Respondent 5 also stressed the importance of holding ground through the application of multiple simultaneous actions on the advancing enemy in the future scenario, as opposed to trading space for time in the current scenario.[89]

With these results in mind, this analysis revisits Tables 1 through 4, populating the initial concept column with feedback gleaned from respondent solutions.

Table 5: Comparative Analysis of Protection Between Advanced Artillery and Russian Indirect Fires

		Longbowman System	Initial Concept	Refined Concept
Principle	**Definition**	Archer, yew longbow, leather jerk and skull cap, 6-foot wood stake	75% autonomous HMMWV mounted 105mm howitzers, swarm munitions with an ISR focus	
Integrated	Protection is integrated with all other activities, systems, efforts, and capabilities associate with military operations to provide strength and structure to the overall protection effort.	Worse than crossbowmen. Crossbowmen were much more heavily armored, owing to the weapon's shorter range and a desire to protect against missile attacks.	Worse than Russian IDF systems. Hawkeye HMMWV sacrifices armor and mobility in exchange for speed, range, and a smaller signature.	
Layered	Protection capabilities should be arranged using a layered approach to provide strength and depth to the overall protection system.	Equal to crossbowmen. A crossbowmen's armor was more robust, but crossbowmen did not employ wooden stakes at Agincourt.	Better than Russian IDF. Because the munitions are also a vehicle system, they are targetable. This reduces the potential targetability of delivery platforms, or at least forces the enemy to divide resources in order to target both.	
Redundant	Redundancy ensures that specific activities, systems, efforts, and capabilities critical for the success of the overall protection effort have a secondary or auxiliary effort of equal or greater capability.	Worse than crossbowmen. At Agincourt, France's crossbowmen had shields, which provided a redundant protection to their plate armor.	Better than Russian IDF. Because 75% of the delivery platforms are autonomous, firing formations can sustain higher casualties with fewer human losses, allowing them to continue mission.	
Enduring	Protection has an enduring quality that differentiates it from defense and specific security operations.	Worse than crossbowmen. A crossbowman could take advantage of a shield much more quickly than a longbowman could take advantage of his wooden stake.	Worse than Russian IDF. It takes time for the swarm to build up, which increases firing unit signature during this process.	
Full-Dimension	Protection is not a linear activity - it is a continuing and enduring activity. Protection efforts and activities must consider and account for threats and hazards in all directions, at all times, and in all environments.	Equal to crossbowmen. Crossbowmen are better suited to immediate reaction and under a wider variety of situations, but England's Longbowmen were better suited to their specific opponent at Agincourt. Wooden stakes offset France's cavalry advantage.	Worse than Russian IDF. Because the advanced artillery system is reliant upon a deployed swarm, it is not as well suited to hasty situation as is a standard armored and tracked vehicle with a mounted howitzer or mortar.	

[89] *Kaliningrad Transit*, Current and Future Versions, Respondent 5, Field Grade Officer, February 16, 2017.

The similarities between the longbow and the advanced artillery system, relative to their respective opposing systems, are clear. The advanced artillery system is more well protected than a similar system in the Russian force in two categories, and less well protected in three, whereas the longbow was equal to its opposing system in two categories and worse in three. Thus, the advanced artillery system has more protection at a system level than did the longbow, but still contributes a negative overall protection value to a composite force.

Table 6: Comparative Analysis of Protection Between American and Russian Forces in the Future Scenario

		English Army	**Initial Concept Force**	**Refined Concept**
Principle	**Definition**	Henry's Army as deployed and employed at Agincourt	All systems and tactics are identical to present day, with the exception of the new Artillery system	
Integrated	Protection is integrated with all other activities, systems, efforts, and capabilities associate with military operations to provide strength and structure to the overall protection effort.	Better than France. All forces employed to achieve a complementary protection effect	Worse than Russia. Even with the advanced artillery system, the level of protection for an airborne infantry battalion paled in comparison to a mechanized brigade.	
Layered	Protection capabilities should be arranged using a layered approach to provide strength and depth to the overall protection system.	Better than France. Complementary nature of protection achieved a somewhat layered quality (enemy targeted with missile fire before melee combat with men at arms)	Better than Russia. With a deployed swarm, Russia had to contend with firepower in two domains (land an air) while only able to fight in one (land).	
Redundant	Redundancy ensures that specific activities, systems, efforts, and capabilities critical for the success of the overall protection effort have a secondary or auxiliary effort of equal or greater capability.	Worse than France. Because of the disparity in number of men at arms, England had no redundancy (no forces held in reserve).	Better than Russia. Because of the way the scenario was designed, the US force had more sources of firepower, and thus diversified its vulnerabilities across multiple sources to mitigate exposure.	
Enduring	Protection has an enduring quality that differentiates it from defense and specific security operations.	Worse than France. England relied upon complementary effects to achieve integrated protection, which is not an enduring quality.	Worse than Russia. The US force can only achieve a high degree of protection once fully deployed. The Russian force is always armored, and thus always protected.	
Full-Dimension	Protection is not a linear activity - it is a continuing and enduring activity. Protection efforts and activities must consider and account for threats and hazards in all directions, at all times, and in all environments.	Worse than France. Although longbowmen had a range advantage over crossbowmen, this advantage would quickly disappear if the commander with longbow did not have time to deliberately deploy his army.	Worse than Russia, for the same reason identified above.	

At a composite force level, the US degree of protection relative to its Russian opponent is no different than England's was relative to France. The only major change is that the US force is less well protected with respect to integration, and better protected with respect to redundancy when compared to England. The nature of the swarm system increases redundancy, but decreases integration because of the physical separation of the swarm from the rest of friendly combat power.

Table 7: Analysis of the Advanced Artillery's Ability to Achieve the Effects of Fires in the Future Scenario

		Longbowman System	**Initial Concept**	**Refined Concept**
Effect	**Definition**	Archer, yew longbow, leather jerk and skull cap, 6-foot wood stake	75% autonomous HMMWV mounted 105mm howitzers, swarm munitions with an ISR focus	
Deceive	Deliberately mislead an adversary, thereby causing the adversary to take specific actions that will contribute to the accomplishment of the friendly mission.	A longbow formation's place on the battlefield, relative to other friendly or enemy formations, could deceive an opponent. However, longbowmen did not possess organic capabilities to aid deception.	Rapid mobility, autonomous drivers, swarm size, and conventional munitions combine to produce excellent deceptive capability	
Defeat	Occurs when an enemy force has temporarily or permanently lost the means or the will to fight.	Very adept at defeating opponents, especially those without sufficient protection.	Not good at defeating armor organically due to lack of munitions designed to do so (except DPICM, which is all but outlawed)	
Delay	Slow the time of arrival of enemy forces or capabilities or alter the ability of the enemy to project forces or capabilities.	Volleys can force an enemy commander to make a decision which he would not otherwise make.	Very capable of delaying because a swarm forces the enemy to act in response to its presence	
Destroy	Physically render an enemy force combat-ineffective until it is reconstituted.	Unlikely to achieve destruction independently due to the protective effects of armor.	Not good at destruction for the same reason that it is not good at defeating armor	
Disrupt	Upset an enemy's formation or tempo, interrupt the enemy's timetable, or cause enemy forces to commit prematurely or attack in a piecemeal fashion.	Most applicable effect to what England's longbowmen achieved at Agincourt.	Very disruptive. Most likely to achieve disruption with this concept over any other effect.	
Divert	Draw the attention and forces of an enemy from the point of the principal operation.	Not possible through offensive action alone. Required complicity on the part of the enemy to avoid targeting longbowmen.	Swarm is an excellent diversion. The enemy must commit resources to the swarm, taking resources away from a potential friendly main effort.	
Neutralize	Render enemy personnel or materiel incapable of interfering with a particular operation.	Certainly possible, given the right set of battlefield conditions.	Could apply to certain types of enemy formations.	
Suppress	Temporarily degrade the performance of a force or weapon system below the level needed to accomplish the mission.	Certainly possible, given the right set of battlefield conditions.	Could apply to certain types of enemy formations.	

The primary differences in firepower projection capabilities between the longbow and the advanced artillery concept are found in their respective abilities to deceive, defeat, and divert. Deception and diversion are aided by the presence of the swarm, and the development of special types of munitions which can produce vastly different signatures than could a longbow arrow. On the other hand, longbow arrows were well suited to piercing some armors and killing horses, enabling longbow formations to defeat enemy formations. With the exception of DPICM, there is nothing in the conventional inventory, or in the advanced artillery concept, which can have a reliable defeating effect on a mechanized or armored formation.[90]

[90] A full consideration of DPICM exceeds the scope of this paper, but the author makes the assumption that the Army will continue to avoid the use of DPICM due to its tendency to produce duds, and because the scenario from this decision game takes place in a friendly partner nation, and not on enemy soil.

Table 8: Analysis of the US Force's Ability to Achieve the Effects of Fires in the Future Scenario

		English Army	Initial Concept Force	Refined Concept
Effect	**Definition**	Henry's Army as deployed and employed at Agincourt	All systems and tactics are identical to present day, with the exception of the new Artillery system	
Deceive	Deliberately mislead an adversary, thereby causing the adversary to take specific actions that will contribute to the accomplishment of the friendly mission.	Not achieved. Henry's deployment was very straightforward. If France could not see the longbowmens' wooden stakes from far away, then that would be a type of deception.	Achieved. Several respondents included feints from the north to draw Russia's attention away from friendly combat power.	
Defeat	Occurs when an enemy force has temporarily or permanently lost the means or the will to fight.	Achieved. France's cavalry lost the will to fight against England's archers before the charge even began, and the rest of France's formation lost the means to fight after sustaining heavy casualties.	Achieved. Most respondents believed the system could support targeting efforts that would allow the Apaches to destroy key enemy systems.	
Delay	Slow the time of arrival of enemy forces or capabilities or alter the ability of the enemy to project forces or capabilities.	Achieved, but because of France's decision to send individual battles forward, and not because of any English firepower projection action.	Achieved. From passive acts, such as the deployment of the swarm to active acts such as kinetic targeting, the Russian force was delayed.	
Destroy	Physically render an enemy force combat-ineffective until it is reconstituted.	Not achieved by firepower projection.	Not achieved due to imbalance between force ratios.	
Disrupt	Upset an enemy's formation or tempo, interrupt the enemy's timetable, or cause enemy forces to commit prematurely or attack in a piecemeal fashion.	Achieved by England's longbowmen throughout the entire battle.	Achieved continuously.	
Divert	Draw the attention and forces of an enemy from the point of the principal operation.	Unclear. France elected not to target England's longbowmen, despite the impact of the longbowmen on the battle.	Many solutions included a task to divert some of Russia's combat power so that the force could be defeated piecemeal.	
Neutralize	Render enemy personnel or materiel incapable of interfering with a particular operation.	Achieved. Helped to compress France's formation so much that it was unable to fight effectively.	Achieved, specific to enemy ADA systems.	
Suppress	Temporarily degrade the performance of a force or weapon system below the level needed to accomplish the mission.	Achieved because of the same compression outcome identified above.	Achieved, for any targeted system, due to precision provided by the swarm.	

The only major difference between what Henry's army achieved and what the aggregated solutions to the future scenario achieved is that present armies are much more well suited to deceiving their opponents. This is likely more attributable to the way modern armies fight with an emphasis on dispersion and a reliance on long range communications and mission command, giving rise to more situations under which deception might be possible. With that said, both

England and the US force in the future scenario were equally adept at achieving the other fires effects, with one notable exception. Many respondent solutions included a diversion of enemy attention through either maneuver or firepower projection, which was not one of Henry's achievements at Agincourt.[91]

Based on these results, it is safe to conclude that the advanced artillery initial concept inspired confidence in the respondents who played this decision game. In general, future scenario solutions were more aggressive than current scenario solutions. Those who employed the initial concept viewed it as a way to effectively target specific enemy capabilities. Recalling the "Target Selection and Discrimination" section of the case study in this paper, proper and uninhibited target selection and prosecution was one of the primary reasons why England's army was able to offset France's advantage in mass at Agincourt.

In terms of a direct comparison between systems, the longbow and the advanced artillery concept were very similar. Both had similar liabilities, and provided similar benefits. From a composite force perspective, both forces enjoyed similar offsets, with the noted exception that England drew on integration for protection whereas the US force from the future scenario drew on redundancy for protection.

Ways to Improve the Initial Concept

The author received 11 solutions to the future scenario version of the decision game. From those 11 solutions, most of the recommendations for ways to improve the concept fell into three

[91] This shows that it only takes 16 modern field grade officers to exceed the tactical prowess of King Henry V.

categories: organic precision targeting capability for armor defeat, signature management, and kill chain optimization.

By far, the most common comment was that the concept should include a kinetic kill capability. 8 of the 11 responses included some type of comment relating to kinetic kill. Respondent 10 specified the need for an anti-armor munition,[92] a sentiment shared by 6 other respondents. In addition to requesting a kinetic kill capability for armored vehicles, Respondent 11 also suggested a kinetic kill capability for counter-air, suggesting that an armed swarm "could be used for counter UAV via midair collisions and swarming the target and blowing up."[93] This would be ideal for targeting very advanced UAVs, especially if friendly swarm munitions are inexpensive in comparison.

