
Dissertation

Presented in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in the Graduate School of The Ohio State University

By

Albert P. Palazzo, B.A., M.A.

* * * * *

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Dissertation Committee: Allan R. Millett
Williamson Murray
Martha Garland

Approved By

Allan R. Millett
Adviser
Department of History
To my father
ACKNOWLEDGEMENTS

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# VITA

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<td>1982</td>
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<tr>
<td>1983</td>
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</tr>
<tr>
<td>1990 - Present</td>
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## FIELDS OF STUDY

- **Major Field:** History
- **Minor Field:** European Military History - Dr. Williamson Murray
- **Minor Field:** American Military History - Dr. Allan R. Millett
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GENERAL ABBREVIATIONS

ANZAC - Australian-New Zealand Army Corps
ASW - Anti-Submarine Warfare
AWM - Australian War Memorial
BEF - British Expeditionary Force
BGHA - Brigadier-General Heavy Artillery
BGRA - Brigadier-General Royal Artillery
CA - Chemical Adviser
CAC - Churchill Archives Centre
CB - U. S. Army Military History Institute, Carlisle Barracks
CBSO - Counter-Battery Staff Office
CDA - Canadian Divisional Artillery
CGS - Chief of the General Staff
CIGS - Chief of the Imperial General Staff
DCIGS - Deputy Chief of the Imperial General Staff
DGS - Director Gas Services
FMC - Field Marshall Commanding
FSR - Field Service Regulations
GOC - General Officer Commanding
GOCRA - General Office Commanding Royal Artillery
HA - Heavy Artillery
HE - High Explosives
HQ - Headquarters
IG - Inspector General
IWM - Imperial War Museum
LC - Liddle Collection
LHCMCA - Liddell Hart Centre for Military Archives
L of C - Lines of Communication
MPH - Miles Per Hour
NAC - National Archives of Canada
NAM - National Army Museum
NLA - National Library of Australia
NLS - National Library of Scotland
OC - Officer Commanding
OP - Observation Post
PRO - Public Records Office
RAI - Royal Artillery Institute
RA - Royal Artillery
RE - Royal Engineers
RFC - Royal Flying Corps
RGA - Royal Garrison Artillery
SBR - Small Box Respirator
SP - Strong Point
SR - Shrapnel
TWD - Trench Warfare Department
WO - War Office
GAS ABBREVIATIONS

BB - Mustard Gas
CBR - Phosgene (50 percent) and Arsenious Chloride (50 percent) or Phosgene (60 percent) and Stannic Chloride (40 percent)
CG - Phosgene
DA - Diphenylchlorarsine
DM - Diphenylaminechloroarsine
HS - Mustard Gas
JBR - Hydrocyanic Acid (55 percent), Chloroform (25 percent) and Arsenious Chloride (20 percent)
JL - Hydrocyanic Acid (50 percent) and Chloroform (50 percent)
KJ - Stannic Chloride
KSK - Ethyl Iodoacetate
NC - Chloropicrin (80 percent) and Stannic Chloride (20 percent)
PG - Chloropicrin (75 percent) and Phosgene (25 percent)
PS - Chloropicrin
RP - Red Phosphorus
SK - Ethylidooacetate (75 percent) and Ethyl Alcohol (25 percent)
WP - White Phosphorus

Blue Star - Chlorine (80 percent) and Sulphur Chloride (20 percent)
Green Star - Chloropicrin (65 percent) and Sulphuretted Hydrogen (35 percent)
Red Star - Chlorine
Two Red Star - Sulphuretted Hydrogen (90 percent) and Carbon Disulphide (10 percent)
White Star - Chlorine (50 percent) and Phosgene (50 percent)
Yellow Star - Chloropicrin (30 percent) and Chlorine (70 percent)
CHAPTER I
INTRODUCTION

"Gas achieved but local success, nothing decisive; it made war uncomfortable, to no purpose."¹
- James Edmonds

"If the war had gone on until 1919 you would have won by gas alone."²
- Fritz Haber

Since its appearance in World War I, chemical warfare has been marked by controversy. The comments of Brigadier General James Edmonds, the compiler of Britain’s official history of the war, and Fritz Haber, the Nobel Prize winning German chemist and father of gas warfare, suggest the widely diverging conclusions that knowledgeable people could come to on the efficacy of gas. While the true assessment undoubtedly lies somewhere in between Edmonds’ and Haber’s extreme opinions, both men advanced legitimate conclusions when examined from their culturally different viewpoints. Haber, a scientist and the product of modernist Germany, saw gas as an independent device that could help transform war into an activity dominated by technology,³ while Edmonds, an officer and the product of a British Army that valued tradition and moral values, saw gas as a weapon that would violate
the primacy of man in battle. Each used their particular perspective to evaluate gas, and their arrival at different conclusions is not surprising.  

Edmonds' and Haber's statements are a reflection of the cultural context of all human endeavors, war included. Presented with gas, a weapon with which they had no previous experience, the combatants of World War I had to adapt quickly to its arrival and integrate it into their operations, both defensively and offensively. The battlefield became the forum for rapid and painful adaptation, and at no point was the task an easy one. There were false starts, dead ends and conclusions that were simply wrong, and, out of the multitude of options tried, only a few led to a successful utilization of the weapon.

When confronted with new weapons, military institutions must decide whether, and how, to incorporate them into its method of waging war. The process involves both a mechanical assessment of the weapon's worth and a determination of its place within the corporate mentality of the institution. The implementation of change requires two steps, one intellectual -- innovation -- and the other practical -- adaptation. Although these two terms are frequently associated, it is important to realize that they represent two separate and distinct processes. This work uses innovation to mean the change in how an army perceives the nature of war and how it plans to achieve victory. For most armies innovation typically involves a re-assessment of its doctrine. Adaptation, however, is the modification of tactics, weapons, organization, and other aspects of an
army operation that attempt to enhance its ability to implement its principles. The relationship between the two concepts is analogous to the differences between strategy and tactics.\(^5\)

This work will assess how the British Army underwent this dual process of innovation and adaptation and the means by which it added gas to its weaponry. First it will explore the cultural background of the British Army's decision-making process and place gas operations within a cultural context that demonstrates the institutional ethos which guided commanders in the selection of gas options. Second it will address the practical side of chemical warfare's evolution within the British Army - the invention of devices, substances and tactics - and the integration of gas into the army's operations. Through this process it will also address the question of whether innovation is possible and the extent to which military institutions can adapt during war.

This emphasis on culture may give the reader the impression that this dissertation will advocate culture as the most important, if not the exclusive, factor in commander decision-making. In fact this work will not suggest that cultural determinism is the principal mechanism by which the outcome of wars is decided. War is a highly complex endeavor, made all the more difficult by events beyond the control of even the greatest of commanders, Clausewitz's concepts of friction and fog capture this reality. Instead this work will maintain that culture set the parameters within which leaders could select options, but that the war was fought upon an ever changing battlefield where commanders had to solve tactical
problems. Ignorance or misinterpretation of the tactical situation could and did result in disaster, and the futile sacrifice of troops. This work does not suggest that cultural bias and tactical necessity must always work against each other, nor does it intend to challenge the validity of the historiography based upon tactical analysis. Rather, it seeks a balance by showing that both culture and tactical necessity determine the decisions commanders make on how to employ a weapon.

At this stage it would be helpful to the reader to provide an outline of this work's structure and its methodology. It falls into two conceptual halves. The first part, chapters 2 to 4, will establish the intellectual framework of the British decision-making process.

- Chapter 2: Doctrine or Ethos. Military institutions typically possess an intellectual framework that provides them with unity of ideas and methods. Scholars, however, have asserted that many of the difficulties the British Army encountered in World War I were due to or exacerbated by their failure to construct this framework, or doctrine as it is usually called. In fact, this is an argument with which few British officers of the period would have disagreed. The British Army frequently debated the need for a doctrine and invariably decided that it would be inappropriate and inefficient to develop one. Yet this does not mean that the British lacked an intellectual focus by which to define their method of waging war and guide their operations. Instead, this chapter will establish that the British possessed an institutionally-accepted ethos by which they defined the principles that underlay all their
operations on the Western Front, and that the success or failure of their army must be measured through their allegiance not to a doctrine but to this ethos.

- **Chapter 3: Decisive Victory.** As this work's title suggests, the British objective in the war was decisive victory -- a victory of such magnitude that the enemy would no longer be capable of defending itself and the victor would be able to impose its will over the defeated. Britain was not alone in possessing this objective, as all combatants sought a quick and overwhelming victory to bring the war to a successful conclusion. This concept derived from the acceptance of neo Clausewitzian dogma and Napoleonic hero worship, along with a recognition of the power of modern weapons, and complemented the officer corps' desire to imbue their troops with an offensive spirit. Despite strategic, operational and tactical variants, decisive victory remained an elusive objective, for the British were unable to achieve their quest. This chapter will describe the origins of decisive victory and establish its place as the cornerstone of British strategy.

- **Chapter 4: Asymmetry.** The British realized that in order to obtain a decisive victory, they had to achieve an essential precondition; the establishment of an asymmetric relationship between their own army and that of their opponent. While the British strove for asymmetry in many different spheres, they focused their efforts on two broadly defined areas - maneuver and morale.
The combatants enjoyed only two brief periods during the war when maneuver was the norm -- during the opening campaigns of 1914 and from the German spring offensives of 1918 to the end of the conflict. Trench warfare was the standard for the more lengthy middle term. Yet the image of immobility during the trench phase does not truly reflect the operational intentions of the British leadership. Throughout the period of stalemate, the pursuit of maneuver was an integral part of British plans, and the British employed gas in an effort to increase the mobility of the attackers and to create the opportunity of striking at an enemy flank or breaking through into their line-of-communications. The British restoration of mobility to their offensives hastened the collapse of the enemy in the war's closing months.

The army's prewar cultural preference for intangible standards found continuity in the selection of morale as the principle area in which the British would strive to achieve superiority over the Germans. Gas proved to be a formidable weapon against morale, and the British thoroughly exploited its ability to cause misery and to wear down the enemy. This chapter will first establish the importance of asymmetry, then analyze the army's belief in maneuver and finally explain the British preference for morale. It will explore the culture of late Victorian and Edwardian England and illustrate how the Boer War, German invasion scares and the phenomenon of improvement movements, such as National Efficiency and the National Service League contributed to a focus upon these values.
Having established the intellectual parameters, the dissertation will then address the tactical evolution of British chemical warfare. Chapters 5 to 8 will demonstrate the influence of culture and ethos on the leadership's decision-making processes.

- **Chapter 5: Introduction and Reaction.** The German use of gas came as a surprise to all the combatants of World War I. Its introduction at 2nd Ypres was dramatically effective as the affected troops collapsed and the Germans gained an impressive advance. Despite angry and self-righteous protest, the allies immediately initiated their own chemical warfare programs. Retaliating at Loos, the British achieved their own success as gas helped the attackers through the enemy's defences. This chapter will discuss Britain's nascent efforts at chemical warfare. It will document how the operational interpretation of the battles of 1915 led to the army's critical reliance upon gas for success. It will also show how the army's prewar intellectual paradigms guided the British interpretation of the weapon's potential and its application on the battlefield. Finally, this chapter will demonstrate that, from the first, the army's leadership saw gas as another opportunity to gain asymmetry, and that they perceived superiority at chemical warfare as essential for eventual victory.

- **Chapter 6: Experimentation.** Second Ypres and Loos suggested but did not achieve the possibilities of gas. Under the shadow of the colossal struggles of Verdun and the Somme, the British would spend 1916 in experimentation, seeking both the agents, dispersal systems, and ideas by which to make gas effective.
Britain also had to overcome the liability of its woeful chemical manufacturing infrastructure, a responsibility which fell to the Ministry of Munitions. Germany was the pre-war European leader in chemical production, an advantage that it would take the Ministry of Munitions several years to overcome. Gas played a part in Haig’s conception of the Somme, but in a minor way when compared to the offensive potential of the other arms. However, by the battle’s end the British had evolved the theoretical principles, invented the appliances, and established the organization by which they would wage chemical warfare. This chapter documents the learning process and the incorporation of gas into all aspects of operations. By the year’s end gas was no longer a novelty but an accepted instrument of war.

- Chapter 7: Institutionalization. The successful employment of gas required not only adaptation by the army but also the building of a huge chemical infrastructure. By the end of 1917 the British had completed the foundation for both. The year witnessed a series of offensives by Britain and France, as they bid for victory, culminating in the quagmire of Passchendaele. In all of these operations gas played a role. The British had defined missions for its use by the artillery, engineers and infantry, and they integrated chemical agents into all levels of operations. The army conducted none of its major attacks and few of the minor ones, including raids, without the assistance of gas. More importantly, the British began to display growing technical superiority over the Germans, not only in gas tactics, but also in the critical area of
gunnery proficiency. The year would not end with decisive victory, but the emerging advantages of the western democracies in a number of technological areas was clear.

- **Chapter 8: Victory.** The war’s final year began dangerously for the western democracies as the Germans, reinforced by troops from the east, struck hard in the spring. The allies withstood the challenge and by mid-summer it became clear that the condition of the hostile army was grave. From July to the end of the war, the British, French, Belgian and American armies forced the enemy back under a relentless hammer of blows. Gas, however, faced a new challenge. With the return of mobility to the battlefield its role was at first less clear. The chemical soldiers accepted the challenge and contributed to every struggle in the advance to victory. The battlefield remained a chemical environment to the war’s end. Moreover, these battles revealed that the British Army had achieved its long-sought superiority over the enemy, a competition in which gas continued to play an important role.

- **Chapter 9: Conclusion.** This chapter will discuss the contribution of gas to decisive victory and the pervasiveness of chemical warfare. It will also touch upon British gas plans for 1919, which anticipated a greatly increased role for gas. Finally it will answer the question of whether or not the British undertook innovation during the war.

Two questions remain before turning to the main body of this work. The first is why use gas as a vehicle to address the British reaction to gas and its incorporation into their pursuit of decisive
victory. In other words, what are its advantages as an analytical tool over other weapons, such as the tank, to which the leadership also had to adapt? Part of the answer is that the nature of gas was unique. Until the introduction of gas, all weapons relied upon mechanical force to kill or injure.\textsuperscript{9} Gas, however, used the reaction of caustic or toxic chemicals upon the respiratory, optical and epidermal systems. Thus there was no tradition of use or possible association with a related weapon to ease the adaptation process. Furthermore, its nature was insidious. Unlike shells or bullets which became harmless when they exhausted their kinetic energy, gas remained a threat after its means of projection ceased.\textsuperscript{10} Finally, none of the combatants had anticipated its use when the war began. As Ludwig Haber wrote in *The Poisonous Cloud*, “it sprang, as it were, in its final form, on an unprepared enemy.”\textsuperscript{11} Therefore, due to its uniqueness and lack of prior development, gas exercised a greater degree of tension on the intellectual response of the British than if it had been a traditional weapon. Its incorporation simply required greater debate and thought than other weapons for which an established tradition existed. For these reasons, gas should be an excellent lens through which to study the British Army’s process of innovation and adaptation.

Finally, the need for another work on chemical warfare, especially when the historiography is already vast, should be explained.\textsuperscript{12} The principal reason is that the approach this work takes is a novel one. No author has attempted to view the adaptation process through a cultural matrix. A second reason is that this work
is only partially about chemical warfare. Rather, it uses gas as a mechanism to look at issues central to the performance of a military institution in war. First it examines the cultural context of decision-making by the senior officers. Second it analyzes the nature of victory and the mechanisms for its achievement. Furthermore, while chemical warfare is now eighty years old, its controversial presence, as the recent Gulf War illustrates, along with the continued role of culture in war, provides a continuing relevance.\textsuperscript{13}

A brief summary of the historiography would be useful to illustrate the intellectual trends in writing on chemical warfare and highlight the unique perspective of this work. During the interwar period, proponents of gas wrote about it in order to advance its case as technological breakthrough which could restore decisiveness to war. B. H. Liddell Hart saw gas as a means to avoid a repetition of the slaughter that occurred on the Western Front. In his \textit{A History of the World War, 1914-1918} he describes poison gas as "the least inhumane of modern weapons," a theme that Fuller echoed in his own writing.\textsuperscript{14} J. B. S. Haldane, a British gas chemist, in \textit{Callinicus: A Defense of Chemical Warfare}, urged the government to make gas technology an integral part of the armed forces and argued that it was a more efficient and less dangerous method of war than bullets and shell fire. Giulio Douhet in \textit{The Command of the Air} proposed a new style of war based upon bombers dropping high explosives, incendiaries and gas on defenceless cities. He believed terror attacks would cause a collapse of the civilian population's will to fight and force the enemy to sue for peace. Liddell Hart agreed with Douhet
and argued strongly in *Paris, Or the Future of War*, that air power was now the most potent service and that combatants would use gas to break national resolve in a war.\textsuperscript{15}

As tensions increased in Europe, civilians became alarmed over the prospect of gas attacks. Civilian defense agencies issued numerous publications to calm the population and provide emergency workers with the means to identify, decontaminate, and protect themselves from chemical weapons. These publications included titles such as: *The Detection and Identification of War Gases; Medical Manual of Chemical Warfare; and War Gases, Incendiaries, Infernal Machines and Sabotage and Fire Fighting as Applied to Military Explosives and Ammunition*. James Kendall contributed *Breathe Freely! The Truth About Poison Gas*, as an attempt to persuade the public that Douhet over-rated the threat from chemical weapons and that urban areas were safe, while Major-General Henry F. Thuillier wrote *Gas in the Next War* in an effort to educate British civilians on the nature of gas and its role in a future conflict.\textsuperscript{16}

Another important theme in chemical warfare historiography is the spread of chemical weapons and the effort to reach an agreement on disarmament. One of the earliest works of this type advocated controls upon Germany's chemical production infrastructure. Victor Lefebure pointed out, in *The Riddle of the Rhine*, that Germany's chemical industry was intact and that they could easily resume the production of gas weapons. After the Second World War, chemical deterrence and disarmament became increasingly dominant themes. Edward Spiers pursued this in two
books - Chemical Warfare and Chemical Weaponry. In Chemical Warfare A Study in Restraints, Frederic J. Brown discusses efforts to deter the spread and use of these weapons. Robert Harris and Jeremy Paxman in their A Higher Form of Killing: The Secret Story of Gas and Germ Warfare extend the debate to include biological and herbicidal chemicals.\textsuperscript{17}

Some recent scholarship has avoided both the technological solution argument and the disarmament debate. Charles Heller, in his concise Chemical Warfare in World War I, discusses both the tactical and organizational changes the United States Army underwent to counter the introduction of chemical weapons. L. F. Haber, in The Poisonous Cloud, concentrates upon the relationship between scientists and soldiers, and the changes chemical weapons imposed upon the combatants' economies. The grass-roots story of the British chemical warfare troops is the subject of Donald Richter's social history, Chemical Soldiers.\textsuperscript{18}

A number of members of the Special Brigade wrote of their experiences. Foulkes authored "Gas!" The Story of the Special Brigade as a unit history and as a means to promote chemical warfare within Britain's military establishment. Major S. J. M. Auld recorded his chemical warfare experiences in France and as a liaison officer to the Americans in Gas and Flame. Martin S. Fox provides the enlisted man's perspective in With the Special Brigade.\textsuperscript{19} There are a large number of works which discuss the chemistry of the war gases. Among the best are Mario Sartori, The War Gases and Augustin M. Prentiss, Chemicals in War. The pathology of gas is
outlined in Edward Vedder's *The Medical Aspects of Chemical Warfare*. Finally, there are several useful introductions to the subject of gas warfare. John Terraine dedicates a chapter to gas in *White Heat*, as does Guy Hartcup in *The War of Invention*. Lastly, Ian Hogg's pictorial history, *Gas*, provides a visual image of chemical warfare.

From the above it is clear that this work touches on a number of concepts. It discusses innovation, adaptation, tradition, technology, and culture, amongst other things. However, each of these themes is really a thread in a more subtle fabric. This work is principally about the limitations culture places on the decision-making processes of military institutions. An intelligent commander tries to understand the culturally delineated parameters of his opponent's options; a wise commander recognizes the culturally imposed limitations of his own decisions.

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2"Harold Hartley to C. G. Douglas," 26 March 1958, Hartley Papers, 32, CAC.


4For a modernist comparison of Germany and Britain and their different reactions to the war, see Modris Eksteins, *Rites of Spring, The Great War and the Birth of the Modern Age* (New York: Anchor Books, 1989).

5For a discussion of the processes of innovation and adaptation,


I am indebted to Professor John H. Guilmartin of The Ohio State University, for this observation.

It is difficult to provide a estimate of how long gas remained effective after its discharge. The type of gas; the weather including the temperature, humidity, cloud cover, and wind speed; the time of day; and whether the gas lay in the open, in trenches, or in dug-outs, affected the duration of the danger.