The concept of signature management came up with respect to both the Hawkeye Howitzers and the ADSS. The initial concept specified a recovery capability for the drones, making them reusable, and Respondent 3 astutely identified that any returning drone could be tracked, thus revealing the location of the recovery team, firing unit, or both if they are co-located.[94] The other side of signature management regarded the swarm drones themselves. Respondent 14 identified the need for low observable technology to reduce successful tracking of the drones during launch, and thus the system firing them.[95] Respondents 15[96] and 5[97] both suggested that each drone should have a range of signature options from no signature to a signature for a formation of conventional aircraft. The ability to choose a signature based on the battlefield

[92] *Kaliningrad Transit*, Future Version, Respondent 10, Field Grade Officer, February 22, 2017.
[93] *Kaliningrad Transit*, Future Version, Respondent 11, Field Grade Officer, February 16, 2017.
[94] *Kaliningrad Transit*, Future Version, Respondent 3, Field Grade Officer, February 23, 2017.
[95] *Kaliningrad Transit*, Future Version, Respondent 14, Field Grade Officer, February 23, 2017.
[96] *Kaliningrad Transit*, Future Version, Respondent 15, Field Grade Officer, February 10, 2017.
[97] *Kaliningrad Transit*, Future Version, Respondent 5, Field Grade Officer, February 16, 2017.

situation would provide a commander with ways to enhance military deception in support of an overall concept of operations, or as a way to draw or avoid enemy targeting attention as needed.

Finally, there were two main suggestions related to kill chain management. The first came from Respondents 3 and 5, who both suggested that AH-64s should have the ability to either incorporate the drone swarm into their independent hunter/killer targeting process,[98] or gain control of a portion of the swarm for independent control.[99] Either option would increase targeting options, and would expedite the kill chain with respect to AH-64 targeting. The other comment regarding the kill chain came from Respondent 12, who identified that a swarm of hundreds of drones all sending full motion video to an operations center would very quickly exceed the bandwidth capability of any expeditionary headquarters.[100] This respondent's suggestion was to use GMTI for tracking and targeting purposes, which would also reduce bandwidth requirements for a supported operations center.

Having validated the decision game and the usefulness of the initial concept, and armed with suggestions for how to improve the concept, this analysis moves on to a refined concept for an advanced artillery system.

[98] *Kaliningrad Transit*, Future Version, Respondent 3, Field Grade Officer, February 23, 2017.
[99] *Kaliningrad Transit*, Future Version, Respondent 5, Field Grade Officer, February 16, 2017.
[100] *Kaliningrad Transit*, Future Version, Respondent 12, Field Grade Officer, February 23, 2017.

Refined Concept

Swarm becomes a ground-based DAS asset (like air interdiction).[101]

--Respondent 5, Kaliningrad Transit: US Future vs. Russia Current

With longbows at Agincourt as a benchmark, this analysis recalls Tables 5 through 8 in identifying how to modify the advanced artillery initial concept in order to achieve a similar level of offset to mass. While this analysis can incorporate modified or new capabilities, the evaluative function of decision game responses is not available, as the author only administered decision games for the initial concept. With that in mind, any evaluations for the modified concept are based on the author's contextually informed, yet subjective, opinion.

Design

The advanced artillery initial concept was a combination of two ideas, a semi-autonomous and highly mobile fleet of delivery platforms, and the swarm-capable family of reconnaissance munitions. A revision of the initial concept now considers each of these sub-ideas in turn.

The two most applicable comments for refinement of the delivery platform are signature management and system capabilities in a real-world joint fight. Although the discussion of signature management applied mostly to the munitions themselves, Respondent 5 identified a desire to have antenna farms or other means of confounding enemy targeting efforts for ground-based systems.[102] Table 5 identified integration and full-dimensionality as two of three principles of protection where the initial artillery concept was less well protected than similar Russian

[101] *Kaliningrad Transit*, Future Version, Respondent 5, Field Grade Officer, February 16, 2017.
[102] *Ibid.*

systems. The introduction of some type of signature confusing capability, such as decoy antenna farms or signature minimization technologies, would assist in closing the gap on this relative deficiency. Finally, drones in the refined concept will not require recovery, as they did in the initial concept. This will help to preserve the location of delivery systems, or recovery teams, by eliminating a possible way for enemy forces to track friendly movements and use that knowledge to enhance their targeting efforts.

To make the delivery platform more well-suited for a true joint fight, this analysis recalls the Army's Operating Concept. Long range and precision were two of the most commonly used adjectives when describing fires capabilities. While precision is largely the province of individual munitions, increasing the size of the howitzer from 105mm to 155mm, or expanding the family of delivery platforms to include a type of light-weight missile delivery system, would assist in extending the system's range. The loiter capability of the initial concept munition family already increases range beyond that of a conventional 105mm, but the modifications described above would extend potential range even further.

With respect to the family of munitions, several modifications would enhance the overall artillery system. First, adding a kinetic kill capability to some, or all, drones would enhance the concept by providing an organic destruction mechanism for armored targets. Like the R-series hellfire munitions, drones in this refined concept could have both a precursor shaped charge and fragmentation sleeve on each munition, providing a targeting option for both soft and hard targets.[103] This analysis does not recommend a percentage of drones which should have a kinetic kill capability, but rather stipulates that the capability is necessary, regardless of how it is met.

[103] Joakim Kasper Oestergaard Balle, "AGM-114 Hellfire Missile," *Aeroweb*, April 8, 2015, http://www.fi-aeroweb.com/Defense/AGM-114-Hellfire-Missile-System.html.

Next, a modification to signature management would greatly assist in a wide range of friendly capabilities. A low signature capability would increase survivability of delivery platforms, individual drones, and the overall swarm, by mitigating enemy targeting efforts. The ability to produce a large, or over-large, signature when desired would assist with tasks such as identifying enemy IADs locations for eventual defeat, or providing military deception as to the size of a friendly airborne element. Switching a signature from over-large to low observable following an ineffective enemy counter-air action could also provide a false positive for enemy targeting efforts, causing them to take an action which they might believe to be lower risk than it is in reality. In turn, this would provide an exploitation opportunity for friendly forces.

Finally, comments regarding video downlink bandwidth concerns raised by Respondent 14 are certainly valid, especially in a contested environment where the risk of enemy electronic disruption or intercept is high. To address this concern, the refined concept maintains a video capability on board every aircraft, but relies upon swarm logic, managed by the queen, to dictate which feeds are provided to the operations center, and when. The refined concept will also include other forms of battlefield sensing such as GMTI and synthetic aperture radar (SAR), and others.

As with the above discussion regarding kinetic kill capability, this paper does not recommend an exact method for distributing these sensors across the swarm. Part of the advantage of the longbowman in 15th century England was his relative cost advantage compared to other types of soldiers. Adding more capabilities to each drone makes the overall cost rise, especially since there is no longer a need for recovery. An academic optimization project would likely help to identify an effective distribution of system capabilities based on swarm size and anticipated threat environments, but such a project lies beyond the scope of this paper.

This analysis turns to Tables 5 and 7 in order to speculate on the effectiveness of the degree of protection for this system, and its ability to achieve a variety of fires effects. Since Tables 6 and 8 require a composite force for analysis, this paper will not revisit them, as there is no decision game to test the advanced artillery refined concept. However, the next section, "Character of Future Combat," will address some of the ways to employ the refined concept, and how it might integrate with certain types of force compositions.

Table 9: Subjective Analysis of Protection for the Advanced Artillery Refined Concept

		Longbowman System	**Initial Concept**	**Refined Concept**
Principle	**Definition**	Archer, yew longbow, leather jerk and skull cap, 6-foot wood stake	75% autonomous HMMWV mounted 105mm howitzers, swarm munitions with an ISR focus	Signature management for delivery platforms and munitions, kinetic kill capability for munitions
Integrated	Protection is integrated with all other activities, systems, efforts, and capabilities associate with military operations to provide strength and structure to the overall protection effort.	Worse than crossbowmen. Crossbowmen were much more heavily armored, owing to the weapon's shorter range and a desire to protect against missile attacks.	Worse than Russian IDF systems. Hawkeye HMMWV sacrifices armor and mobility in exchange for speed, range, and a smaller signature.	Improvement. Making the combined delivery platform and munitions system harder (or easier) to target more fully integrates overall sources of protection to offset an armored advantage.
Layered	Protection capabilities should be arranged using a layered approach to provide strength and depth to the overall protection system.	Equal to crossbowmen. A crossbowmen's armor was more robust, but crossbowmen did not employ wooden stakes at Agincourt.	Better than Russian IDF. Because the munitions are also a vehicle system, they are targetable. This reduces the potential targetability of delivery platforms, or at least forces the enemy to divide resources in order to target both.	Improvement. No change from initial concept, with the exception that advantages are enhanced by signature management capabilities.
Redundant	Redundancy ensures that specific activities, systems, efforts, and capabilities critical for the success of the overall protection effort have a secondary or auxiliary effort of equal or greater capability.	Worse than crossbowmen. At Agincourt, France's crossbowmen had shields, which provided a redundant protection to their plate armor.	Better than Russian IDF. Because 75% of the delivery platforms are autonomous, firing formations can sustain higher casualties with fewer human losses, allowing them to continue mission.	No change from initial concept.
Enduring	Protection has an enduring quality that differentiates it from defense and specific security operations.	Worse than crossbowmen. A crossbowman could take advantage of a shield much more quickly than a longbowman could take advantage of his wooden stake.	Worse than Russian IDF. It takes time for the swarm to build up, which increases firing unit signature during this process.	Improvement to initial concept due to advantages afforded by signature management.
Full-Dimension	Protection is not a linear activity - it is a continuing and enduring activity. Protection efforts and activities must consider and account for threats and hazards in all directions, at all times, and in all environments.	Equal to crossbowmen. Crossbowmen are better suited to immediate reaction and under a wider variety of situations, but England's Longbowmen were better suited to their specific opponent at Agincourt. Wooden stakes offset France's cavalry advantage.	Worse than Russian IDF. Because the advanced artillery system is reliant upon a deployed swarm, it is not as well suited to hasty situation as is a standard armored and tracked vehicle with a mounted howitzer or mortar.	Improvement to initial concept. Having delivery platform options such as decoys or signal spoofing will degrade the effectiveness of enemy targeting.

Without the benefit of peer critical analysis, all the recommended changes to the initial concept appear to either increase or maintain the degree of protection for the advanced artillery system. Most of the improvements are the result of signature management, which should increase the swarm's survivability. The swarm's health is closely tied to delivery platform protection, so any measures taken to protect the swarm naturally protect the delivery platforms as well.

Table 10: Subjective Analysis of the Advanced Artillery's Ability to Achieve the Effects of Fires

		Longbowman System	**Initial Concept**	**Refined Concept**
Effect	**Definition**	Archer, yew longbow, leather jerk and skull cap, 6-foot wood stake	75% autonomous HMMWV mounted 105mm howitzers, swarm munitions with an ISR focus	Signature management for delivery platforms and munitions, kinetic kill capability for munitions
Deceive	Deliberately mislead an adversary, thereby causing the adversary to take specific actions that will contribute to the accomplishment of the friendly mission.	A longbow formation's place on the battlefield, relative to other friendly or enemy formations, could deceive an opponent. However, longbowmen did not possess organic capabilities to aid deception.	Rapid mobility, autonomous drivers, swarm size, and conventional munitions combine to produce excellent deceptive capability	Added kinetic kill capability may enhance deceptive potential if the enemy believes the drones do not have such a capability.
Defeat	Occurs when an enemy force has temporarily or permanently lost the means or the will to fight.	Very adept at defeating opponents, especially those without sufficient protection.	Not good at defeating armor organically due to lack of munitions designed to do so (except DPICM, which is all but outlawed)	The addition of a kinetic kill capability substantially improves defeat potential.
Delay	Slow the time of arrival of enemy forces or capabilities or alter the ability of the enemy to project forces or capabilities.	Volleys can force an enemy commander to make a decision which he would not otherwise make.	Very capable of delaying because a swarm forces the enemy to act in response to its presence	No change to initial concept.
Destroy	Physically render an enemy force combat-ineffective until it is reconstituted.	Unlikely to achieve destruction independently due to the protective effects of armor.	Not good at destruction for the same reason that it is not good at defeating armor	Addition of a kinetic kill potential
Disrupt	Upset an enemy's formation or tempo, interrupt the enemy's timetable, or cause enemy forces to commit prematurely or attack in a piecemeal fashion.	Most applicable effect to what England's longbowmen achieved at Agincourt.	Very disruptive. Most likely to achieve disruption with this concept over any other effect.	No change to initial concept.
Divert	Draw the attention and forces of an enemy from the point of the principal operation.	Not possible through offensive action alone. Required complicity on the part of the enemy to avoid targeting longbowmen.	Swarm is an excellent diversion. The enemy must commit resources to the swarm, taking resources away from a potential friendly main effort.	Adding capabilities to the swarm makes them more expensive and valuable. This reduces the potential to use them as a target in order to achieve a diversion.
Neutralize	Render enemy personnel or materiel incapable of interfering with a particular operation.	Certainly possible, given the right set of battlefield conditions.	Could apply to certain types of enemy formations.	No change to initial concept.
Suppress	Temporarily degrade the performance of a force or weapon system below the level needed to accomplish the mission.	Certainly possible, given the right set of battlefield conditions.	Could apply to certain types of enemy formations.	No change to initial concept.

With the exception of achieving a diversion, the refined concept either maintains or enhances the advanced artillery concept's ability to achieve the identified effects of projected fires. Most of the improvements are a function of the added kinetic kill capability, which makes destruction, defeat, and deception more possible. Diversion potential does not decrease because of some deficiency in the munitions, but rather because adding more capabilities to each munition, such as a warhead and a signature management system, makes each drone more expensive to produce. Even if fiscal responsibility is not an issue, the knowledge that the drones have many capabilities, as opposed to just a few, makes it more difficult for a commander to sacrifice them.