1957).


CHAPTER II

DOCTRINE OR ETHOS

"... we have got an outstanding way of muddling through"
Lieut.-Gen. Ivor Maxse, 1918

"... the British Army has come to it [doctrine] only lately and somewhat hesitantly."
Lieut.-Gen. Sir Garry Johnson, 1992

Military theorists have frequently accused the British Army of not only having been unprepared for the rigors of the Western Front but also of having sacrificed combat efficiency by their refusal to develop standardized fighting methods. The inability of the British Army to accept the need for uniformity and, as a consequence, the absence of standard training procedures, this accusation continues, resulted in the wastage of lives during the war. The British failure to construct a universal structure for training or, to use the accepted parlance, a doctrine, is a weighty charge, and has greatly influenced the evaluation of the officer corps' competence. Although senior officers and official publications did make reference to the term doctrine, it is clear that its meaning was not the same to the British as it was to other armies. This chapter will acknowledge that the British Army was indeed not a doctrine-driven institution. However,
it will also maintain that, despite the absence of a doctrine, the army did possess a unifying philosophy, or more accurately an ethos, which provided a structure for the decision-making process, and which was the basis for all operations. In ways much more dramatic and all-encompassing than doctrine, ethos provided the British with strategic, operational and tactical guide-lines.⁴

Contemporary military dogma maintains that the creation and dissemination of doctrine is a fundamental preparation for war - an essential ingredient by which commanders integrate and maximize the combat performance of their units. Doctrine is an aspect of war that is difficult to define, although certain key principles are evident. Shelford Bidwell and Dominick Graham identify doctrine as the “study of weapons and other resources and the lessons of history, leading to the deduction of the correct strategic and tactical principles on which to base both training and the conduct of war.”⁵ In a recent essay, Brian Holden Reid suggests that the aim of doctrine is not to create rigid dogma but rather to attempt to inculcate a military institution with a common framework of tactical understanding.⁶ Williamson Murray considers doctrine the “conceptual framework within which one plans and trains one’s forces in peace and in war so that they reach maximum effectiveness in battle.”⁷ Timothy Lupfer defines doctrine as “guidance for the conduct of battle approved by the highest military authority.”⁸ Each of these scholars have identified doctrine as the distillation of ideas into a framework which an army uses to train its forces so that they can achieve maximum battlefield potential. They stress uniformity
and acceptance by commanders that the entire army must be trained within a uniform system and to standardized goals, and the degree of success is measurable during training exercises and comparable in readiness reports. These are terms that the British did not use in their training or in analysing the capabilities of their forces. Instead, one must recognise a different, and perhaps more important, scale to assess their strengths and weaknesses.

Despite its apparent necessity, the British Army, unlike its European rivals, went to war without a doctrine, and commanders from the most junior to the senior levels consistently sought their own solutions to the situations they faced. Tim Travers demonstrates that corps and divisional commanders had great latitude in accepting General Headquarters suggestions when designing offensive operations or defensive schemes. General Headquarters provided operational goals, but it was up to each commander to determine how he would achieve these objectives. Travers illustrates this point with examples of the lack of uniformity in the attack plans for the 1st day of the Somme - certainly not the most brilliant day in the history of British tactics. He writes that Maxse trained his 18th Division in open ground fire and movement tactics so that his troops could fight their way across to their objectives, while General Jardine, the CO 97th Brigade, put his men into No Man’s Land before zero hour so that they could advance directly behind and protected by the barrage. Hubert Johnson has observed that as late as December, 1917 British corps were still independently formulating their defensive schemes. After the
Cambrai debacle, Maxse, who was now the GOC of XVIII Corps, concluded that the best protection for his corps would be a fluid defence in depth that was stiffened by redoubts in a battle zone. By contrast, the Canadian Corps decided that they would employ a linear defense based upon trench lines which would be held at all costs.\textsuperscript{10} General Headquarters was aware of these differences and during the winter 1917-1918, it analysed the lessons of Cambrai and advocated a defensive formation that was similar to Maxse’s idea of a battle zone.\textsuperscript{11} However, the staff at General Headquarters could not force this scheme upon the corps and division commanders. Travers suggests that inconsistencies in divisional defensive arrangements in Fifth Army on the eve of the German spring offensives of 1918, and the failure of divisional commanders to implement the defense-in-depth plan designed by General Headquarters, greatly aided the enemy in their penetration of British positions and contributed to the collapse of the army.\textsuperscript{12}

Towards the end of the war the British themselves reached similar conclusions on the consequences of their independent tendencies. A report prepared for the Chief of the Imperial General Staff confirmed that the armies, corps, and divisions held divergent views and practiced different methods. The problem was further exacerbated when a division moved to another army or corps and encountered new doctrinal standards. Even at the administrative level the British Army showed a disregard for institution wide practices. The report continues that each of the five armies of the British Expeditionary Force employed different methods for corps
and divisions to render their returns. Nor was uniformity imposed upon smaller units. Haig believed that the commander of each level was responsible for making his unit's own tactical plans within the framework of the general scheme. He believed that it was his responsibility to simply outline the battle to his subordinates and leave its execution to them. Therefore, commanders traditionally passed on their orders to their units but did not interfere with the method of carrying them out their instructions. Until the very end of the war, common methods were virtually impossible to achieve.

Historians have advanced numerous theories to explain this practice. Dominick Graham has argued that the British regimental system prevented the imposition of a centrally directed concept of how the army would fight. Instead, unit commanders made their decisions based upon their own preferences and the demands of the local situation. John Terraine would certainly agree with this assessment. He has described the British forces as not so much an army but rather a reservoir of imperial garrisons, lacking the organizational unity and common doctrine to bind the regiments into a common whole. John Baynes adds that it is the regiment, not the army that is the focus of loyalty and tradition and that officers, N. C. O.s, and the other ranks all shared in this devotion. Baynes goes on to explain that the garrison system frequently imposed physical limitations that hindered the training in tactics. When the 2nd Scottish Rifles were on Malta the confining nature of their base resulted in an emphasis upon musketry rather than tactical field work. For many officers their relationship to the regiment is what
John Keegan has described as membership not in a military organization but rather a large Victorian family, complete with ornate silverware in the mess and photograph laden histories. The regiment embodied the values of upper-middle class society, including an institution with ancient lineage, connections to the gentry through its emphasis upon country life, and associations with the court by the practice of naming members of the Royal Family as honorary colonels.¹⁹

Paddy Griffith in *Battle Tactics of the Western Front* advances a variant on the regimental rationale which helps to explain the army’s refusal to create a doctrine. The system promoted tradition or perhaps ‘myth’ of the ability of any British regiment to fight its own battles, more or less on its own. In fact, diverse imperial commitments forced many regiments to stand alone. The legends of Albuera, Waterloo, Rorke’s Drift, and Baden-Powell’s stand at Mafeking all suggested an infantry that cherished the ability to stand fast - despite the odds - for sake of the regiment. Furthermore, since the majority of the army was infantry, self-sufficiency became most associated with that arm and strengthened the belief in the need for a decentralized approach to tactics.²⁰

Travers has suggested that the avoidance of doctrine represented a preference amongst most officers for an amateur army rather than a professional, technically-based one.²¹ Writing in 1897 the army’s most senior and respected officer, Lord Wolseley, summed up the institution’s attitude toward professionalism. He wrote:
I hope the officers of her Majesty’s army may never degenerate into bookworms. There is happily at present no tendency in that direction, for I am glad to say that this generation is as fond of danger, adventure, and all the manly out-of-door sports as its forefathers were.\textsuperscript{22}

J. F. C. Fuller encountered a similar attitude while with the Oxfordshire Light Infantry at Curragh. His brother officers considered the depot a plum post because they could hunt, fish and shoot cheaply, and the preferred topics for mess conversation were foxes, trout and ducks. By contrast, Fuller had a miserable time and spent his free hours in his room reading.\textsuperscript{23} British officers frequently identified sportsmanship as the essential attribute for leadership. One declared, “I should say [riding] is one of the things that matters most for an officer . . . . Men will always follow an officer who’s got the sporting spirit.”\textsuperscript{24} G. F. R. Henderson also commented on this preference for amateurism. Writing in 1902 he believed that before the army could adapt the Moltke system it had to make fundamental changes in its approach to war. He believed the army needed to overcome its traditional disdain for intellectual pursuits and that officers had to become specialists. Henderson went on to criticize the army for far too great an attention to the pursuit of sport instead of the study of war.\textsuperscript{25} Even during the war there were accounts of a lingering preference for amateurism. A brigadier hotly remarked to some artillery surveyors that, “you damned surveyors with your
coordinaters and angles and all the rest, are taking all the fun out of war; in my day we galloped into action and got the first round off in thirty seconds."26 Finally, one officer saw the end of World War I as the opportunity to "get back to some serious soldiering."27

Travers has concluded that the imposition of doctrine requires an institutional willingness for self-criticism, a problem for the British Army which valued tradition, character, deference, and group loyalty.28 The institution could interpret many actions as a breech of the trust or the family setting that these values encouraged. A comment by General Robertson hinted at this point. He objected to the proposed writing of a controversial manual on tactics because it "would be subjected to a considerable amount of criticism, and that is not altogether desirable."29 Fuller believed he had to retire before he could openly criticise the army, and felt it necessary to say in his preface to The Army in My Time:

Should this book be considered too highly critical, my defence is that through criticism alone can we hope for progress. The serving soldier is forbidden to criticise - consequently, if it is to be done, it is right that the retired soldier should do it.30

Ivor Maxse recognized the dangers he faced when he proposed significant changes in battalion organization. He began his outline with the acknowledgment that he was willing to hazard the wrath the institution reserved for those who criticise because his objective
was improvement. General W. G. Nicholson, Chief of the Imperial General Staff, suggested the army’s official attitude towards criticism in his introduction to the premier issue of the Army Review. He included the ominous statement that the goal of the publication was to “evolve the formulation and expression of individual ideas on matters which are open to discussion,” thereby indicating that only certain topics were safe. In a subsequent issue, General John French clarified the problems an intellectual renegade faced in expressing different opinions. While French welcomed submissions he expected them to conform to the ideas established in the army’s manuals. A contributor could submit novel ideas, but he warned that they would be severely scrutinized and only published once they had been deemed inoffensive to the army’s principles. French’s standards do not suggest a willingness to foster an open and lively debate, nor that the expressing of independent ideas was the best way to foster a career.

The observant Henderson concluded that the lack of uniformity had a more practical source. The staff college, he noted, only graduated thirty-two officers a year and that the total number of alumni barely filled half of the army’s staff positions. Yet, he continued, even if the army had sufficient trained officers, uniformity would still prove illusive, as the instructors at the staff college had not attempted to train their students in the same system. Nor could officers have sought to solve the mysteries of doctrine on their own. Outside the staff college, Henderson continued, there was little encouragement for professional military education, and
commanding officers were not held liable for the intellectual advancement of subordinates. In any case, the army did not provide lists of suggested reading. If an officer wanted to learn, his education was no one's business but his own.\textsuperscript{34}

Compounding these attitudes was a structure that did not have an institutional mechanism to formulate, disseminate and implement a doctrine, nor a hierarchy that rewarded officers for doing so. Writing after the Boer War, Henderson commented that:

in the British Army no means existed for collecting, much less analyzing the facts and phenomena of the battlefield and the range . . . . Experience was regarded as the private property of individuals, not as a public asset, to be applied to the benefit of the army as a whole.\textsuperscript{35}

On the eve of the Great War this tendency was still evident. French found it necessary to explain that it was the duty of all officers to share their knowledge with their fellow officers rather than keeping it to themselves.\textsuperscript{36}

Even after Maxse took up the position of the newly created Inspector General for Training in mid-1918, with the responsibility for setting standards for tactical training, there remained a lingering preference for the old ways. One of the booklets issued by his office recognized that the
value of training is that it helps to coordinate the various arms into an integral whole. This is important because it makes the whole machine more effective . . . towards its sole purpose - the KILLING of the enemy.\textsuperscript{37}

However, another of his publications reached a stunningly different conclusion on the value of training. It defined success not by the practical examples illustrated above, but by intangibles such as determination. Instead of recommending a fixed program of standardized training it concluded that if one is “determined to kill the enemy, ways and means of doing so will readily suggest themselves.”\textsuperscript{38} The difference in emphasis in Maxse’s pamphlets was only the latest example of a long-standing debate between forces that favored a more scientific approach to tactics and those that preferred a continued reliance upon moral values. Haig’s experience at the Staff College exemplified this conflict. He concluded that “the science called tactics has certainly its uses, but its study will be to no purpose if the combatants are deficient in courage, activity, and a determination to conquer.”\textsuperscript{39} Therefore, it is not surprising that even within the organization that the British conceived as the means to create uniform tactics their traditional hostility towards doctrine continued to assert itself.

The absence of the unifying standards was not the result of accident, neglect, nor ignorance, rather, it was a policy that the British Army knowingly and deliberately selected. The FSR maintained that while the principles of war were few, their
application was difficult and could not be defined by rules, and the infantry training manual deduced that, since no two military operations were exactly the same it was impossible and undesirable to establish fixed and unvaried rules for the tactical handling of troops. During the years before World War I the British Army weighed the issue of creating a doctrine and concluded that such intellectual conformity had no place on the modern battlefield. At a 1911 conference of staff officers, Captain C. A. L. Yates suggested that the army should produce a manual of applied tactics for officers to study. The guide would provide a series of situations and solutions. Many of the officers at this conference loudly condemned the proposal as the first step in creating an officer corps imbued with standardized responses to potential situations. Major General F. S. May believed that the idea was dangerous because officers would study it to the exclusion of works of a more general interest. As a result it would lead to stereotypical responses, a liability since Britain might have to fight anywhere in the world under greatly differing circumstances. Another officer, Brigadier General Davies, objected because he feared officers would become tempted to seek answers to tactical problems in a book rather than using their intelligence. After brief consideration the General Staff Directors opposed the suggestion, due to the difficulty of keeping it current with other manuals, the fear that it would promote stereotyping, and because it could not possibly be sufficiently comprehensive to cover all potential situations. An article in the Army Review announcing the publication of a new edition of Infantry Training reinforced this
declaration. It stated that “considerable latitude in applying principles and instructions to local conditions has been left to commanders and that due to differences of training programs throughout the empire, strict adherence to one method would be impossible.” Finally, while this insistence upon geography provided one explanation, another author simplified the issue with the suggestion that all an officer needed to solve any situation was common sense.

Fuller, certainly among the most erudite of British officers, made the same observation. Writing in the *Journal of the Royal United Service Institution* in 1914, he concluded:

I have no doctrine, for I believe in none. Every concrete case demands its own particular solution, and... all that we require is skill and knowledge, skill in the use of our weapons, knowledge of our enemy’s formations.

He continues, “if there is a doctrine at all then it is common sense, that is action adapted to circumstances.” Fuller, a leading proponent of professionalism, did not belong to the school of thought that advocated an amateur army. He fundamentally believed that success in war required practice and study; yet he too saw no need for doctrine and preferred to let commanders, properly trained, deduce their own solutions to local situations. Callwell, in *The Tactics of Today*, shared Fuller’s opinions. He believed that the constant
progress in military equipment meant that tactics were always in a state of transition and that only in war could one understand the full implications of the advances in weaponry. Callwell concluded that the, "art of leading troops in action is a progressive art," and that "the changing tactical environment was only visible during war."

While these were the stated objections, they are also only components in a superficial rationale for the officers' objection to any attempt to instil a doctrine, and, more importantly, to the imposition of change that it required. The sustainment of the practice of giving officers considerable latitude in tactics represented more than a decision regarding the nature of doctrine, it also stood for the victory of the traditionalists over the reformers. In part, it was a continuation of the debate between an amateur and a professional army that Travers and others have already observed. However, the army was not the only venue of this struggle between amateur and professional values, but merely one stream in a much more broadly based society-wide debate. Furthermore, while the issue of imperial defense posed a major political conundrum in the years before the war, and even though there it had some valid military points, the army seized upon it as a means to resist change and to justify the continued supremacy of anti-doctrine philosophy. Several years before the war's outbreak, the question of imperial defence, in military terms, had already become an issue of secondary importance.

After the 1904 Entente with France and its implied commitment to intervene on the continent, it became increasingly
clear that the priority for the army was no longer imperial defense but instead its ability to wage war against a European opponent.\textsuperscript{47} Lord Haldane’s reforms after 1906 and the creation of the six division expeditionary force reinforces this conclusion. The army’s continued insistence on the needs of imperial defense as the basis for its refusal to adopt a doctrine contradicts its security priorities and demands a better rationale than just inertia. Both George Dangerfield and Samuel Hynes have suggested an explanation for this reluctance.\textsuperscript{48} Dangerfield uses the crisis in the House of Lords, the rebellion in Ulster, the dislocation of the labor strikes, and the violence of the suffragette movement to illustrate that Britain, on the eve of World War I, was a society nearly torn apart by domestic dissension. These disturbances broke the confidence of the Liberal Party and of liberal values in the conduct of society. Dangerfield goes on to show that the nation’s willingness to accept gradual change evaporated and that the forces of conservatism reemerged to maintain the moral standard and to hold society together.\textsuperscript{49}

Hynes goes even further and suggests that the tensions which racked Britain were not only due to domestic problems but were also a manifestation of conservative Edwardians’ desires to preserve Victorian values from the relentless onslaught of modernism. For these conservatives, change, any change no matter how trivial, had to be bitterly resisted, as any concessions could lead to a breach in the moral order and the collapse of the organization of society. According to Hynes the prospect of change terrified the establishment:
The essential fear . . . is a fear that society will change so radically under these liberating pressures as to remove it from the authority of the established order and of the abstractions that that order depended on: property, the family, Christianity, class, the dominance of men.50

Hynes believes that the Tories associated all change with both the moral and physical decline of the nation and that their resistance was the only means to safeguard society. The traditional and conservative minded officer shared the reaction of the Tories to the threat of change that the evolving nature of military commitments demanded, and like their counterparts in the rest of society they resisted any attempt to change the character of service in the army.51

For the scholar these attitudes of the British Army raise a rather awkward dilemma. If doctrine is vital and if the British, knowingly failed to conceptualize one, then they must deserve the ignominy that is frequently heaped upon their faculties. However such an approach, while possessing the benefits of simplicity, is inadequate because it attempts to hold the British to a too sharply drawn standard which insists that the army's central focus must be on a universally approved and inculcated doctrine rather than probing more deeply to discover if armies could base their intellectual framework on a different type of foundation. World War I was a lengthy conflict and during its course the British continually
adjusted their tactics to the ever changing context of war. In some cases the reaction was dramatically fast. The first day of the Somme was a disaster but they quickly identified the faults, implemented corrections, and the next attack on the 14th was a dramatic success. Furthermore, the British successfully applied innovations in an effort to find solutions to the impasse of the Western Front that would set the stage for the decisive battle and the achievement of victory. These were not the product of random events but rather part of a determined effort to find the answers to the war’s difficulties. If the British did not have a doctrine by which to guide themselves through this process and to disseminate their innovations how did they incorporate their innovations into their method of war?

In reality, ethos obviated the need for a doctrine. Ethos provided the continuity of thought which linked the army into a whole, because it was soundly based upon the cultural values of the nation and accepted by the members of the officer corps, not only at the senior ranks and the general staff but also which percolated down to the level of the junior officers and even to the NCOs and the other ranks. Culture played a particularly important role in the British Army, for it was culture, rather than doctrine, that defined the British method of war. To criticise the British Army for its failure to have a doctrine misses the point when studying its adaptation to the realities of World War I. To castigate the army over this issue, or to label it as ill-prepared or stolid for their failure to adopt something so obvious as a doctrine obscures the fact that
the British did have a framework through which to interpret the war and to guide their response to its challenges.

Ethos refers to the characteristic spirit and the prevalent sentiment, taste or opinion of a people, institution or system. To be identifiable, a people’s ethos must contain several features - it must be representative of the values of the society; it must include a significant part of the population, particularly those in positions of power and influence who are able to shape the culture; and it must be enduring, the state must possess the desire to maintain it and to instil the next generation with similar values. While there is a temptation to label it as tradition, ethos is not a static state of irrational beliefs that isolate a society or prevent the evolution of ideas. Only in the extreme cases does it act as a barrier and then only in cultures that are determined to resist change at all costs, or whose leaders see a political benefit in excluding the outside world, as did the government of Japan during the Tokugawa period which isolated the country from western influence for nearly 250 years.