Taken together, all these refinements help to identify a collection of capabilities which a modern analogue of the 15th century longbow needs to successfully offset an advantage in enemy mass. The delivery platform should rely upon deception, speed, and a low signature in order to enhance survivability. These platforms should be part of a larger system which compensates for a relatively low degree of organic protection, benefiting from a complementary protective effect. The platform's munitions must assist in protecting the platform by drawing enemy targeting resources, and must also have the capacity to achieve a wide variety of battlefield effects. These effects should run the gamut from non-kinetic effects such as deception and diversion to the highly kinetic effects of destruction and defeat. In order to aid in expanding the range of possible effects, the munitions should have variable electronic signature potential, and kinetic kill potential for soft or hard targets. The strength of the swarm is reliant on its size, so the delivery mechanisms must have enough organic ordnance to deploy a sufficiently large swarm, even in austere environments.

Character of Future Combat

With a list of advanced artillery system capabilities in mind, this analysis attempts to anticipate some of the more favorable operating environments for employing the system. Having identified a proper environment, this analysis next suggests methods for friendly employment and potential friendly force compositions. Finally, the analytical portion of this paper concludes with a review of combat verities in order to determine whether or not the conclusions of this analysis warrant a modification to those same verities.

Since the decision game portion of this project used a Russian opposing force, this analysis now considers a Russian operating environment. While Russia is researching several autonomous systems such as the humanoid robot to replace an individual soldier,[104] and semi-autonomous tanks,[105] many experts also acknowledge that Russia's current military advantage in Eastern Europe means that they would not need to modernize at all in order to successfully invade and hold the Baltic states.[106] With the United States already pursuing 6th generation fighters in order to maintain air supremacy over Russian and Chinese rivals,[107] this analysis continues under the assumption that the US and NATO will successfully maintain an air advantage over Russian opponents, which will translate into a successful IADS defeat prior to an invasion to restore Baltic sovereignty.

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[104] John Dyer, "Ivan the Terminator: Russia Is Showing Off Its New Robot Soldier," *Vice*, May 26, 2016, https://news.vice.com/article/ivan-the-terminator-russia-is-showing-off-its-new-robot-soldier, 2.
[105] Andrew Williams, "Russian Military Unveils T-14 Armata Semi-Autonomous Tank," *Robot Business Review*, July 24, 2015, https://www.roboticsbusinessreview.com/security/russian_military_unveils_t_14_armata_semi_autonomous_tank/, 2.
[106] Dyer, "Ivan the Terminator," 4.
[107] Kyle Mizokami, "U.S., NATO Already Planning the Next Generation of Fighter Jets," *Popular Mechanics*, September 27, 2016, http://www.popularmechanics.com/military/research/a23069/us-nato-6th-generation-fighter-planes/.

The ideal operating environment for the advanced artillery system and its swarm is one in which a gap in IADS coverage exists. Individual SAM and AAA weapons may persist, but the most sophisticated enemy radar and missile systems would not contribute to the fight. The enemy would likely enjoy a defensive posture, having successfully seized control of key terrain within the Baltics, and a fight for air supremacy between NATO forces and Russia would be ongoing.

In this operating environment, the advanced artillery system could operate from very small to very large echelons with good effect. At the very large end, the system could replace existing artillery battalions in order to provide direct support or general support. Planners would incorporate the swarm into an overall concept of fires, and air force counterparts could include it on the air tasking order, airspace coordination order, or both. Units employing the swarm would execute survivability moves just like a conventional artillery unit would, and could also deploy closer to the forward line of friendly troops because of the autonomous Hawkeye's rapid ability to emplace into and displace from a firing point.

The advanced artillery system also presents an opportunity for planners to experiment with new task organizations for expeditionary forces. For example, the Marine Corps could incorporate a platoon of advanced artillery into a counter A2/AD Company team for rapid employment. An example task organization would be a platoon of infantry, a platoon of advanced artillery, a friendly ADA system, and a conventional UAS. A Company team with this composition would function well because of the complementary protection afforded to the howitzers by the infantry platoon, and the resulting intelligence gathering and kinetic kill capability of an expeditionary swarm. The attached friendly ADA system would protect the force from enemy counterbattery or air-to-surface fires in instances where enemy A2/AD systems attempt to contest friendly positions.

With potential employment options in mind, this paper now considers the totality of the analysis done to this point in evaluating a list of combat verities. Renowned military historian COL(R) Trevor Dupuy described 13 "Timeless Verities of Combat" in his book *The Evolution of Weapons and Warfare*.[108] From this list, the author identified three which likely need revision based on the results of this analysis. They are that successful defense requires depth and reserves; superior strength always wins; and that firepower kills, disrupts, suppresses, and causes dispersion.

Agincourt provides a prime example of an instance where a successful defense did not require depth or a reserve. In fact, the case study portion of this analysis suggests that one of the reasons England won at Agincourt was because they had virtually no depth or reserve. Henry arrayed his forces so as to inflict as much simultaneous firepower against the enemy as possible. Holding forces in reserve, or creating depth would have limited his ability to mass fires and effectively disrupt France's attack.

The best way to revise this verity is to replace the terms "depth" and "reserves." Both of these words are methods aimed at achieving a desired characteristic. It is more useful to state the verity in terms of the desired characteristic. In this case, depth and reserves provide redundancy

[108] Dupuy, The Evolution of Weapons and Warfare, 326-333. His verities of combat are:

1. Offensive action is essential to a positive combat result
2. Defensive strength is greater than offensive strength
3. Defensive posture is necessary when successful offense is impossible
4. Flank or rear attack is more likely to succeed than frontal attack
5. Initiative permits application of preponderant combat power
6. Defenders' chances of success are directly proportional to fortification strength
7. An attacker willing to pay the price can always penetrate the strongest defense
8. Successful defense requires depth and reserves
9. Superior strength always wins
10. Surprise substantially enhances combat power
11. Firepower kills, disrupts, suppresses, and causes dispersion
12. Combat activities are slower, less productive, and less efficient than anticipated
13. Combat is too complex to be described in a single, simple aphorism

to a defense. Based on this, and the results of this paper's analysis of protection, the author would re-write this verity as "Successful defense requires redundancy and protection."

The next verity in need of revision is that "superior strength always wins." Again, Agincourt shows that this is not the case. France possessed more combat power than did England, but used it poorly. By sending successive battles composed of portions of its force, France ceded its overall advantage in mass by fighting three successive micro-battles where they were actually at a relative disadvantage in overall mass. Their superior strength did not win because of a failure to take advantage of the potential to achieve an overmatch.

In the same way, Respondents who played the decision game portion of this analysis widely recognized the need to disrupt Russia's force in both the current and the future scenario. Many concepts included plans to force the Russian column to deploy early or seek multiple simultaneous routes of advance. Some defensive plans even included an offensive arm where precision strikes degraded Russian combat power prior to contact with friendly forces. All these respondents recognized that strength did not matter if it could not effectively target the friendly center of gravity. For this reason, the author would re-write this verity to say "Superior strength always wins when properly employed."

The final revision is not a criticism as much as it is an expansion of the existing definition. COL(R) Dupuy said that "firepower kills, disrupts, suppresses, and causes dispersion." While he certainly did not intend to list out every possible tactical task or effect of fires, all the listed transitive verbs use the friendly force as the subject, and the opposing force as the direct object. As the decision game review portion of this paper reveals, this is only half of the equation. Many respondents used the position of friendly units, or even the swarm itself, to draw the enemy's

attention. Military deception is a much larger portion of conventional operations than it was in 1980 when COL(R) Dupuy published his book. Emerging trends in hybrid warfare demonstrate the effectiveness of tactical tasks which run the gamut from non-kinetic to fully kinetic. As a result, this paper recommends adding one more item to this verity. With revision, it would read "firepower kills, disrupts, suppresses, causes dispersion, and draws attention." This revision emphasizes the importance of military deception, while also reinforcing the axiom that "smoke draws fire."

Counterarguments and Concerns

One potential criticism of this project's recommendation is that it may be the "fruit of the poisonous tree," to borrow a legal metaphor. According to the Common Operating Precepts of Joint Operations found in *JP 3-0*, modern operations "integrate joint capabilities to be complementary rather than merely additive" and "achieve and maintain unity of effort within the joint force."[109] Because the test for this project's concept used a sterilized scenario free of the modern realities of joint combat, any conclusions drawn from the results of the test are underinformed and potentially not useful. This argument certainly has merit. The author deliberately designed the scenario to test the potential value of sufficiently protected firepower projection against mass, while purposefully removing other sources of combat power from the equation. Neither force had attached engineering capability, air support, naval support, cyber capabilities, or any other source of combat power present on a modern battlefield.

The author's response to this argument is that the decision game was not meant to evaluate how well this system would operate in a fully-integrated, multi-echelon joint force. The purpose

[109] Department of Defense, *Joint Operations*, JP 3-0 (Washington, DC: Department of Defense, January 17, 2017), I-3.

of the decision game was to determine whether or not the advanced artillery initial concept could achieve the same type of offset to an advantage in mass that the English longbow did at Agincourt. If it could, the results evaluation portion of this paper sought to determine if the means of achieving this offset were the same or different, and if this mattered. Although it is not a substitute for a fully developed decision game, the previous section of this paper, "Character of Future Combat," attempted to answer the question of whether or not the advanced artillery refined concept would fit well in a modern joint environment. Based on the conclusion to that section, the answer is most likely that the refined concept has the potential to work in most operating environments that are free of a robust IADS network.

Another potential argument against the advanced artillery refined concept is that it is too reliant on a large swarm of drone aircraft for both protection and firepower projection. The absence of conventional munitions with a kinetic kill capability for moving armored targets[110] means that it falls upon the swarm to inflict casualties when facing an armored foe. Furthermore, IADS, SAM, and AAA proliferation amongst many of America's near-peer competitors means that it will be difficult to build a large enough swarm to overwhelm an enemy's defenses. Even if a sufficiently large swarm made it to a target area, a well defended area such as Kaliningrad could reduce the swarm to an ineffective saturation level without much trouble due to the relatively exposed nature of the drones (slow and low) compared to other airborne platforms.

In response to this argument, the author acknowledges that while the advanced artillery refined concept might possess many of the same qualities as the English longbowmen, it will never

[110] In the future, modifications to the Excalibur munition could fill this gap. If the munition were scaled down to a 105mm variant, given an added laser guidance capability, and equipped with a shaped charge warhead, this would provide a redundant kinetic kill capability to the advanced artillery system. However, without these changes, the Excalibur lacks the requisite guidance system and armor penetration capability to serve as an effective substitute.

be the panacea that the longbow was for nearly 100 years. With the exception of nuclear weapons, there will likely never be another combat system to achieve as disproportionately large of an advantage as the longbow achieved for England. Modern combat power, and thus modern vulnerabilities, are distributed over a much more diverse force. The loss of a single type of system might be problematic for a modern commander, but there is often a combination of other systems at his or her disposal which could achieve a similar and redundant effect if needed.

With that in mind, this analysis acknowledges that even if all drones in the swarm were outfitted with low observable technologies, it is still likely that a sufficiently advanced enemy air defense network could effectively target the swarm. The advanced artillery concept is not meant to win every battle the way that longbowmen did for England during the 100 Years War. It is meant to offset an advantage in mass, likely in the form of armored ground vehicles. As the previous section identifies, the swarm will be more effective in some situations than in others. Furthermore, the swarm would likely deploy alongside other systems such as high altitude precision strike aircraft and long range missile systems which could assist in an IADS defeat mission. Once defeated, the range of possible swarm employment options would expand for a friendly commander.

The final possible argument considered in this analysis against the advanced artillery concept is that it may be cost ineffective. As the refined concept section describes, every additional capability added to the drones likely makes them more expensive. Having more capable drones might expand a commander's options, but would also make a commander less willing to sacrifice that capability, even with a virtually unlimited budget. A likely scenario to imagine is that a commander knows an enemy has a robust IADS network, but cannot pinpoint exact IADS locations. The commander could deploy a swarm in order to find the location of the enemy systems

as they target the swarm, but this will also deplete stores of swarm drone munitions. This places the friendly commander on the horns of a dilemma between a short-term gain for a long-term loss, or potentially flying friendly manned aircraft into a well defended area of operations.

There are two possible responses to this concern. The first is that optimization of the swarm would mitigate the cost prohibitive nature of a sacrificial action such as allowing the swarm to be targeted for the purpose of increasing friendly intelligence. As the previous section discussed, part of the process for developing this project would require the need to develop several different swarm drones, each with their own set of capabilities. It would then be up to a commander and his or her staff to determine not only which types of drones to request for a certain campaign, but then how much of each type of munition to dedicate to a specific mission within the campaign. This is relatively similar to the choice amongst conventional artillery munitions that commanders make today. One potential way to increase the range of options would be to have relatively inexpensive "slick" drones with very limited capabilities, deployed specifically to draw enemy attention in support of developing an intelligence picture. Even in an active swarm with an offensive task, a certain percentage could be "slick" in order to increase the overall swarm volume and oversaturate a potentially unexpected SAM or AAA response.