Instead ethos plays an active role in society. Even in a country such as Britain with an entrenched conservative element, ethos can bend and adjust to forces which shaped the culture. The hallmark of the years before the war was the bombardment of the existing order by new ideas, inventions and experiences as modernism attempted to infiltrate British culture. The conservatives resisted but were generally unsuccessful in their confrontation with change. Hynes identifies a standardized response to the introduction of the new theories of modernism. Whenever they appeared, during those
tumultuous years before the war, the pattern was the same: "the New behaved brashly, insolently, or violently, and the Old responded with an arthritic resistance." One part of society sought stability while the other struggled for change. Yet Britain did slowly change, for its ethos was not rigid and it gave the nation a mechanism to assess new genius and to shape the adaptation of novel ideas into a recognizable and comfortable form so they can be incorporated into the existing order.

Mirroring society, the institution of the army also contained the necessary elements to create a viable, sustainable and dynamic ethos, and, as discussed above, the army also underwent a struggle with change during the years leading up to the war. The army derived its ethos by borrowing its values from the broader culture, institutionalized it by imposing it upon the vast majority of the officer corps, particularly at the senior levels, and assured its continuance by incorporating mechanisms to pass it on to the next generation. The army’s ethos revolved around certain intangible qualities such as a preference for amateurism, an aversion to professionalism, and an emphasis on the character of the individual. More directly, the army identified particular values such as loyalty, self-confidence, physical courage, obedience, moral virtue and sacrifice as representative traits of their ethos. This emphasis comes through repeatedly in the testimony of Major General Sir Hugh Sandham Jeudwine who proudly identified the traits the British brought to the war as “courage, devotion to duty, determination, and endurance.” General Sir Henry Rawlinson believed victory was the
result of the invincible will to conquer in every officer, NCO and
man.\textsuperscript{55} The gunner, W. H. F. Weber, observed that technology might
achieve temporary success but victory depended upon national
character.\textsuperscript{56} Fuller described the officer corps as being composed of
"men of honour, men who could be trusted, who were loyal to King,
country, their men and to their caste,"\textsuperscript{57} and the FSR concluded that
"skill could not compensate for the want of courage, energy, and
determination . . . ."\textsuperscript{58} Travers, among others, has also advanced
these traits as the fundamental values which guided the mentality of
the British Army.\textsuperscript{59}

To be effective, however, an institution must widely accept its
ethos, a qualification that the British readily achieved. Facilitating
the army’s dissemination and integration of its code was the officer
corps’ traditional reliance on recruits drawn from a narrow, cohesive
layer of society.\textsuperscript{60} Class stratified the nation into a series of well
defined sets and the army drew its officers from levels that shared
common values and assumptions on the nature of society and their
role in the military. Originally the preserve of the nobility, the
military families and some clergy, the officer corps, over the course
of the 19th century, extended itself to include the gentry and the
professionals. Thus the narrow pool of candidates encouraged a
similarity of outlook and station.

The prevalence of class, however, while critical to one’s
acceptance as an officer, does need qualification. The barriers were
not totally impermeable and it was possible for outsiders to cross the
divide that separated the officers from the other ranks, such as
William Robertson’s rise from private to Field Marshal. During the war the flexibility of the caste system became critical as the army’s rapid expansion and high officer casualties greatly increased the need for leaders beyond the ability of the traditional sources to supply. When pressed by the needs of war the real determinate of membership became clear; it was not class that defined who could be an officer but rather character, of which the most important trait that determined a candidate’s acceptance into the caste was whether or not the individual was a gentleman. Throughout the war the British strove to maintain the social exclusiveness of the officer corps. While they resorted to a number of expedients, such as shortening training periods and speeding up the process of commissioning, the army consistently made gentlemanly qualities a prerequisite for commission. Initially the universities and public schools provided a ready source of suitable material, but after casualties forced the army to promote from the ranks, it selected first from soldiers belonging to the professional and managerial classes and not the workers.

Officer Training Battalions served not only to teach potential subalterns leadership but also to measure a candidate’s gentlemanly qualities. Henry Ogle, promoted from the ranks, wrote down his experiences at officer training school in 1917 in his journal. The unit’s commander, according to Ogle, believed it his duty to make his students into “officers and gentlemen.” Commenting on mess practices, Ogle observed that the commanding officer had “a rota for cadets to dine at the officers’ table, so many every day, so that he
[the commanding officer] could note how we shaped at table talk and eating peas." Class was a potential indicator of a candidate’s worth, but what really unified the officer corps into a monolithic institution was its adherence to the idea that all its members epitomized the ideals of a gentleman and possessed a willingness to adhere to the values of the majority.

While one would expect an officer corps with similar backgrounds, educational experiences and social attitudes would develop or adhere to a common ethos, would the rest of the army, the NCOs and Other Ranks, also share these values? In a society in which class played such a dominant role, one might assume that each category of people would develop its own ethos, derived from the unique experiences of the middle class, the working class or the different sentiments of the nationalities that composed the United Kingdom. However, this is not the case. The top echelons of British society were responsible for not only the running of government but also for the setting of a national ideology. Moreover the non-public school world recognized the supremacy of the upper class’s cultural ideas which filtered downward and permeated all of society. Before the war anyone who could afford servants had at least one, a reflection of the divisions in society between those who led and those who obeyed. After the war began, this distinction continued. Captain Arthur Gibbs, a young officer in the Welsh Guards who had attended Eton, reported that his new batman was “a very nice boy who promises well. An ex-footman, he has quite the correct manner.” The provision of junior officers with servants was not
merely the preservation of a tradition but a deliberate attempt by the army to perpetuate the supremacy of the upper class, and as the officer class expanded, the army symbolically issued all the temporary officers their own batman. The class system worked in both directions. It required deference, not only in appearance or demeanor but also in ideas. It is not surprising that volunteers responded by the tens of thousands to Kitchener's call to arms or that grown men could so readily accept in the trenches, with little resentment or reluctance, the leadership of officers who were little more than boys, but who were also public school men.66

As the war progressed, the army would have to rely heavily upon the youth of the upper classes to provide it with the necessary numbers of officers. Fortunately for the army, it was virtually impossible for a boy to pass through the cultural system of elite society and not absorb the qualities and attitudes expected of an officer. Before the war, the majority of the army's officers had attended public school and university, a pattern which was to play an important role as the army expanded. The schools emphasised education “in a gentlemanly tradition of loyalty, honour, chivalry, Christianity, patriotism, sportsmanship and leadership,”67 which assured that their graduates met the army's educational and social requirements. Furthermore, the schools fostered devoted allegiance to one's house, school and country; sentiments that the army could transfer into devotion to one's regiment. Reinforcing these tendencies were the schools' often maniacal emphasis upon sport, which not only developed the physical body but also instilled moral
virtues, developed team spirit, and the concept of striving for the common weal instead of the individual. The widespread use of sporting metaphors to describe the war is not surprising, for every officer understood the need to play the game. The boys were not merely the graduates of these institutions but the product of a deliberate molding process, and they were all from the same mold. With such focus upon character-building, the actual education of the pupils or the creation of an active intelligence were, by comparison, of minor importance. Consequently, the staff at the army’s schools at Sandhurst and Woolwich did not include leadership in their curriculum but assumed that their candidates came equipped with the necessary social and moral qualities to be future officers.⁶⁸

The military instruction of public school boys had existed for some time, but for most of the nineteenth century it was a rather minor affair and most of the schools did not sponsor a cadet corps. At those that did it tended to be a small, poorly run, and little respected activity. However, after the Boer War the environment quickly changed as the debate over military efficiency and fears of German invasion swept the public schools, along with the rest of society. More schools founded cadet corps, participation improved, and the administration along with the boys showed an increased level of keenness. Lord Haldane’s establishment of the Officer Training Corps in 1908, as part of his military reforms, put the training of boys in the military arts onto a more regular basis. Haldane saw the Officer Training Corps as a potential source for officers for the regular army, the auxiliary and the territorials. The
War Office issued regulations for the training of the boys and undertook their examination, thereby providing the army with an opportunity to expose the cadets to its military values at an early age. Thus, while at school the boys not only received the gentlemanly character expected of an officer, but also exposure to basic military training and the idea that their future role was to be leaders of men. By 1914 over 100 public schools and twenty-two universities had officer training programs.⁶⁹

Haldane’s Officer Training Corps scheme, along with the entreaty of Lord Roberts of the National Service League, helped to provide the army with a pool of candidates that could not only be quickly commissioned in case of national emergency but ones that had also already incorporated its ethos into their beliefs. On the day Britain declared war the War Office sent out 2,000 invitations to university and public school men to apply for commissions. The War Office believed that these men had the background and Officer Training Corps experience to take up leadership positions with minimal additional training. Reliance upon the Officer Training Corps for a ready supply of officers quickly accelerated, particularly from the universities. By the end of the first year Oxford had supplied 2,500 officers, Cambridge 2,300 and the Inns of Court 2,500 with smaller amounts contributed by the lesser centers.⁷⁰

Other old boys, who rallied to Kitchener’s call, but who wanted to serve with their friends, instead of accepting commission in a host of units, formed their own pals battalions. Composing The University and Public School Brigade were the 18th through 21st Battalions of
the Royal Fusiliers while another battalion became the 16th Middlesex Regiment. However, these men came under pressure to take up their proper role, and the units became depots for officers. By 1917 the University and Public School Brigade had given off over 7,000 officers while the Middlesex a further 1,400. Instead of serving as ordinary soldiers these old boys had to fulfil the responsibility for which their training and breeding had intended them, the leadership of men.\textsuperscript{71}

While the need to be gentlemen helped make the officer corps into an exclusive club, the expenses of membership further contributed to the creation of a homogeneous institution. Not only was a public school or university education a major drain on a family resources but even after commissioning considerable private resources were necessary to support a young officer determined on an army career. A subaltern’s salary fell far short of the amount needed for the purchase of uniforms, mess bills, cases, mufti, servant’s outfit, annual maintenance the costs of field sports and social events, and those in cavalry units had to provide not only their own charger but also several ponies for hunting and polo. The regimental system helped to stratify the officer corps even more as the costs of joining a regiment varied greatly, with the more prestigious units generally being more expensive. Financial resources helped to assure that one served with comrades who were from a similar economic and social background and further strengthened the trend towards a uniform ethos.\textsuperscript{72}
Kitchener’s call to the colors might easily have resulted in the creation of New Armies that were detached from the values and ethos of the Old Contemptibles. However, the army took advantage of the regimental system to instil a sense of tradition and familial association within the newly raised battalions. Instead of inventing new names or assigning arbitrary numbers to the new battalions, the War Office appended these units to existing regiments. Thus the four battalions raised from the city of Hull became the 10th to 13th battalion, East Yorkshire Regiment, the units enrolled in the Newcastle area became part of the Northumberland Fusiliers and those from Glasgow joined the Highland Light Infantry. The raw recruits to the Sherwood Foresters inherited the regiment’s glory from the winning of Canada, the victories of Wellington and service in India and Egypt while the volunteers of Tyneside became part of the Northumberland Fusiliers record of service in the Peninsula, India, Afghanistan and South Africa. Kitchener’s decision linked the new units to the victories of the past, created loyalties, and helped to insure a continuity of ethos between the regular army and the New Army.73