The other response to the concern over unit cost would be a much broader approach. Although it does not discuss acceptable losses in autonomous systems, the *U.S. Army Robotic and Autonomous Systems Strategy* indicates that working with autonomous systems will increase force protection by reducing human exposure to risk. It is only logical to conclude that the autonomous systems would bear that risk, since the overall enemy threat level is unlikely to decrease. Though not explicitly stated, this could suggest a strategy where commanders are more aggressive in their deployment of autonomous systems since the loss of such a system would not necessarily degrade

mission accomplishment, or require a personnel recovery operation.[111] However, neither the Marine Corps Operating Concept nor the Army Operating Concept addresses the potential to fight in an environment where losses in unmanned systems are not only expected, but factored into the planning process. To embrace such a reality would require a paradigm shift across the department of defense. It is beyond the scope of this paper to determine whether or not such a paradigm shift is necessary, or even beneficial. With that said, there are certain advantages to fighting with non-recoverable systems. In Iraq, insurgents offset an advantage in coalition technology for over a decade by using improvised explosive devices (IEDs). In many cases, coalition partners developed tactics and modified their equipment to fight against weapon systems (IEDs), diverting resources which might otherwise have gone towards fighting the insurgents who emplaced them. The advanced artillery system can be thought of as an analogue to flying IEDs, forcing the enemy to divert resources to address the swarm in lieu of other forms of friendly combat power.

Conclusions

God is not on the side of the big battalions, but on the side of those who shoot best.

--Voltaire, Personal Notebook, 1735-1750

The French had every right to expect that they would win at Agincourt. They outnumbered the English, they had far more and better trained men-at-arms, they were well-nourished and well-rested, and they defended along Henry's route of retreat back to England. Yet despite all these

[111] Maneuver, Aviation, and Soldier Division Army Capabilities Integration Center, *The U.S. Army Robotic and Autonomous Systems Strategy*, (Fort Eustis, VA: U.S. Army Training and Doctrine Command, March, 2017), 12.

advantages, they suffered one of the most lopsided defeats in military history because of a misapplication of combat power and a masterful control of both the battlefield and the battle on the part of their English opponents.

From this battle, the effectiveness of well-protected firepower projection stands out as the most relevant lesson. Running a close second is the importance of effective targeting. England benefitted from France executing poor target selection criteria at Agincourt. Although England did not intend this consequence, modern armies can learn from this by deliberately presenting an enemy force with a highly visible but less than ideal targeting option.

These two concepts contributed to the concept of the advanced artillery system. By presenting the enemy with a less than ideal target, a swarm of drones, the enemy is forced to dedicate resources such as time, surveillance, and possibly ordnance to addressing the swarm. This dedication of resources takes pressure off of primary friendly maneuver forces, even if the enemy only commits non-kinetic resources to the swarm.

Influencing the enemy's targeting decisions allows a friendly commander to mitigate risk, especially when teaming with unmanned systems such as the drones in the swarm concept. The swarm assumes more risk, leaving manned ground forces with less risk with which to contend. This in turn gives a friendly commander more options, and creates the possibility to fight in a larger range of conditions, and with potentially worse relative combat power ratios than he or she could with purely manned systems.

One of the largest obstacles to the implementation of such a system is the current paradigm of combat power preservation and general risk aversion. In order to fully reap the benefits of MUM-T, future doctrine and leader philosophies may need to embrace phrases such as "acceptable

losses" or even "planned losses" when referring to unmanned systems. Success on the battlefield of the future may depend on a willingness to sacrifice inexpensive systems in order to gain a temporal advantage, deplete enemy resources, or even to improve intelligence estimates.

The advanced artillery system concept is not a cure-all for any future combat scenario. It is a system designed to offset an advantage in enemy mass. This enemy mass could be manned, unmanned, or both. This system is also not designed to offset other advantages such as air superiority, cyber dominance, or control of the information environment. A multi-dimensional approach to future warfare will likely require innovative solutions to offset potential enemy advantages in these disciplines, along with many others. While preparation for any possibility is always the goal, that goal is not always possible. It is only through continued study and forecasting that friendly forces can avoid complete surprise in combat.

Appendix A – Kaliningrad Transit: US Current / Russia Current

Kaliningrad Transit

ASP Decision Game

(US current / Russia current)

Organize a defense and repel a mechanized attack with a lighter but more versatile force

Road to Crisis 2024

- Russian border agents continue their regular practice of delaying by up to three weeks Lithuanian freight which arrives in Kaliningrad and must transit to Lithuania.
- One delayed shipment contained server equipment for Lithuanian company Mediafon, which expanded to include both telecom and cybersecurity divisions in the last 5 years.
- Two weeks into the delay of this shipment, the port authority of Kaliningrad experiences a cyberattack. All databases are compromised, including the protected records regarding Russian military logistics in the province. Port servers are so overwhelmed by an accompanying DDoS attack that port officials cannot conduct daily operations of receiving new shipments or embarking commercial ships of Russian origin.
- Russian officials publicly accuse Lithuania of sponsoring the attack, with no available evidence to support their claim of attribution. Russian forces in Kaliningrad mobilize and stage near their border with Lithuania for what Russia calls a "planned mobilization exercise."
- Lithuanian officials deny the allegation and publicly condemn Russia's inflammatory mobilization along their shared border.

Russian delay of Lithuanian freight

Port delays cause massive traffic jams

Road to Crisis 2024

- Over the next three weeks, Russia regains control of its servers at the port of Kaliningrad. Lithuania reports receiving daily small-scale attacks from Russian forces along their shared border in the form of harassing fire or radio blackout. Russia rejects these accusations, accusing Lithuanian border patrols of inciting hostilities, and attempts to refocus the international discussion on the economic impact from a three-week cyberattack on their port.
- Lithuania requests NATO assistance to maintain peace along the border, and to begin negotiations with Russia for a peaceful easing of tensions.
- America's GRF (1/325 PIR) deploys from training exercise IRON SENTINEL in Poland to the Kaunas International Airport in Lithuania. The remainder of the DIV begins mobilization at Ft. Bragg, with a response time of 96 hours from notification.
- Russia condemns America's involvement, and declares that it has a right to both respond to this overt aggression and prevent future attacks targeting its port, suggesting that maintaining a sovereign route between Kaliningrad and their satellite state of Belarus is necessary to ensure stable future relations between the two nations.
- Diplomatic channels between all nations remain open throughout the mobilization and deployment process. Prior to the commencement of hostilities, all nations sign a non-nuclear agreement should fighting commence.

Lithuanian border patrol

Russian border mobilization

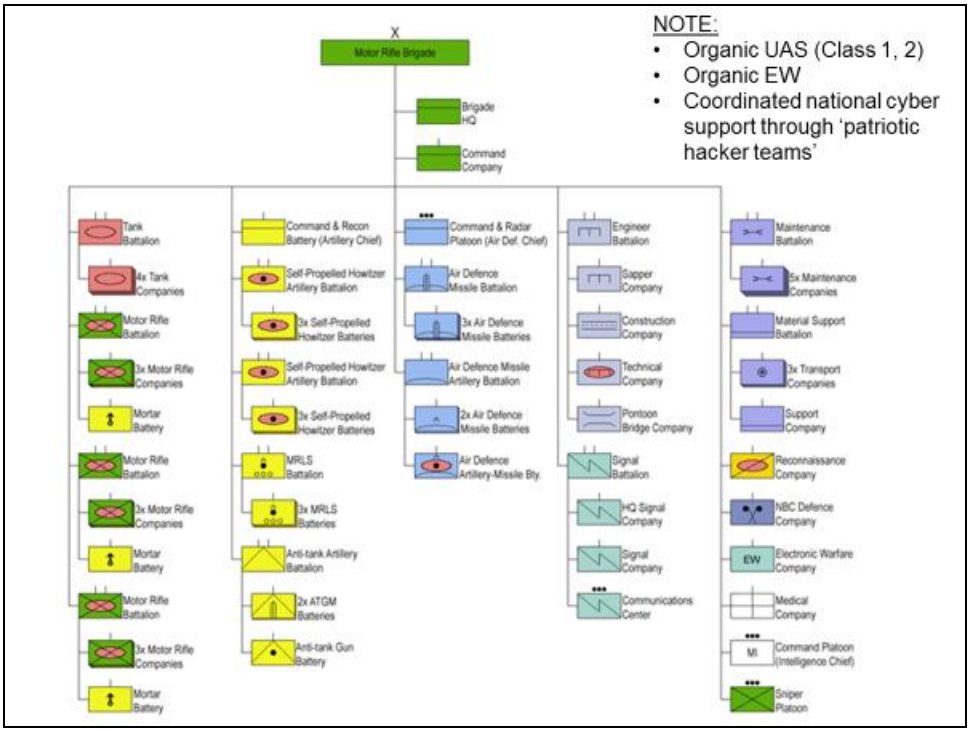
Russian Conventional Force Posture

- Intelligence reports that Russia established JTF Kaliningrad in anticipation of formal conflict composed of the following forces:
- 76th Guards Motor Rifle Brigade and 3rd Aerospace Defense Brigade form the main body
- Estimated enemy strength
  - 375 x tanks
  - 950 x armored fighting vehicles
  - 275 x artillery pieces
  - 16 x MI-24
  - 8 x Su-27
  - 6 x SCUD / SCARAB
  - 10 x S-100 SAMs

MI-24

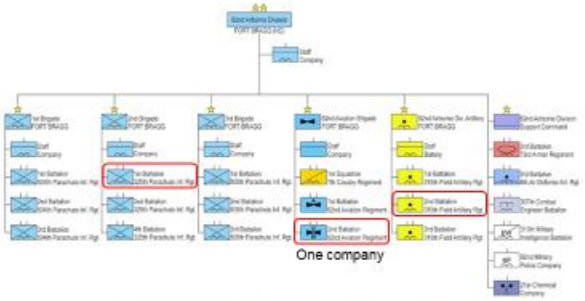
Su-27

SCUD



American Force Posture

- 1/325 has recently arrived at Kaunas International Airport in Lithuania with 100% combat power.
- The Battalion is augmented by A/2/82 AVN and 2/319 FA, both of which were with 1/325 during IRON SENTINEL in Poland.
- Breakdown of combat power:
  - 1/325 - HMMWVs only (they are a light infantry battalion). 600 people's worth of actual combat power, plus 9 x 60mm mortars, 3 x 81mm mortars, and 2 x 120mm mortars in the battalion.
  - Aviation company - 16 x AH-64s for attack purposes only (no lift)
  - Field artillery battalion - 18 x 105mm howitzers (M119) and standard types of munitions (HE, WP, IR ILLUM, SMK, FASCAM).
  - There are no organic cyber capabilities in 1/325 or the units with them. The battalion does have 4 x ravens, but nothing more robust. For EW, each unit has dismounted systems to jam RCIED signals, but nothing substantial regarding offensive capability.



One company

1/325 PIR

Lithuanian & NATO Posture

- Lithuania mobilizes Iron Wolf Brigade along border with Kaliningrad in response to hostilities against border patrols.
- Norwegian, Dutch, and German navies conduct freedom of navigation exercises on both the Baltic Sea and North Sea sides of Denmark, effectively isolating Russian naval forces in the Baltic sea and preventing further Russian reinforcement by sea.
- Germany, Poland, Britain, and six others plan immediate multinational exercise TIGER STRIPE in eastern Poland for an estimated 50,000 troops.
- A SPMAGTF composed of 1/6, companies from 2d Tanks, 2d Tracks, 2d LAR, and 2nd CEB (along with an LCE from 2d CLR, and ACE from 2d MAW) are en route to the Netherlands to provide reinforcements if needed.

Lithuanian Order of Battle

Norwegian Fridtjof Nansen-class frigate and patrol boat

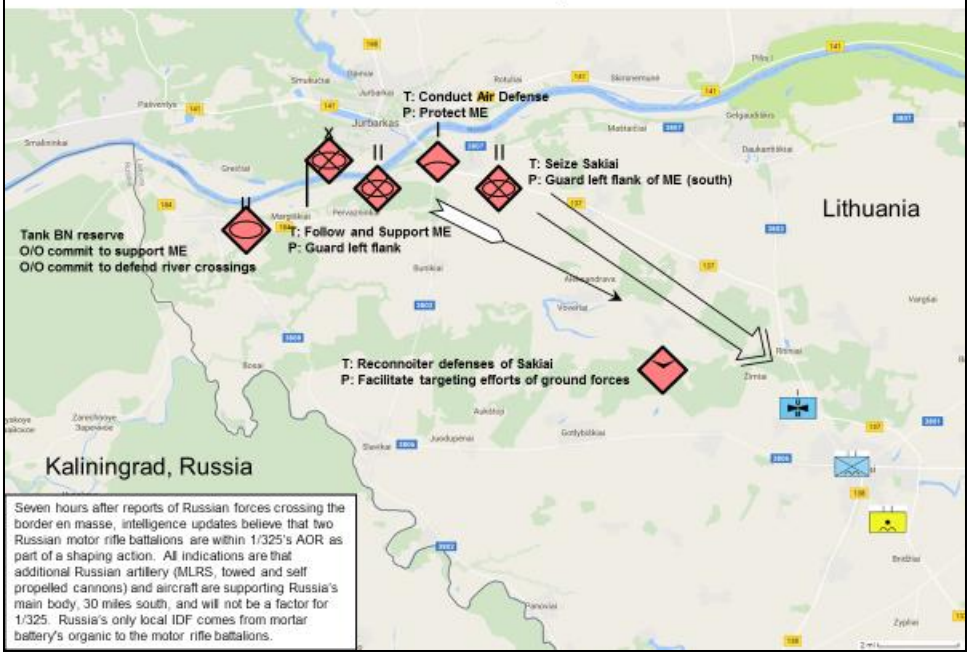
Russian Action

- On the morning of 25 February 2024, Lithuania cellular networks cease to function, and all internet traffic routed through servers in Russia or Belarus ceases.
- Lithuanian border patrols provide sporadic updates, indicating that massive Russian troop concentrations have crossed Lithuania's western border in multiple locations, heading east. Lithuanian headquarters does not receive similar reports from their border with Belarus, but continue to monitor the border closely.
- After four hours, updated reports indicate that the preponderance of Russian forces crossed the border near Vilkaviskis, apparently focused on securing A7, A16, and A3 in order to ensure a secure route between Kaliningrad and Belarus. Thus far, all heavy Russian artillery and air support is IVO Vilkaviskis.
- Lithuanian headquarters requests that 1/325 defend Sakiai from a contingent of Russians advancing east just south of the Neman river. Reports indicate that no Russian forces have moved north of the Neman river, and all indications suggest that Russia is attempting to secure a direct route between Kaliningrad and Belarus through force.