A final indication of the army’s desire to maintain class purity as much as possible is suggested by the types of commissions it granted. Over the course of the war the army commissioned over 200,000 new officers. However, the vast majority were temporary commissions and only 16,500 admitted its holder into the regular army. Once peace came only those who met the prewar conditions of membership would have a continued role to play.74 Furthermore, to
help the hastily commissioned officer to learn and adapt to the army's social roles it provided a series of crib books that suggested tips for the proper behavior of a junior officer, and one recommended to avoid cinemas and not to become a bookworm.\textsuperscript{75}

Having established the nature of the British ethos, did it matter that the army lacked a doctrine? As already suggested, many historians have emphatically maintained that its absence represented a grave failure. It would be tempting to dismiss these scholars with the observation that after all the British were among the victors, and perhaps one should, but flippancy would not due justice to this difficult issue. Whether an army has a doctrine or not is actually of secondary importance to its possession of an ethos, because it must have a value system by which to interpret the problems of combat and test the feasibility of solutions. The ability of a military institution to place the combat environment within its intellectual framework, is a vital prerequisite if an army is to respond fully to the need for adaptation and innovation. In order to change, an army must have a prospect for the examination of new ideas or situations. Without such a focus it is extremely difficult, if not impossible, to implement any modifications, even during the course of a long war. Doctrine is important, but ethos remains essential.

Some additional observations remain. Since an institution must analyze new ideas from the perspective of its ethos, the absence of an intellectual focus in a dynamic environment means that the organization has no basis upon which to evaluate an innovation's
effectiveness. While the British Army may have disliked criticism it did encourage the analysis of new ideas to determine how or if they would incorporate novel methods into their system. Its ethos provided an analytical matrix in which its leaders could consider, test, implement and finally post-operationally assess new ideas. The British adaptation to gas provides a case in point. Their initial emotional reaction upon its surprise introduction was quickly followed by an intellectual response which investigated the potential of the new weapon and determined how it would fit into the existing system. While this might suggest that this practice imposes limits on the weapons uses, it also allows for a rapid response as the implementation of the novelty need not start from the absolute beginning. Furthermore, limits always exist because adaptation occurs within a culturally defined lens which encourages focus upon certain options while obscuring others.

The FSR, the principle manual in which the British described their ethos, identified the principles by which their army would fight. It stated that:

The principles given in this manual have been evolved by experience as generally applicable to the leading of troops. They are to be regarded by all ranks as authoritative, for their violation, in the past, has often been followed by mishap, if not disaster. They should be so thoroughly impressed on the mind of every
commander, that whenever he has to come to a decision in the field, he instinctively gives them his full weight.76

Therefore this work must now turn to the specifics of how the British expected to fight and win a war.


2Quoted in Brian Holden Reid, War Studies at the Staff College, 1890-1930 (Camberley, Surrey: Strategic & Combat Studies Institute, 1992), vii.


4The British were well aware that they did not have a doctrine. See, “The British Army and Modern Conceptions of War,” Journal of the Royal United Service Institution 55 (September, 1911): 1182-84.


6Reid, War Studies at the Staff College, vii.


8Timothy T. Lupfer, The Dynamics of Doctrine: The Changes in
German Tactical Doctrines During the First World War (Fort Leavenworth, KS: Combat Studies Institute, 1981), vii.


10 Johnson, Breakthrough!, 226.

11 One should note that the British adoption of the defense-in-depth scheme was not a original innovation but derived from tactics that the Germans introduced in 1917.


14 “Class notes on strategy,” Haig Collection, 3155/20, NLS.


20 Griffith goes on the explain that the trend towards infantry independence would pose a problem in the Great War because the demands of technology required greater coordination between arms. See, Paddy Griffith, Battle Tactics of the Western Front: The British


Lord Wolseley, "Forward" in Colmar Freiherr von der Goltz, The Conduct of War: A Short Treatise on its Most Important Branches and Guiding Rules G. F. Leverson, trans., (London: Kegan, Paul, Trench, Trubner & Co. Ltd, 1908), v. To Wolseley's credit he does go on to acknowledge the increasing need to study war and military history, especially if an officer hopes to reach the higher ranks.


Quoted in Martin Samuels, Doctrine and Dogma: German and British Infantry Tactics in the First World War (Westport, CT: Greenwood Press, 1992), 166.


Bidwell and Graham, Firepower, 109.

Quoted in Ibid., 146.

Travers, "The Hidden Army," 524.

"Report of a Conference of General Staff Officers at the Staff College," 9-12 January 1911, 5-9, Haig Collection, 3155/87, NLS. However, Robertson did not object to it being published privately.


34Henderson, The Science of War, 394-95, 397-98. In 1906 one staff officer suggested that each regiment should have two officers responsible for the military education of the subalterns. The army did not take up the idea. See, C. A. L. Yate, “Our Present Infantry Organization: A Suggestion,” Journal of the Royal United Service Institution 50 (1906): 1046-47.


38I. G. Training, Hints on Training for Artillery Brigade and Battery Commanders Training Leaflet No. 6, (n.d.), White Collection, NLA.

39“Class notes on strategy.” Haig Collection, 3155/20, NLS.

40General Staff, FSR, 11.

41General Staff, War Office, Infantry Training (London: HMSO, 1914), 120.

42“Report of a Conference of General Staff Officers at the Staff College,” 9-12 January 1911, 5-9, 28, Haig Collection, 3155/87, NLS. Samuels has also reached the same conclusion that the British Army rejected doctrine due to a fear that it would lead to stereotyped tactics. However, he does not consider the option of an ethos but rather maintains that the British simply emphasised in their training the need for unquestionable obedience. See, Samuels, Doctrine and Dogma, 180.

43“Infantry Training,” Army Review 1 (July, 1911): 86. Griffith also recognises the role of geography and suggests that the army relied upon discipline and cohesion, to the expense of doctrine, since
tactics would have to be shaped to local conditions anyhow. See, Griffith, *Battle Tactics*, 52.


"J. F. C. Fuller, “The Tactics of Penetration: A Counterblast to German Numerical Superiority,” *Journal of the Royal United Service Institution* 59, (November, 1914): 389. Though published after the war began Fuller first presented the paper in April, 1914 as a lecture. The published version contains a disclaimer that “the present war, will, no doubt, cause me to modify many of the opinions expressed in it, up to the present date (September 23rd, 1914) it has rather strengthened than weakened them.” See, Fuller, “The Tactics of Penetration,” 378.


Hynes, *The Edwardian Turn of Mind*, 287.

Ibid., 25.


Hynes, *The Edwardian Turn of Mind*, 7-8.


While the anti-traditionalist Fuller identified these as the army’s characteristic he did not think too highly of them as he continued: “As soldiers they lacked one thing only - a knowledge of their profession.” Fuller, *The Army in My Time*, 39.

General Staff, *FSR*, 42.

Travers suggests that the British Army was locked into a traditional 19th century mind-set that placed the emphasis upon qualities such as discipline, courage, optimism and high morale. See, Travers, “Learning and Decision-Making,” 92, 96 and “The Hidden Army,” 524. Keith Simpson believes that the army’s ethos drew upon an exclusive educational system, a commitment to country pursuits, loyalty to institutions, self-confidence and physical courage. See, Keith Simpson, “The Officers,” in Ian F. W. Beckett and Keith Simpson, eds., *A Nation in Arms: A Social Study of the British Army in the First World War* (Manchester: Manchester University Press,
1985), 65.

"For a good summary of the origins of the officer corps see, Ibid., 63-90.

Robertson rose through the staff which may have mitigated the problems of social snobbery. See, Ibid.," 65.

Upon the outbreak of war Kitchener moved quickly to prevent the departure of some 500 officers from the Indian army who happened to be home on leave in order to supplement the supply for the expansion of the British Army. See, Peter Simkins, Kitchener's Army: The Raising of the New Armies, 1914-16 (Manchester, Manchester University Press, 1988), 88-89. The War Office also reactivated a large number of retired officers, "dugouts," to assist in the training of the New Armies. Their usefulness was mixed. Many were too old for serious exertion or their knowledge of military affairs was out-moded, but they still shared the army's ethos and could pass it on to their wards. See, Basil Williams, Raising and Training the New Armies. (London: Constable and Company, 1918), 60-61.


Geoffrey Best, "Militarism and the Victorian Public Schools," in Brian Simon and Ian Bradley, eds., The Victorian Public School: Studies in the Development of an Educational Institution (Dublin: Gill and Macmillan, Ltd., 1975), 140-41; and Simpson, "The Officers," 78. Roberts and other commentators went further than Haldane and called for compulsory training in public schools. Hamilton went so far as to demand mandatory cadet training in all schools, public and

67 Peter Parker, *The Old Lie*, 17.

68 Simpson, “The Officers,” 65; Geoffrey Best, “Militarism and the Victorian Public School,” 140-41; Parker, *The Old Lie*, 17, 56, 99; Spiers, “The Regular Army,” 42. Not all officers believed the public schools were doing all they could to instil the proper values in their students. Hamilton complained that modern pedagogical practice placed too much emphasis on knowledge and failed to develop sufficient character. He concluded that today’s material were not the same measure of men who marched into Afghanistan or struggled up the Nile. See Hamilton, *National Life and National Training*, 24-26.

69 Williams, *Raising and Training the New Armies*, 63.

70 Ibid., 64.

71 Parker, *The Old Lie*, 34, 157-62.

72 Simpson, “The Officers,” 65-66; Spiers, “The Regular Army,” 43. These expenses applied mainly to the prewar regular army. Once the war broke out the War Office did provide some financial relief to facilitate its expansion. The army was anxious that the young officers could meet their financial obligations and maintain the correct life style. Consequently, the army raised the rate of pay to a level that allowed most subalterns to live comfortably. See, Simpson, “The Officers,” 77.

73 A. Hilliard Atteridge, *The History of the 17th (Northern) Division* (Glasgow: Robert Maclehose & Co. Ltd., 1929), 10-11; Simkins, *Kitchener’s Army*, 88-89. Commenting on Kitchener’s system, Williams wrote:

... in this war the proud traditions of almost every regiment in the British Army could be taken as the means of stimulating emulation in those newly attached to the regiment.