Russian Tank Attack

Battery of Russian Artillery

Situation Update



Seven hours after reports of Russian forces crossing the border en masse, intelligence updates believe that two Russian motor rifle battalions are within 1/325's AOR as part of a shaping action. All indications are that additional Russian artillery (MLRS, towed and self propelled cannons) and aircraft are supporting Russia's main body, 30 miles south, and will not be a factor for 1/325. Russia's only local IDF comes from mortar battery's organic to the motor rifle battalions.

Solution Set

Fill in the problem framing, COA Graphic/narrative, and theory of victory slides

References on key terms are provided

Theory of Victory

Synopsis of your Central Idea	Necessary Capabilities
Application & Integration of Military Functions	Spatial & Temporal Dimensions

Problem Framing

Problem Statement (incl. list of key facts and assumptions):
Tensions Between Current Conditions and Desired Conditions:
Elements that Must Change to Achieve the Desired Conditions:
Opportunities and Threats to Achieving the Desired Conditions:
Limitations:

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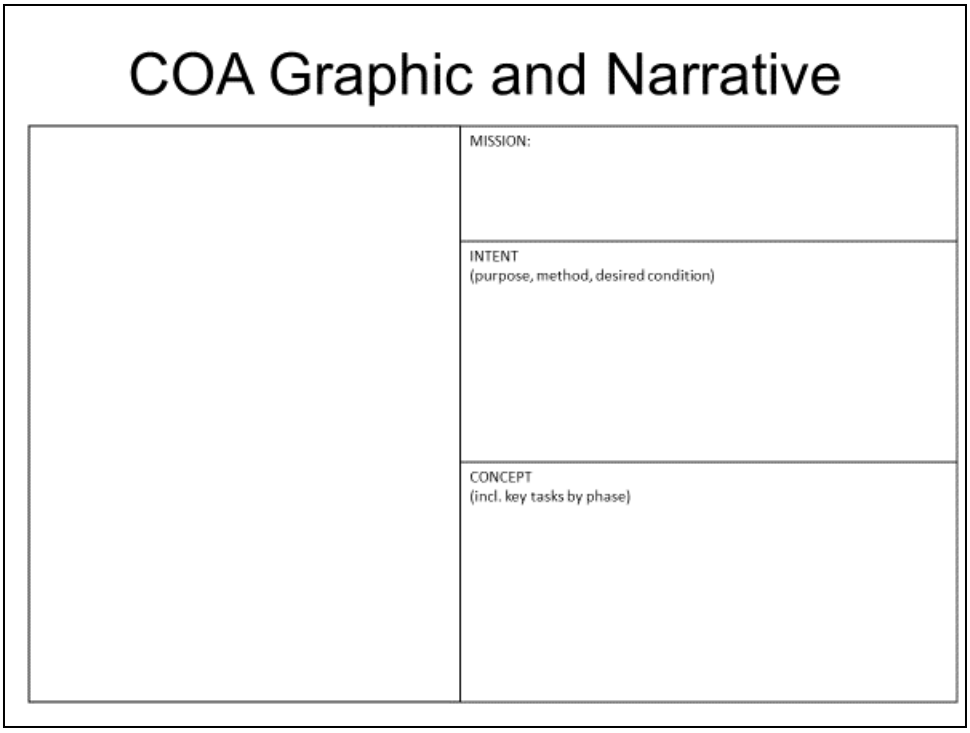
COA Graphic and Narrative
MISSION:
INTENT
(purpose, method, desired condition)
CONCEPT
(incl. key tasks by phase)

Appendix B – Kaliningrad Transit: US Future / Russia Current

Kaliningrad Transit

ASP Decision Game

(US future / Russia current)

Organize a defense and repel a mechanized attack with a lighter force built around next-generation artillery capabilities

Road to Crisis 2024

- Russian border agents continue their regular practice of delaying by up to three weeks Lithuanian freight which arrives in Kaliningrad and must transit to Lithuania.
- One delayed shipment contained server equipment for Lithuanian company Mediafon, which expanded to include both telecom and cybersecurity divisions in the last 5 years.
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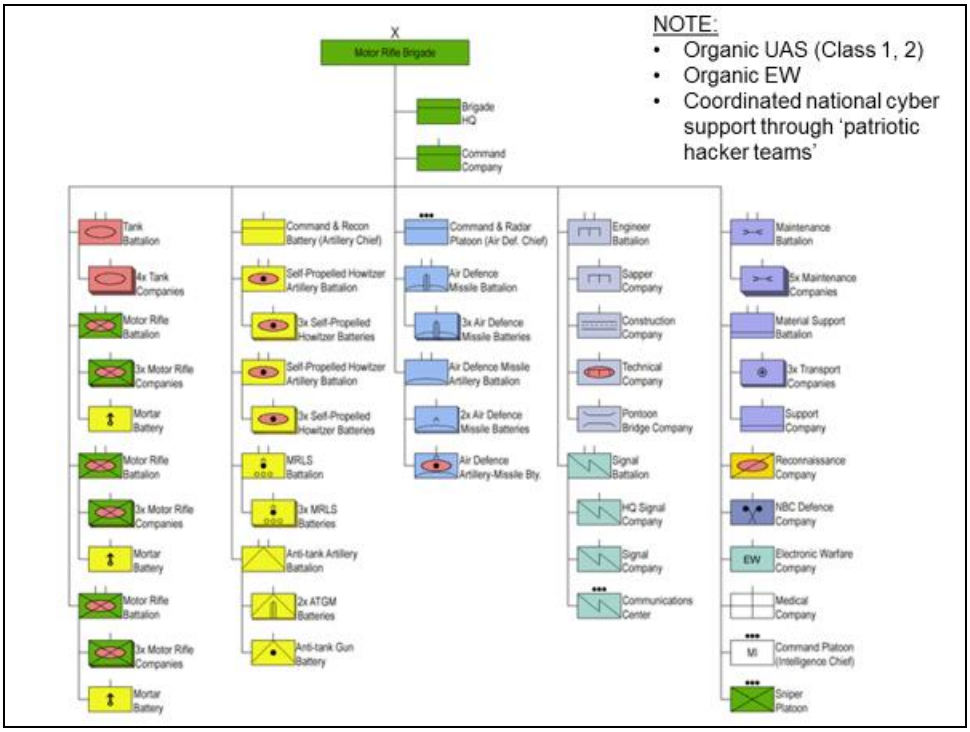

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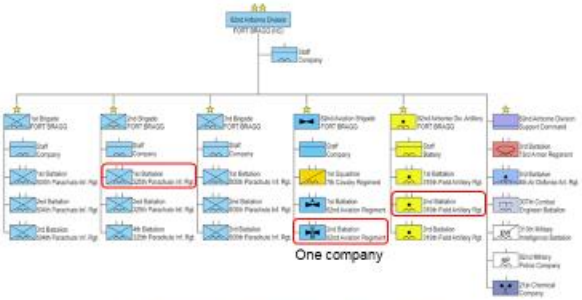
  - Aviation company - 16 x AH-64s for attack purposes only (no lift)
  - Field artillery battalion - 18 x 105mm howitzers (M119). 14 of them are autonomous and mounted on the back of a HMMWV. In addition to standard munitions (HE, WP, IR ILLUM, SMK, FASCAM), they have the new types of munitions described on the next slide.
  - There are no organic cyber capabilities in 1/325 or the units with them. The battalion does have 4 x ravens, but nothing more robust. For EW, each unit has dismounted systems to jam RCIED signals, but nothing substantial regarding offensive capability.



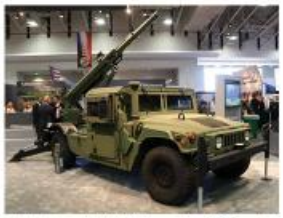
One company

1/325 PIR

Advanced Artillery Systems

- 2/319 FA is outfitted with the army's newest system, the Artillery Delivered Swarm System (ADSS). 400 x D variant, 50 x L variant, as well as a 75% autonomous fleet of HMMWV mounted 105mm howitzers.

"Fire Shadow" (similar concept)



Hawkeye HMMWV (mounted 105mm)

- Family of howitzer launched drones which deploy at altitude and have approximately 1 hour station time.
- The "D" variant has a camera that can sweep 6 km^2 per hour with a 0.5m resolution camera.
- The "L" variant has the same camera, plus a PRF laser for conducting terminal guidance.
- Once on station, the drones form a swarm. Only one drone, designated the "queen" at the TOC, receives human input. The queen controls the rest of the drones to accomplish given tasks. The queen controls flight paths, altitudes, sensor tasks, sorting and labeling of targets, and chooses sensor positions based on enemy activity and terrain.
- Both variants have an autonomous countermeasure system which shuts out all external control if it detects an electronic attack aimed at gaining control of the swarm. Once autonomous, the drones will act on the last confirmed orders, using onboard logic to make decisions when needed, and return to the launch point once they are out of fuel.
- Drones can generate GPS coordinates in a GPS denied environment using inertial guidance systems and advanced imaging software coupled with Army targeting software.
- Once recovered, a drone can be refueled and checked at 10-level for reemployment in 45 min.

Lithuanian & NATO Posture

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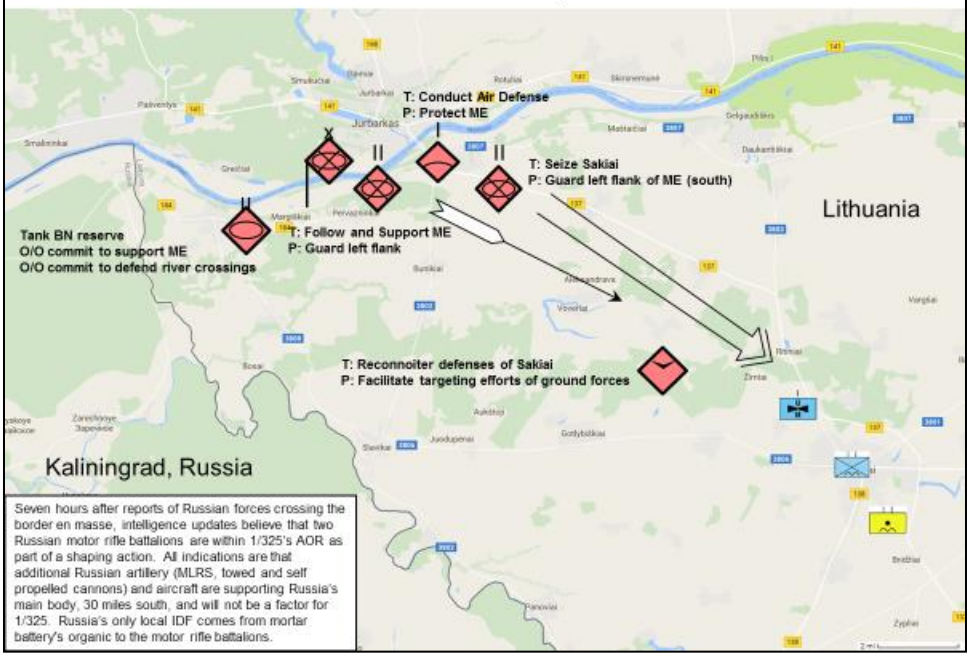

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JP 5-0, Figure III-6

COA Graphic and Narrative

	MISSION:
	INTENT (purpose, method, desired condition)
	CONCEPT (incl. key tasks by phase)

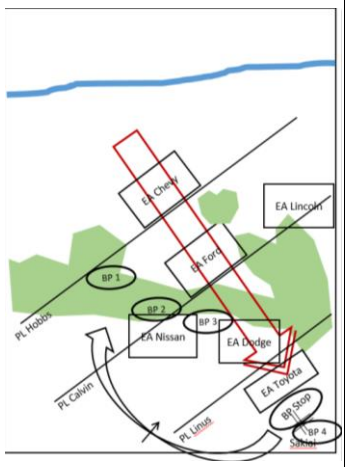
Advanced Artillery Capabilities

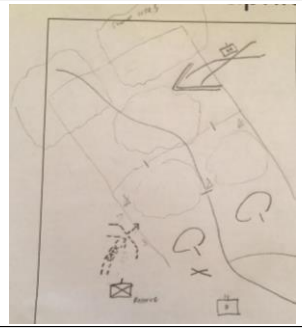
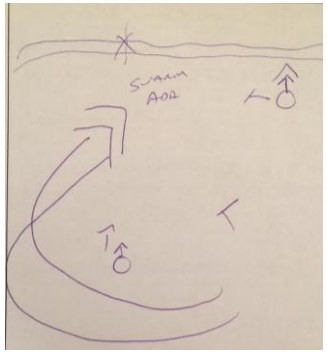
Which of the capabilities described on the Advanced Artillery slide were useful in this scenario?
Which of the capabilities described on the Advanced Artillery slide were not useful in this scenario?
What additional capabilities would make the Advanced Artillery concept more effective in offsetting an enemy's advantage in numbers or armor?
Additional comments:

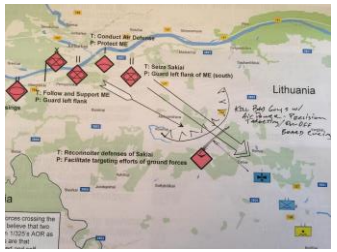
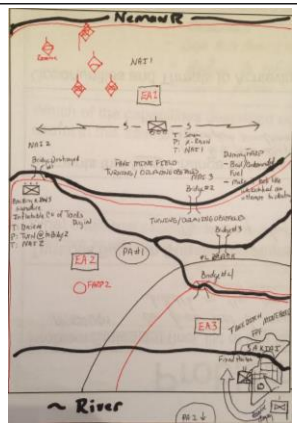
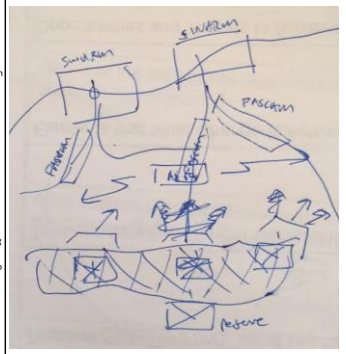
Appendix C - Table of Respondent Solutions to Kaliningrad Transit Decision Games

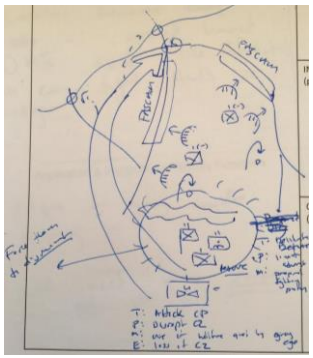
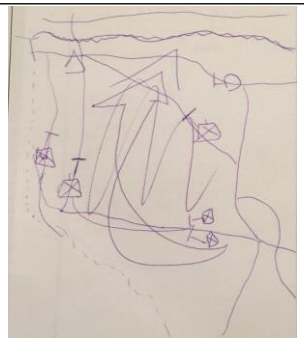
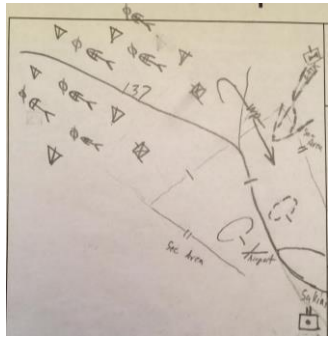
Decision Game Results.xlsx

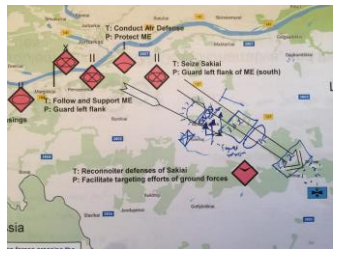
In an attempt to preserve legibility, snapshots of the table of responses begin on the next page. This page contains a digital copy of the table of results for anyone reviewing a digital copy of the paper.

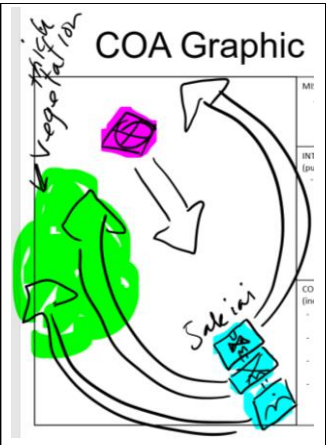
Respondent	Scenario	Theory of Victory				Problem Framing					COA Graphic & Narrative			Advanced Artillery Capabilities				Graphic
		Central Idea	Necessary Capabilities	Integration of Military Functions	Spatial & Temporal Dimensions	Problem Statement	Tensions BTWN Current and Desired	Elements that Must Change	Opportunities and Threats	Limitations	Mission	Intent	Concept	ADV Useful	ADV Not Useful	ADV Additional	ADV Comments	
10	Future	My idea is to execute a defense in depth along the enemy's axis of advance from his river crossing points to the town of Sakiai, exploiting the strengths of the various forces at hand in the process. The immobile infantry BN will concentrate on preparing a positional defense of Sakiai and the critical road network around it. It will be the last line of defense. The artillery BN, with its highly mobile autonomous gun systems, will deploy forward in a series of battle positions south of the major west-east running treeline. They will continuously fire and fall back to the east as the enemy advances to harass, attrite and slow his attack. The main killing force will be the attack aviation company which will use the treeline as cover to maneuver onto the enemy's flank as he advances and destroy his formations as he passes through a series of engagement areas. The entire operation will be enabled by the intel provided by the artillery UAV systems.	1. Large stocks (at least double the standard combat load) of critical munitions such as Hellfire missiles, Javelin missiles, anti-tank mines, and engineer demolition materials. 2. 5th Gen (F-35) Air interdiction and close air support sorties armed with anti-armor munitions (Maverick, SDB-2, etc.) to assist in the deep fight. Must be 5th gen given the high end Russian SAMS in the AO. 3. Secure, uninterruptible coms capabilities to support forward deployment of FA batteries and maintain links to the UAV swarm. 4. Clearly defined and secure logistical support particularly regarding class 3 & 5 stocks and medical care and evacuation.			The main spatial and temporal dimensions of concern in this mission are the time to prep the defense and the time for the enemy to conduct his movement. It was not clear to me from the scenario how long the defending force has been in place before the enemy force started crossing the river. In fact the way it is written it appears that the US force was ordered to defend Sakiai until after the Russian invasion had started. If this is the case it is unlikely that they would have time to conduct the reconnaissance and defensive prep work required to mount a successful defense.	How to prevent the seizure of Sakiai by a large, highly mobile armored force with a small, light-infantry based defending force. Facts: forces available on both sides, missions and concept for both forces, general presentation of AO terrain and geometry. Assumptions: Sufficiency of logistical support, sufficient quantities of critical munitions on hand, Russians will not reinforce failure – especially of a supporting effort so little risk of facing additional forces. Medical evacuation and treatment will be provided by host nation.	Conditions: The main tension between current and desired is that the enemy has a highly mobile and lethal armored force in fairly open terrain while the defender has a much smaller, unarmored and basically immobile ground force with which to defend. The threat of bypass and envelopment is very high for the US Force.	The defending force must find ways to destroy a large portion of the enemy armored force (2/3 to ½) before it can reach the light infantry force defending Sakiai.	Opportunities include the ADSS UAVs to provide real time intel on enemy locations and the extremely high mobility and lethality of the Apache helicopters (provided the critical munitions are available). The main threat is that rather unrestrictive terrain may allow the enemy to move too fast for the attack aviation to sufficiently attrite them before they hit the defenses at Sakiai.	I did not note any explicit limitations placed on the force. The only implicit limitation I saw was that there was no withdrawal criterion provide for the task force (TF) thus it would appear that blue force is condemned to defend to retain regardless of the losses sustained.	TF 1-325 defends in sector and defeats enemy forces advancing on Sakiai to deny the city and the road network passing through it to the attacking force.	Purpose: to prevent the enemy seizure of Sakiai and the road network passing through and around it. Method: Use the mobile artillery systems forward to slow, harass and attrite enemy forces over the course of their advance. These forward batteries will leapfrog back as the enemy advances to keep up continual fires. The attack aviation company will exploit the west-east running treeline west of Sakaiai to maneuver onto the enemy's flank and destroy his armored formations as he advances. The infantry BN will prepare a positional defense of Sakiai and its approaches and prevent enemy occupation of the city. End state: Sakiai and its road networks are denied to the enemy and TF 1-325 remains capable of continued combat operations.	A/2/82 (ME) T: Destroy enemy armored formations in EA Chevy, EA Ford, EA Dodge and EA Toyota P: deny the Russians Sakiai and it's road network. 2/319 T: Occupy BPs 1, 2 and 3 and provide continuous destructive fires. Additionally deploy ADSS UAVs as a directed. Retrograde to BP 4 as required. P: To slow and attrite to enable ME destructive engagements. 1/325 T: Occupy BP Stop and defeat enemy forces in EA Toyota. P: To support the ME in destroying enemy forces in EA Toyota.	The enhanced mobility of the Hawkeye gun system was a critical enabler as it potentially allows for forward deployment of artillery along the depth of the enemy's axis of advance. This potential for sustained deep fires would be invaluable in slowing the enemy advance thus enabling more effective destructive fires on the part of the attack aviation. The ADSS capability would be important to provide the real time intel required to execute the kind of mobile, forward based defense in depth I have planned.	Although I would not categorize this capability as "not useful" the laser designation capability of the ADSS D variant UAVs was somewhat less useful because there is no weapon system provided for the system to laser designate for. The scenario contained no laser guided anti-armor artillery munition (like the old Copperhead) and given the Russian air defense threat in the AO there would likely not be too much CAS available.	As stated above some kind of artillery delivered, laser guided, anti-armor munition would go a long way towards leveling the playing field especially with the enhanced mobility of the Hawkeye guns.		
11	Future	L-variant: Use these as targeting assets. Once targets are assigned, swarming technology can allow queen bee and swarm to allocate assets for designating. User assigns priority of targets. D-variant: Swarming with small built-in munitions (thing controllable RPG or larger) to harass unarmored ground formations or positions, or other low speed aerial assets (Scan eagle, RQ-21, rotor wing, etc.) Each requires camera as well in order to be a scout and/or queen bee.	L/D-Varient: Fuel on board for recovery from max range launch. D-variant: Remote arm and de-arm ability. Ability to self detonate if unrecoverable.			Russian Motorized Infantry has advantage of speed and initiative. Russian force is attacking and has SOM planned and briefed for Offense. US is reactionary. Russia has (most likely) Humint on size/location, dispersion of US force.	Russians have three basic avenues of approach: Rt 137/3806/overland. Russians have larger force.	Find a way to canalize Russian advance and slow advance. Find a way to either stop lead element and slow entire formation or slow rear elements and isolate lead force. Destroy roads 137 and 3802 to force Russia off road and into canalized terrain.	Disable air defense or overwhelm Over match advancing force while they are moving	Time	Disrupt Russian axis of advance on Senei and disable their ability to consolidate power	Using the advanced artillery capabilities, swarm air defense units and forward elements of main body. Make 137/3802/3808 untennable at points through vegetation.	Launch D variant swarms to determine axis of advance and pass targeting info to artillery When lead elements approach/pass choke points, target vehicles to break columns and slow advance by pushing them off-road. Launch L variant swarms to designate for aviation as advancing columns move off road and around obstacles Move D Variant to rear of Russian column to target air defense Split D Variant to target Russian UAVs and swarm them and crash them.	"Queen Bee" Concept L variant PRF capability	Nothing stated range of launch distance Is max range launch going to be able to RTB? What is airspeed? Can they intercept enemy helos and UAVs?	D variant should be a munition. Remotly armed by queen bee. They could be used for counter UAV via midair collisions and swarming the target and blowing up. Could also be used to swarm ground vehicles, troop movements, or helicopters. Just needs to be RPG or a bit larger size munition. D needs to be able to be recoverable, but if can't be then it should self detonate when clear of swarm. Keep cameras too...		
1.F	Future	Deny key terrain to enemy - bridges and river Mislead Russians that US forces are to the north in more places than they thought	Maneuver - ability to mislead / disrupt enemy mobility to obtain position of advantage Request strategic air support for deeper fires Artillery - fires in depth to disrupt / Observers forward to coordinate IDF deep		Strike Russia's LOCs from North / Target Bridges Scout Forward to buy time Ambushes along main MSRs from Neman River to Sakiai	1/325 defend & retain Sakiai Russian LOC north of Neman River Alternate LOC achievable through Lithuania	Russia approaching Sakiai Russian forces disrupted / unable to proceed to Sakiai without employing more resources than desired	Disrupt / deny Russian LOCs, ability to sustain Russian ability to use roads, bridges, main avenues	Opportunity - Russia does not know our CONOP or forces available Threat - Superior enemy size force	Mobility (HMMWVs) Light force Roads for speed vs. offroad	Disrupt ENY forces north of Sakiai IOT defend Sakiai	P: Defend Sakiai M: Aviation strike deep on Russian COG Ambush anti-armor along main MSR to force ENY to employ forces early of their culminating point prior to Sakiai E: Sakiai secure from Russian forces from north Russia disrupted before reaching Sakiai, unwilling to continue once they reach culminating point	1. "Launch the Swarm" from autonomous 105s that displace to new firing points after firing 2. Sarm drives targeting				Add warheads to 25-50% of drones	