Ogle, a war-time volunteer who the army promoted from the ranks, serves as an example of the inculcation of regimental loyalty
in the members of the expanded army. After receiving his commission in The King's Own Royal Lancaster Regiment, he was most put out by his assignment to the rival Loyal North Lancashire Regiment on his return to France. A staff officer brushed aside his protests, but in due course he made it to the King's Own. See, Glover, The Fateful Battle Line, 154, 166.


74General Staff, FSR, 11. Terraine also considers the FSR as the basis of the British way of war and credits Haig for their inspiration. See, Terraine, Douglas Haig, 42-43.
CHAPTER III
DECISIVE VICTORY

"Decisive Success in battle can be gained only by a vigorous offensive"
Field Service Regulations, 1909¹

"It is an axiom that decisive success in battle can be gained only by a vigorous offensive."
Sir Douglas Haig, 1919²

Written ten years apart, the virtually identical quotes above illustrate the British Army's unchanging faith in its principles of war. Haig oversaw the writing of the FSR of 1909, and after more than four years of carnage, he accepts only one change in the principle of decisive success, that of raising it to the status of an axiom. In his Final Dispatch, he goes even further by maintaining that decisiveness in war has "long been recognized as being fundamental, and is based on the universal teaching of military history in all ages. The course of the present war has proved it to be correct."³ Even after enormous losses the British could not be dissuaded from complete faith in their principles. In a post-battle assessment of formations during the Somme, Fourth Army headquarters concluded that:
... nothing that has occurred during the Somme operations would seem to have in any way affected the correctness of the old principles as regards formations for the attack laid down in our training manuals before the war.⁴

The British Army’s belief that it had based its method of war upon a basic, universal and timeless principle explains why it never faltered from its quest and why Haig could claim after the war that it was all “one great and continuous engagement.”⁵

For the British Army, decisive success, or decisive victory as it will be called from here on, meant a victory of such magnitude that the enemy was unable to continue to resist and Britain could then impose its will upon its beaten foe. The destruction of the enemy’s army was central to the British interpretation of this concept, and upon commencement of hostilities the British objective was to seek out their opponent’s main body and achieve “... the quickest and most complete destruction of the enemy’s forces.”⁶ Haig credits Henderson, his instructor at staff college, for instilling the belief that mere tactical success was not enough. Rather, the objective in battle must always be a strategic victory in which the enemy is cut off from its line of communications and destroyed as it attempts to retreat.⁷ The Royal Navy shared this belief, and sailors went to war with expectations of Trafalgar. The war at sea was “... to be quick, destructive and, most important, decisive.”⁸
In the decade before World War I and continuing to the end of that conflict, manuals, orders and instructions repeatedly refer to decisive victory as the goal of any battle. Furthermore, the FSR, both as a compendium of Haig’s ideas, and as the most advanced and widely recognized statement of Britain’s intellectual conception of the nature of war, clearly and forcefully identifies decisive victory as the objective of all battle. The FSR buttresses the concept of decisive victory with a series of principles that define the nature of battle, the function of the various arms, and the role of the commander. The purpose of the FSR was clearly to establish an army wide acceptance of decisive victory as the objective of battle and to set the standards by which commanders were to achieve success.

This chapter will not attempt to question the wisdom of Haig and other senior British officers, nor their unchallenged faith in decisive success. Instead, it will simply define what the British meant by decisive victory and show how this principle became the intellectual foundation of their perception of the nature of war and how it acted as the cornerstone for all their operations on the Western Front. Thus, while the previous chapter admitted the absence of a doctrine, this work will show that the British instead possessed a philosophy of war, understood by all, that guided their actions. Though gas was a novel weapon, the British adopted it within the parameters of an existing intellectual framework. The principles of decisive victory defined how they fought the war and, consequently, how they determined the place of gas in their operations and the methods of its use. Decisive victory must
therefore be explained in some detail so that the cultural, as opposed to technical, limits on the use of gas can be fully understood.

The British refined the principles of decisive victory during the first decade of the twentieth century. The years between the Boer War and World War I were intellectually turbulent ones as military theorists throughout Europe debated the lessons of the wars in Southern Africa and Manchuria, and sought solutions to the problems of modern firepower that these conflicts revealed. While there is some evidence of foreign influence or the ideas of great warriors and theorists such as Napoleon or Clausewitz on the British formulation of their ideas, it would be a disservice to overly credit their influence. Instead, British principles were largely a product of their culture, a product of the spirit of the age. That other nations should come to similar conclusions is not surprising; all European armies wrestled with the problems that modern technology had created. What is unique is the British implementation and their unshakeable faith in their principles. Theorists such as Colonel C. E. Callwell, the future Director of Military Operations in 1914, believed that modern firearms, especially the magazine rifle and machine gun, made it virtually impossible for an attacker to maneuver across open ground in front of an enemy of nearly equal strength. Callwell explained further that troops traversing the fire zone risked being wiped out before they could close with the enemy.

Yet, if modern firepower was so powerful as to create a killing zone before the defenders position that made it impossible to close with the enemy and resolve the battle, how could the British have
selected decisive victory as their preferred method of battle? The explanation of this paradox lies in the deductions the British made from their experiences in South Africa and their observations in Manchuria. Lord Roberts, the conqueror of South Africa, accepted the necessity for achieving a crushing victory over the enemy, despite the costs that modern weapons might impose, and after the Boer War he commented that "...every general engagement should have for its object decisive victory."\(^{13}\) When he left for South Africa, he had anticipated a rapid victory over the Boers. Instead it took the British three long years to overwhelm them. Weighing the eventual costs of a long conflict against the potential casualties of attempting to achieve a decisive success in battle, Roberts concluded that in the long run a quick victory would always entail fewer losses.

Once the British accepted the necessity for a rapid victory as a means to minimize losses, they logically concluded that they must commit all their strength to the effort. Decisive victory, the British believed, necessitated a vigorous offensive,\(^ {14}\) and Haig commented that it was "...impossible to be too strong for a decisive battle."\(^ {15}\) The army's leadership and its manuals constantly repeated these themes, both before and during the war. Manuals outlined that "every form of battle training must be founded on the offensive spirit," and that instructors should spare no effort in instilling in their men an aggressive spirit and desire to kill the enemy.\(^ {16}\) On the eve of the British Army's first truly big offensive, Loos (25 September 1915), Haig ordered that "the attack must be pressed with the greatest rapidity and utmost energy."\(^ {17}\) The following year,
while preparing for the Somme, training manuals reiterated the FSR dictate that vigorous action was the basis of success in battle\textsuperscript{18} Continuing this theme, the 1917 manual of platoon training mandated that “all ranks be taught that their aim and object is to come to close quarters with the enemy as quickly as possible so as to be able to use the bayonet. This must become second nature.”\textsuperscript{19} As the war’s end approached, instructors still demanded vigorous action in all operations. In a lecture on the employment of artillery, Major General Herbert Uniacke emphasised the need for boldness, determination, and above all blood-thirstyness. He explained that “if you can maintain the bolder attitude for five minutes longer than the other fellow you have got him by the short hairs every time.”\textsuperscript{20}

The British identified several preconditions that were essential for the achievement of a decisive victory, which the next chapter will discuss. They also believed that decisive battles always followed a series of well defined phases. Victory, they imagined, unfolded like the plot of a play, each scene building upon its predecessor. until, at the climax of the last act, the battle reached its crescendo, the British routed the enemy from the field and destroyed their now broken foe with a vigorous pursuit. The following pages will suggest reasons for these uniquely British expectations of combat and the pageantry of battle.

While attending the staff college at Camberely, Haig first noted the phases of battle by which he would eventually conduct British operations in World War I.\textsuperscript{21} He divided battle into four parts. The first stage focused upon the advance as the British sought out their
opponent, maneuvered for advantage, and fixed the enemy to the field of combat. The next phase was the fire position, the gradual build-up of British fire superiority and the diminution of the enemy's fire strength. Next came the assault when the infantry would advance upon the enemy's position and force them from the field of battle. Once the attackers had pierced the enemy's position, the commander would order forward the general reserve which would break through the enemy's lines and strike the decisive blow. Finally, by pushing forward the cavalry and fresh troops as rapidly as possible, the British would annihilate the enemy in the pursuit." Later, Haig referred to these phases as the guiding principles on which he had based his planning and declared that they "had proved successful in war from time immemorial..." When he oversaw the writing of the FSR, Haig made sure that it incorporated these phases of battle and that they became an essential component of the British Army's principle of decisive victory. Haig was successful, the objectives of the army exercise of 1913 derived directly from his values.

Once the war began the British largely remained true to these phases of battle, the only exception being that their orders and instructions tended, for an obvious reason, to omit the first phase; since the onset of trench warfare there was no need to locate and engage the opponent. Only a few examples are necessary to illustrate the continuity between prewar and wartime expectations. At a lecture in 1915, Lt. Col. E. M. Colston explained to his audience of the necessity of wearing down the enemy's power of resistance in
order to use up their reserves as a prelude to the striking of the decisive blow. In outlining his intentions for 1916 in his diary, Haig noted the importance of these principles in the following year's attack, and six months later he repeated these same themes in a planning paper for the Somme battle.

Even in hindsight, British officers maintained their faith in battle phases. Haig created a model for the war by correlating the theoretical stages of battle with stages in the conflict as it unfolded. He correlated the first stage of battle, the maneuver for position and fixing of the enemy, with the state of the war to the beginning of trench warfare in late 1914. He identified the years 1916-1917 as the struggle for fire supremacy as the British morally and physically wore down the Germans. Finally, he interpreted the climactic blow as the final 100 days of 1918, when the British forced the now beaten Germans back towards Germany. Major General Archibald Montgomery, the chief-of-staff of Fourth Army, arrived at a similar interpretation. In his unpublished autobiography, he identified the Battle of Amiens (8 August 1918) as the beginning of the final round, while the struggle from the Battle of Mons (23 August 1914) to the spring offences of 1918 constituted the wearing down phase. The historian of the Scottish Division also divided the war into distinct periods based upon the nature of the battle. He identified the attritional period as the battles before Amiens when the British fought for supremacy, and the advance period as the battles during their march to victory.
Perhaps one can accuse Haig and Montgomery of using hindsight simplistically in order to neaten the war and make it conform to their pre-war expectations, and yet their interpretation does have significant substantiation as reflected by GHQ’s constant interest in the state of the enemy’s morale and estimates of its manpower. Foulkes, as Director Gas Service, participated in this monitoring of the condition of the German Army. He required the field officers of the Special Brigade to report on the presumed effects of gas upon the enemy, while his intelligence staff sifted captured documents and interrogated prisoners for information on their attacks. Foulkes used these reports not only to document chemical warfare’s contribution to the wearing down of the enemy but also to illustrate the usefulness and importance of his unit.