1.2	Future	Any NATO fight is a joint battle with a heavy show of force	GMTI / C2 agent that holds "track quality" & "IDs" targets for action Swarming RPAs / UAVs (FMV) = HUGE bandwidth MILSAT to C2 (JOC) feed (30-45 sec delayed), not real time, but near time, targeting a moving object requires real time	Concept may work with different system mix (AH-64 + howitzers) vs. (F-35 + HIMARS / MLRS) creates a deep mix, especially in an isolated AO															
2.F	Future	Aviation isolates EN ME BN and SE BN IVO Jurbi Infantry conducts defense in depth Artillery - HE on RTE 137 and strong point defense IVO Ritria i to Zimini (depth and survivability are improved by using swarm UAS to isolate lead BN and destroy enemy leadership prior to offensive)	Locate and destroy EN C2 Locate and pinpoint bridges Infantry does not need to use demo, because of increased fires range	Fires can act more autonomously to isolate and attrit enemy forces as they transit RTE 137		Enemy has an advantage in maneuver and localized firepower, we will attrit forces as they transit RTE 137	Enemy bridging assets need to be destroyed and briges must be destroyed behind enemy forces	Enemy deploys	Enemy firepower bypassing detection systems prior to their deployment							D variant should have shape charges embedded		
3.F	Future	Utilize ADSS recon capability & aviation mobility to conduct mobile defense ahead of battalion position Battalion position defense is more cohesive than in non-ADSS scenario ID enemy C2 nodes (leaders) & target them first	Downling between swarm & aviation (swarm control from apaches?) Masked fires from helos (pretty sure this is a standard tactic) Rapid displacement of firing artillery battalions	C2 between artillery / drones / maneuver units Intel (recon) & fires	Better ability to find & affect Russians quickly & farther out	Assumption - ADSS can provide terminal guidance for Apache launched missiles Same as current assumptions for #3 (below) Statement - How to disrupt Russian SE attack?	Imbalance of combat power	Locate main Russian elements Reachback for additional striking power (air / missiles) beyond organic BN+ assets	Time EW signature of swarm control Early firing signatures of Arty / Apaches Ability to recover drones (auto return gives away position for recovery team)	Ammo available Direct downlink availability to maneuver units (including aviation company)	Defend Sakia i IOT prevent enemy from securing ME flank	Prevent enemy from securing ME flank Mobile defense using aviation CO maneuverability queued by swarm recon CO battle position utilize additional time to prep position & coordinate external supporting fires Russian formations are located and held in contact by aviation & fires well forward of position defenses	Identify main Russian formations Suppress AD assets, swarm terminal guidance AVN company destroy lead elements	Forward recon & terminal guidance Assuming HMMWV arty displaces faster than towed	What is the range limitation of the swarm between drones (dense swarm or wide area network?)	Armed variant with loiter capability - human controlled or autonomous targeting ability Ability to launch / control multiple swarms by single and / or multiple controllers Battle handover between offgoing drones & newly delivered ones (continuous on-station ability)	Recovery team is vulnerable How big does a swarm need to be to cover 6 km^2?	
1.3	Future													I would employ the D variant to provide location on mech vehicle advancement & the L variant to enhance targeting accuracy	I am not sure that a swarm is useful because the size, when coupled with multiple vehicles, may give away friendly location. I am not sure with the current camera sweep how many drones close together is useful for a near real time battlefield SA below the drone loiter area.	It could be useful for the drone to release explosives (armor penetrating)	GPS coordinate generation & autonomous counter measures seem useful	
4.F	Future										Block Russian TF for 24 hours IOT prevent Russian force from supporting ME in south	Prevent Russian force from supporting ME in S by using swarm & fires to destroy required capabilities (ADA & UAS), infantry to block in restricted terrain, alternatively to destroy key assets in detail	Swarm - 105 mm Priority - ADA, UAS control INF block & CATK AH-64s kill tanks				Need a broader map with situation How long do we need to block or delay for? What are our adjacent units?	

14	Future	How do we prevent movement east of Neman River? Your Drones are going to be shot down by S-350s, SA-26s, & most likely SA-17 follow-on	Russia will detect your arty point of origin & track your drones from ground zero (my opinion)- need to have low observability (stealth) capability	C2 - joint target request through JAOC Fires - F-35 / F-22 with integrate dground fire support	Drones need to be masked & have autonomous mensurated coordaintes prior to kinematic max effective range of Kaliningrad's SAMs (this will be tough because they are mobile & masked)	How do these drones accomplish their mission without getting shot down by russian IADs?	Need to come up with a more multi-axis approach	Low observability (stealth) capability - Kaliningrad IADs & other enemy will see everything & be waiting	Would have to oversaturate the IADs to get through & strike target	Number of queens - she will be the first to get whacked	1/325 prevent russian roces from crossing Neman River IOT enhance / enable NATO resolve	P - strike lead tank / troop elements in order to stop movement M - launch drones / swarm coordainted with 5th gen low observable (stealth) capabilities to precision target and enable autonomous modes at range		Swarm piece - queen drone is a target (in my opinion) that will be engaged at range	None	Have different capabilities across EM spectrum so it will make it more defendable against jamming & targeting	Nice job, cool concept & lots of work put into this. Recommend researching open source capabilities of detect & targeting of Kaliningrad IADs - it is assumed to be the most lethal in the world.	
15	Future	Sakiai defended from Russian occupation and effects of Russian influence. (This is what I have been asked to do ... I have not been told why ... which is why my central idea is so narrow in scope. Only focused on Sakiai and not focused on restoration of sovereignty). Because their purpose is to secure (this means they must control / hold / seize) a "land bridge," they will need to mass for contact and disaggregate to hold the vast swath of "land bridge."	Undegradable C2 systems (redundant) Anti armor - deep, mid-range, close Countermobility Counterreconnaissance Combined arms Reconnaissance MILDEC IW Linguists Offensive arm to the defense of Sakiai Mobility Human terrain assistance (IDPs) Unimpeded source of supply Riverine attack / recon / screen Unmanned driverine craft Semiautonomous riverine craft - armed, anti-armor Air supremacy (FW)	COG - TM Tank company CC - Seize terrain rapidly, defeat armor, operate in chemical environment, spot fires, rapidly bypass "surfaces" CR - Fuel, air supremacy (local), ammo, maintenance - logpack - transportation elements, bridging capability CV - vulnerable to air attack if attached ADA company non-mission capable	The greatest C2 gift I could have here is the dimension of depth ... armed with sufficient depth to my defense, I can attrit ... trade space for RF combat power & slow advance to Sakiai. Since I seek to also protect Sakiai from RF influence, the deeper my defense, the better. I would like the RF attackers to expand their breadth ... how might I compel them to do this? A. Comply with a false directive / order B. Move to seize key terrain or deny it to their main effort C. Establish contact with an isolated unit	Our forces need to compel RF attackers to disaggregate and expand their breadth so they can be defeated piecemeal	The price of doing nothing is failure (potentially)	Main force must disaggregate or chagne mission or receive a 2nd mission to accomplish simultaneously			1/325 (REIN) defends Sakiai IOT impede RF forces efforts to secure a "land bridge" between Kaliningrad and Belarus	T: Defense (mobile) P: Impede RF efforts to secure a land bridge bdtween Kaliningrad and Belarus M: Defense in depth, mobile defense - capitalizing upon natural obstacles, reinforcing with deliberate counter-mobility efforts. Defense designed to limite opportunities for RF to "spin" "American aggression." Defense designed to "spend" RF forces and time. The longer the Russian offensive, the less patience the world will ahve for it.	Phase I: Construct defense, build Eas, rehearse defense, destroy key bridges, employ sensors, screen (counter recon) Phase II: Fight EA1, Rear passage of lines by EA, Employ advanced artillery capability, T1: recon, T2: destroy ADA, T3: Deceive ADA to a) emit, b) fire to destroy perceived US A/C, T4: SEAD, T5: screen, counter recon Phase III: Fight EA2, rear passage of lines by EA, don't destroy bridge 2, 3, or 4 until PL BLACK, artillery, T1: CAS attack, T2: screen counter recon, T3: destroy FARP 2 after RPOL, T4: deceive RF to "gap" bridges 2, 3 and 4 Phase IV: Fight EA3, no pen line, counterattack w/ reserve company, press release "truth sandwich" to local population regarding destroyed bridges all rearward movement covered by smoke & CAS all SEAD includes EW component / physical dimension - lethal & non-lethal Priority of targets - EAD / Armor / C2 / Infantry	Reconnaissance Deep anti-armor (with standoff) Resistance to external control attempts Terminal guidance The generation of GPS coordinates in a GPS denied / degraded environment Rapid turnaround of sorties		Masked / no / low electronic signature changed electronic signature for MILDEC (make a single system "look" like a larger echelon - of any capability - even an aircraft like a CAS or SCAR platform)	How do they return to the launch point NOT armed as artillery projectiles?	
S.F.	Future	Swarm became a ground-based DAS asset (like air interdiction) You can fight air-land battle 21st century	Swarm AH-64 & Gray eagle	AH-64 & Gray eagle primary Still need more FIREPOWER in ABN INF BN	I DO NOT trade space & buy time. I use simultaneous actions (FASCAM, CP strike, Precision point strike) to disrupt enemy advance	No change	No change	No change	Opportunity - swarm gives deep precision fires that allow me to effect crossing points early DAS-like	Weather? Can swarms fly in unfavorable conditions?	Conduct an area defense IOT deny enemy use of roads after the bridge	Tie into terrain, use the swarms to hit bridges, C2, & armor reserve (fuel stores), & SAM (radar) (all soft targets) AH-64 covers, ATK enemy mech that make it through FASCAM / TRP artillery & swarm. Enemy cannot pass Zirniai	Phase I: Swarm gains S/A. Hit soft targets & bridges. Lay down FASCAM Phase II: AH-64 covering force I am assuming if I stay low enough I can beat SAMs & make my countermeasures more effective	Swarm as DAS	All were useful	Kill chain with AH-64 & Gray Eagle Ability to prosecute deep fires in rapid succession at BN level	1. Could we integrate swarm that was EW capable OR MLAD-like (decay - emit signature of larger force) 2. Bait & ambush - tactical decoys (ground vehicle, CP antenna farms) would have given me more flexibility 3. I am still concerned on limited engagement range of most BN systems relative to Russian mech / tank. Yes, javelin, but how many are currently in a BN? Will we need to increase the number? 4. Infantry is still susceptible to enemy IDF given terrain. If I dig in, I can still be overrun by mech forces. How do I increase force protection? Is it simple mobility? 5. Could I have other unmanned artillery than HMMWV / 105mm? 6. What are BN trains / resupply & retrans here? Could I partially automate speedballs?	

5 C	Current	Elasticity (hit & run) to draw out enemy lines and enable a CATK once armor reserve & command post starts to move across bridges	AH-64 & grayeagle Javelin Infantrymen hard as nails!	Combined arms 10:1 & tieing effects into terrain (anti-armor, choke points, etc)	I trade space to buy time for an attack on the command post & dig into more defendable terrain	Facts 1. Range, lethality mismatch without joint effects (air, cyber, naval gun) 2. River is a choke point 3. Limited cover / concealment Assumptions 1. I have limited mobility relative to mech force	Current conditions: overmatch desired: defeat in detail - pull the enemy apart into "bite size pieces"	BREAK APART, disrupt tempo, attack C2 to accelerate loss of cohesion	Opportunity: Command Post Threat: Enemy maintains a "disciplined" push (21st century creeping barrage)	I AM AMERICAN, I HAVE NONE! (Just kidding) Lack of protection, infantry engagement range, # of javelins, AH-64 & grey eagle susceptible to SAM	Delay enemy advance IOT attrit their force and shift combat power in a manner that enables a defeat in detail	Use a defense in depth Attrit lead element with Javelin ambushes (cover areas with TRPs if enemy dismounts) Enable deep strike against CP IOT disrupt C2 & create confusion Strong point in woods	PH I - Shape - FASCAM high speed avenues of approach, ambush sites (Platoon -) along route PH II - CATCK - CP and armored reserve PH III - "Pray" use terrain & deliberate defense to limit enemy advance Will smoke mess up enemy UAS? At Phase III, I need them to dismount IOT limit fires & armor advantages					
4 C	Current										Delay Russian advance in order to allow NATO forces to organize a defense of Lithuanian terrain	Attrit Russian force & delay for 2 hours Method: Use fires & hasty defense in restricted terrain to slow the lead elements	(Assumption: limited CAS) 1. Blow bridge 2. Deploy FASCAM 3. A Co Block 3807 4. B Co Block 137 5. C Co Block 3802 6. AH-64 attack tank BN reserve 7. O/O displace A, C, B 8. BPT CATK B Co OBJ Neman River bridge A Co SE					
6	Current	Defeat recon force Neutralize Air Defense Delay motorized BN advance	Air to ground missile capability to defeat air defense Artillery launched obstacle / mines with accompanying authorities	Ground maneuver with artillery	Sequentially Blind recon element Neutralize air defense Emplace obstacles / mines						O/O 1/325 delays the advance of russian forces on main axis of advance IOT allow for reinforcements to flow into theater	Purpose: To delay forward advance and reinforcement of enemy forces Method: Destroy recon capability, neutralize air defense and delay advance / reinforcement with FASCAM End state: EN cannot advance or retreat. Local air superiority	1. A Company w/ artillery destroys recon element 2. A/2/82 neutralizes enemy AD positions 3. 2/319 deploys FASCAM IOT delay enemy advance & retreat					
3 C	Current	Defense in depth Rapid deployment of hunter-killer javelin teams forward along primary AoA Assumption - 1/325 in static defense easily overmatched by 2 x motorized rifle battalions FO elements in hide to target major formations with artillery & apache	Commo / locations for arty observers Commo not essential for H/K teams (independent engagement & displacement criteria) Reachback for theater level support	Mission-type orders & decentralized command Maneuver will have to provide intel for fires due to lack of supporting, higher level ISR assets	<14km from border to Sakiai, already within artillery range Need time for reinforcements to arrive (& air support)	A - Russian units have done thorough map recon & planning A - limited Russian FW air support for SE A - 1/325 in static defense is overmatched by 2 motor rifle battalions A - airport is under enemy observation A - Lithuanian focus is on Russian main effort attack F - Fight already at close range Statement - how to disrupt Russian SE and generate uncertainty for ME attack	Coordinated Russian force with significant combat power	Russian unit cohesiveness must be broken up before units can launch a deliberate attack on Sakiai US forces must figure out area & terrain quickly	Good US AA missile capability Lithuanians will support US forces Key capabilities (artillery & apaches) are vulnerable once employed	Light infantry protection Non-ground recon assets Ammo (missiles & arty)	Defend Sakiai IOT prevent enemy from securing ME's flank	Prevent enemy from securing ME flank 1/325 has limited time and space or force for a deliberate area a defense and lacks the mobility (excepting air) for a mobile defense Delay w/ 2 companys forward employing H/K missile teams and concealed FO teams - utilize local knowledge for emplacement & concealment 1 company prepares hasty defense & engagement area for apache counterattack Desired condition - Russian units are attritted & disorganized such that they cannot continue attack towards Sakiai for 2 days	FWD Cos delay Rear CO defends AV CO destroys BN withdraws into Sakiai H/K teams engage & attempt to withdraw FO teams remain in place to target main formations (arty)					

7	Current	The main idea is to force the enemy to use HWY 3808 & 3802 and not the open terrain on HWY 137 & 3803 The south canalizes their maneuver ability and can focus fires in a small area	Range enemy forces out of enemy IDF & direct fire range Persistent observation on Eas & routes Establish blocking & disruption, fixing position in depth before a fast move force is in position to attack	Intel - utilize to ID movement and location of anti-armor capability / employ messaging that mines are on RTE 137 & 3803 Fires - concentrate with HE & FASCAM. Concentrate on taking down or degrading Russian UAV and enemy artillery MM - maneuver forces into a superior position to provide devastating fires and prevent enemy FOM Sustainment - provide sustained rate of supply to degrade enemy and allow forces to maneuver on enemy	Russian driving time to Sakiai - 1 hour (4 hours if tactical) Terrain favors defense - cannalizes enemy	Key fact - 100% manned and equipped, AT & Javelins Assumption - fuel within Sakiai can support AH-64 ops Russian forces are attacking toward Belarus The Russian force most be prevented from using Lithuania as a direct route to Belarus	The enemy has been in place and can launch and be within Sakiai in 1 hour. Defense will take time to deploy to an area and employ	Force enemy into EA to prevent bypass Emplace obstacles & forces Task organize AA company to turn Russia to South	Opportunities - use helos to divert & feint Threat - Enemy can bypass and attack Belarus	Speed for emplacement Don't have a 1:3 for a hasty defense	1/325 defends Sakiai IOT deny enemy FOM IVO Sakiai	T: 1/325 defends Sakiai P: Deny enemy FOM	PH I: Preparation - prepare defense Deploy FASCAM on RTE 137 & RT 3802/3808 Establish EA VIC FASCAM site PH II: Deploy ISR on to EA T: Observe enemy movmenet - conduct recon P: Identify enemy C2 and execution of MDCOA/MLCOA PH III: Conduct Defense T: Defend AO P: Prevent eny from using Sakiai for movement corridor					
2.C	Current	Aviation isolates EN ME BN and SE BN IVO Jurbi Infantry conducts defense in depth Artillery - HE on RTE 137 and strong point defense IVO Ritriai to Zimini	Demolitions - specifically cratering for isolation SMAW-D for destruction of bridges along RTE 137	Fires: Aviation delivered fires will support SE1 Artillery deployment of FASCAM minefield to disrupt second EN BN		The enemy currently enjoys an area of fire superiority near the Russian border. We will isolate elements with engineering effects to leverage superior combat power in a compartmentalized area to reduce	The enemy has superior mass, fire power, and range	Enemy elements must be isolated	Forrested / hilly area IVO Zinai and Voveriai		O/O 1/325 conducts defense in depth IVO RTE 137 IOT destroy enemy mechanized infantry battalion	We will isolate enemy mech battalion with fires, disrupting them in order to allow ME to destroy mech battalion 2	1. INFIL 2. Defend in depth 3. Isolate 4. Defeat 1 BN 5. Defeat 2 BN 6. Consolidate / BPT destroy bridges with fires					
1.C	Current	Deny key terrain to enemy - bridges and river Mislead Russians that US forces are to their north in more places than they thought	Maneuver - ability to mislead / disrupt enemy mobility to obtain position of advantage Request strategic air support for deeper fires Artillery - fires in depth to disrupt / Observers forward to coordinate IDF deep		Strike Russia's LOCs from North / Target Bridges Scout Forward to buy time Ambushes along main MSRs from Neman River to Sakiai	1/325 defend & retain Sakiai Russian LOC north of Neman River Alternate LOC achievable through Lithuania	Russia approaching Sakiai Russian forces disrupted / unable to proceed to Sakiai without employing more resources than desired	Disrupt / deny Russian LOCs, ability to sustain Russian ability to use roads, bridges, main avenues	Opportunity - Russia does not know our CONOP or forces available Threat - Superior enemy size force	Mobility (HMMWVs) Light force Roads for speed vs. offroad	Dirsupt ENY forces north of Sakiai IOT defend Sakiai	P: Defend Sakiai M: Aviation strike deep on Russian COG Ambush anti-armor along main MSR to force ENY to employ forces early of their culminating point prior to Sakiai E: Sakiai secure from Russian forces from north Russia disrupted before reaching Sakiai, unwilling to continue once they reach culminating point	1. Aviation swings from north to disrupt / mislead Russian fires to strike in multiple directions 2. FASCAM on major routes of approach to Sakiai 3. Ravens scout to coordiante fires 4. Ambushes to disrupt / delay Russians en route					

8	Current	Use speed and surprise to ambush advancing mech forces by enveloping with 1/325 & 2/319 to the northwest concealed in vegetation and the A/2/82 awaiting at safe standoff range to the northeast As EN mech/armored infantry pass synchronize attack IOT defeat by disabling their ability to move and communicate via EW and kinetic weapons Attack will begin by heavy long range kinetic attacks by A/2/82 then the 2/319 and 1/325 will move in close for additional kinetic attacks rendering EN long range weapons ineffective US forces will retreat back to Sakiai prior to arrival of EN reinforcements Coalition forces ground forces from Poland will reinforce US forces at Sakiai	Jamming from HMMWVs to disrupt comms Tank and armor piercing weapons Concealment from vegetation for infantry, artillery, HMMWVs Speed of infantry, artillery, aviation faster than EN vehicles Does artillery/aviation have mines they can use? Would really like some more airborne strike! Where's the USAF?	Speed – to move into position and retreat faster than mech forces to Sakiai Surprise – to mount ambush of passing vehicles from dense vegetation and air Maneuver – to draw mech forces in close to render EN weapons ineffective Mass – mass firepower from 1/325, 2/319 & A/2/82	Mech forces are only ~6 miles away so closing speed/timing will be fast. Lighter US forces need to move faster than EN forces to take position IOT for ambush	Russians initiated cyber offensive and began crossing border en masse with a heavily mechanized force to secure a route between Kaliningrad and Belarus through force.	Current conditions are Russian mechanized force advancing without interruption. Desired state is US forces defend Sakiai as a piece of key terrain to prevent Russian path from Kaliningrad to Belarus.	US force must use speed, surprise, and maneuverability to their advantage.	Main opportunity of a light weight force is potential for speed and surprise. Main threat is a heavy mechanized force mobilized and on the move.	Limited sized force; limited ISR, cyber, EW capabilities	Ambush approaching EN mech forces IOT envelop and attack, first with long range heavy weapons from A/2/89 and then with 1/325 and 2/319 at close range rendering EN long range weapons ineffective	Desired condition – disable mech/armored infantry. Delay additional mech forces from advancing until additional coalition ground forces can reinforce from Poland	1. T: 2/319, 1/325 move to northwest & A/2/82 hold to northeast, P: Prepare for ambush 2. T: C/O jam and mount heavy attack from A/2/82, P: disrupt EN forces 3. T: 2/319 & 1/325 mount close attack on EN forces, P: disable EN forces 4. T: US forces move to Sakiai, P: mass forces and protect flank					
9	Current	Use the range advantage provided by organic artillery and RW assets to delay then destroy EN forces. Then, as the force ratio approaches a more favorable state, counter attack through vehicle and help to exploit mobility and surprise at the most vulnerable moment.	ISR, FASCAMs, Speed in Maneuver	Command & Control - Command and control is going to provide the vital link between intelligence, fires, and maneuver ensuring victory. Intelligence - Successful observation of potential avenues of approach is absolutely critical, with out the timing from intelligence, the whole plan will fall apart. Fires - Must be responsive enough to emplace mine fields along multiple avenues of approach in the face of a mobile enemy. Fires must be accurate and at the exact moment when the enemy becomes entwined in the mine fields to be effective. Movement & Maneuver - Speed and timeliness of counter attack Protection - In addition to the offensive minded defense projected outward, a sound fallback defense must be established around the city. Sustainment - Sustainment and resupply must be able to handle sustained isolation.	The operation is dependent on timing. Massed and accurate fires must strike the enemy as they are temporarily held in place by the mine fields. If the enemy is allowed to break contact and continue to maneuver, FN forces do no have the flexibility in fire support to prevent the enemy from entering into mortar range which would strongly favor the enemy's superior numbers despite the better firepower contained in FN artillery.	1/325 must defend the City of Sakiai for 96 hours against a maneuverable numerically superior force without the benefit of air superiority and limited fire support assets. Enemy rate of march provides for sufficient time to emplace multiple minefields along avenue or approach. EN FW assets will remain north.	While 2/319 provides a range advantage over the Russian mortars, the Russian Motorized Infantry provides the ability to out maneuver the artillery until their own mortars are within range. Due to the proliferation of SAMs RW participation levels are variable therefore the mission must be able succeed without RW assets.	1/325 must find a way to limit the Russian maneuver capability in order to capitalize on their organic IDF and RW assets.	Threat: the Russian UAV capability hinders surprise/clandestine efforts to canalize the Russian forces. Opportunities: The forested areas to the north limit the avenues of approach to an extent, but not enough to force the enemy into an unfavorable situation. Instead, it is a natural asset from which to build on.	Supply, reinforcement, ISR	O/O 1/325 occupy the city of Sakiai in order to prevent Russian forces from securing the A7 expressway and subsequent land bridge between Belarus and Kaliningrad 2/319 and A/2/82 are in direct support.	Purpose: Prevent Russian forces from moving south and taking control of the A7, A16, and A3 expressways, the key thoroughfares between Belarus and Kaliningrad. Method: Canalize the enemy forces by laying FASCAM fields outside of mortar range along the limited roads transiting through the dense forested areas. As the enemy forces are delayed by the mine fields, engage with conventional IDF and RW fires followed by a swift and aggressive counter attack. End state: Russian forces combat ineffective and unable to continue a southward attack.	Phase I: Minefield emplacement / 2/319 ME / Emplace FASCAM fields along key roads transiting the forested areas to fix the approaching EN force. Phase II: Attrition of Russian Forces / 2/319 ME / Destroy enemy forces with conventional IDF and RW fires when delayed by minefields. Phase III: Counterattack / 1/325 ME / Destroy the remaining enemy through a counter attack.					
16	Current	Request IO support for MILDEC to replicate comms signature 15 miles SW of current location and disinformation of plans & locations of units. Dig in to defend Sakiai TGT HQ, follow-on, & reserve w/ artillery BN. AH-64s & 1/325 mortars for defense against ME	Must be able to destroy enemy ADA, artillery, & mortar capabilities. Must be able to engage multiple enemy formations simultaneously.	Fires - attack enemey secondary, HQ, & reserve Maneuver - dig in & defend city from ME, AH-64s attack ENY ME Intel - provide L&W of enemy location & movement Mission Command - request additional IO support Protection - establish & maintain good OPSEC; utilize IO if provided	AH-64 section positioned within friendly cover but west & east of dug-in defenses IOT confuse the enemy as to which direction we are truly oriented	1/325(+) faces a Russian BDE(-), assuming the Arty BNs are supporting higher, of two motorized inf BNs with mortar companies and a tank battalion in reserve. Fact - outnumbered beyond 3:1 ratio, we have air attack capability, Russians have ADA Assumption - Russian artillery battalions supporting higher, have intel support from higher for target purpose, we do not have any support from higher	Russian troops desire to pass through city of Sakiai	Russian troops mission or will to privide support / reinforcement to troops in the south must be changed or broken	Russian early warning & recon capabilities limited so possible to shape what they see & how they target. We retain air attack capability & pre-established location in city. Threat: ADA & outnumbered	Limited intel capability, little to no additional assets / support from higher. At least 96 hours before reinforcements available.	Secure the cross roads of Sakiai IOT prevent Russian troops in the North from reinforcing Russian troops in the south.	Deny use of south & south westerly avenues of approach into Sakiai using limited deception, targeting enemy ADA, C2 capabilities, and reserve forces with organic artillery assets. Once ADA assets neutralized, utilize air assets to further disrupt & deny enemy movement south to prevent reinforcement to southern Russian troops	Phase 1 - AH-64 sections conduct overwatch operations east & west of Sakiai and south of east-west LOCs to mislead enemy on our direction of focus. Artillery BPT provide fire support when 1/325 digs in defense positions & alternate defense positions. Phase 2 - Artillery destroy enemy ADA & mortar positions. Phase 3 - Artillery attrit reserve & HQs by 25%. AH-64 attack enemy forces moving south. 1/325 defend LOCs.					

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