The British Army published a lengthy series of manuals that laid out the steps a commander had to follow to achieve victory. As the FSR explained:

The general principle is that the enemy must be engaged in sufficient strength to pin him to his ground, and to wear down his power of resistance, while the force allotted to the decisive attack must be as strong as possible.

The 1914 infantry training manual reiterated this point. It instructed commanders to divide their force into two parts. The first part would develop the attack, wear down the enemy’s resistance, and force him to commit his reserves to his firing line. Then, when
the enemy no longer had any reserves, the commander would release the second part of his force - the general reserve - which would strike a decisive blow against the opposition's position. Commanders were further instructed to refuse any requests for reinforcement from the general reserve, which had to be held in its entirety, and only committed at the decisive moment.

Once the engagement had begun, the FSR dictated the steps by which a commander was to achieve a decisive victory. The initial objective in any attack was to develop a superiority of fire over the enemy in preparation for delivering the decisive blow. The infantry would not be able to begin the assault until the enemy had been reduced by fire power. The infantry training manual expanded on this point and explained, "the object of fire in the attack, whether of artillery, machine guns, or infantry, is to bring such a superiority of fire to bear on the enemy as to make the advance to close quarters possible." As the war evolved there was a commensurate change in the nature of the struggle for superiority. At Loos and the Somme the intention was to destroy the defenders, and at Vimy, Messines, and the opening of Passchendaele the emphasis was on suppressing the enemy, while during the final months of the war neutralization became the objective. However, despite tactical modifications in the application and intention of fire, the fire supremacy phase remained an integral sequence in the British battle plan. Till the war's end, the advancing infantry's survival depended on the success the British had in achieving this dominance. If it were obtained, one Brigadier
suggests, then the infantry would have little difficulty in securing the enemy’s position.\textsuperscript{38}

British officers understood that no matter how critical fire superiority was, it was merely a means to an end, not the final point in and of itself. Superiority provided the means by which the infantry could advance close to the enemy, assault with the bayonet and secure a decision by shock tactics. This point was driven home at Camberley. During a discussion of fire supremacy, Brigadier General L. G. Kiggell emphatically stated that it was not firepower but the bayonet that brought victory.\textsuperscript{39} Therefore, manuals insisted that it was essential for the firing line to advance as rapidly as possible and to press forward at all costs. Even in 1917 manuals continued to recommend a rapid closing with the enemy. The manual for platoon training stated, “all ranks must be taught that their aim and object is to come to close quarters with the enemy as quickly as possible so as to be able to use the bayonet. This must become a second nature.”\textsuperscript{40}

Once the firing line had successfully closed with the enemy, the moment to release the general reserve and launch the decisive blow had arrived. Major-General W. R. Robertson cautioned that it was essential to commit the general reserve as a concentrated force at the decisive point, while the FSR warned that it was impossible to overwhelm the enemy everywhere. Instead the commander had to focus the decisive blow against a weak point in the enemy’s position which the advance of the fire line or the struggle for fire supremacy had revealed. Therefore, continued the FSR, the commander had to
stay in close touch with the events of the battlefield and strike with the reserve at the right time and place. Finally, the advance of the reserve was the signal for the application of the greatest possible pressure against the enemy's front by the entire army to complete the overthrow of the enemy.41

The other combat arms also had roles to play in the battle's successive acts. Although the initial role of the artillery was to help gain fire superiority, its ultimate objective was to assist the infantry's advance. The field artillery's training manual identifies several specific tasks through which the guns would support the attack. When the assault commenced, the artillery was to subdue the enemy's batteries to protect the infantry from interdicting fire. As the infantry came within range of defensive rifle fire the artillery was to provide covering fire while also continuing to suppress the enemy's guns.42 As the assault progressed the artillery was to intensify its fire so as to demoralize the enemy and lower their resistance.43 The manual cautioned that it was impossible for the artillery to ensure decisive success by its own destructive action. Rather "it is the advance of the infantry that alone is capable of producing this result."44 It concluded that the underlying principle of artillery tactics was the maintenance of the mobility and offensive power of the infantry.45

The experience of war led merely to a refinement, not a revision, of these ideas. A 1917 publication stated that, while artillery was indispensable for success, its function remained to support the infantry. In the wearing-down phase of the battle the
artillery was to prepare the way for the infantry by overpowering
the enemy’s batteries, by destroying physical obstacles to the
infantry’s advance, and by lessening the enemy’s morale and
numbers. When the attack commenced the artillery would assist the
advance by beating down the enemy’s resistance from the front or
flank and by preventing the assembly and approach of counter-
attacks.46

Though of a more limited nature, the cavalry also had a part to
play in orchestrating a decisive victory. The horse had to locate the
enemy’s forces, protect the infantry during the advance and assist in
the pursuit.47 Despite the difficulties of maneuvering horsemen on
the modern battlefield, the anticipated role they were to play in the
exploitation phase insured their retention, even if at reduced levels.
Haig was reluctant to concede that they no longer had a place and on
many occasions throughout the war he ordered the cavalry to ready
themselves for the pursuit.48

When the infantry charged with the bayonet the crisis of the
battle had arrived, and if they were successful the shock of their
blow was to dislodge the enemy from their positions and create the
opportunity for pursuit. It was during the pursuit, while the enemy
was demoralized and disorganized, that the greatest opportunity for
its annihilation existed. Haig noted that:

The object of giving battle is to destroy the enemy’s forces
which are in our front. This result can only be obtained in the
pursuit which must immediately follow the struggle. The
annihilation . . . of the enemy’s army can only be produced during his retreat.⁴⁹

At Loos, in expectation of success, Haig instructed his subordinates that a “vigorous pursuit, regardless of losses, is essential.”⁵⁰ The training manuals reinforced this point by claiming that the battle was only half won if the enemy had merely been driven from their positions. Rather, a rapid advance was essential for the enemy’s complete destruction.⁵¹ The FSR demanded that officers press the pursuit “by day and night without regard to the exhaustion of the men and horses so long as the enemy’s troops remain in the field.”⁵² And, it continued, “all pursuing troops should act with the greatest boldness and be prepared to accept risks which would not be justifiable at other times.”

To increase the possibility of success, the manuals provided principles by which leaders could multiply the offensive potential of their forces. The FSR instructed commanders to be flexible in how they determined the point for launching the decisive assault. It explained that during the course of the battle unexpected opportunities might arise, such as a weakening of a section of the enemy’s line, which if exploited immediately might force the enemy to fall back.⁵⁴ Manuals also instructed commanders on the benefits of surprise and envelopment. The FSR explained that the moral effect of an envelopment was always great and that the achieving of fire superiority was facilitated by trying, from the outset, to turn one or both of the enemy’s flanks.⁵⁵ Lt. Gen. Sir G. M. Harper, during
the planning for the Battle of Arras (April 1917), echoed these themes. One of his main principles of offensive operations was the envelopment of the enemy - "hold him in front and attack him in flank."\textsuperscript{56}

Even in defence, the principles mandated commanders to still seek a decisive victory. The defence was a temporary state and the defender had to create the opportunity to seize the initiative. One could not achieve victory through defensive actions, only the attack could yield the overwhelming defeat of the enemy. If a commander refused or was unable to seek the initiative then the contest was merely a delaying action that could not achieve decisive results. The passive occupation of a defensive position, the \textit{FSR} goes on to warn, allows the enemy a freedom of maneuver which it can use to its advantage and which may result in the defender's crushing defeat.\textsuperscript{57} The \textit{FSR} explains:

> Whatever may be the strategical situation, the underlying principles of defensive action which aims at decisive results are constant. \textbf{No natural or artificial strength of position will of itself compensate for loss of initiative when an enemy has time and liberty to manoeuvre.} The choice of position and its preparation must be made with a view to economize the power expended on defence in order that the power of offence may be increased.

Thus, even in defense commanders were to still divide the army into
two groups, one to hold the position and the other for a counter-attack which might throw the original attacker onto the defensive and open the way for a decisive action.\textsuperscript{59}

Although following these principles could not guarantee victory, the British believed that they were the only methods that provided the possibility of success. Any radical departure from the phases of battle would assure defeat. Yet, were they, as Haig had asserted, timeless? When the British encoded their method they had had no experience with warfare on the scale of the Great War. Even the Boer War, despite its difficulties and duration, did not compare with the intensity of war on the Western Front. As one reads prewar manuals, there is a sense that the authors envisaged war on a more Napoleonic scale. The army’s commander, presumably from a hilltop with a clear view of the field, exerted complete control over the battle and directed it through its phases.\textsuperscript{60} The British recognized the effects the increased firepower and technological innovations of the twentieth century brought to war but believed that the time, space, and manpower parameters remained as they had been in the nineteenth century. If so, did this create a paradox for the British?

If they had developed their principles for battle on the Napoleonic, or even Boer War scale, how could they continue to remain committed to these principles in the face of total war? The explanation is not altogether surprising. Since the principles themselves were timeless they did not require any change, instead it was the scale of the engagement that they had to modify so that the
implementation of these principles came to reflect the realities of World War I. This does not suggest that military theorists should credit the British with superior wisdom for their refusal to codify tactics into a series of case studies. Rather, it recognizes that, as an institution that relied upon ethos instead of doctrine for its intellectual guidance, the British Army had little choice but to remain true to its principles, for it lacked the tools to base its method of war upon anything else. For armies imbued with a doctrine, adaptation at the fundamental level in the midst of war is difficult enough; for the British it would have been even harder. As the war approached one theorist noted that, “the principles of tactics are timeless. However it is the application of the principles that need to be modified to meet modern conditions.” As late as 1916, Robertson could comment quite seriously that the conditions in France were certainly not at present normal but might become normal one day. The British expected war to bring change. A theorist wrote in 1910 that:

It is perfectly true that circumstances change, that machinery changes, that weapons change; but it is also true that in the essence of war there is much more that remains constant, that does not change, than can be challenged by fresh inventions.

While change was inevitable and while it could be radical, it could only occur within the existing parameters defined by their ethos.
Even late in the war the British still believed that their methods remained valid. Writing in 1918 they asserted:

The general principles laid down in the Field Service Regulations . . . hold good to-day provided due allowance is made for the time and space conditions of the present war. To understand the principles thoroughly and to apply them correctly under existing conditions, it must be realized that where in the Field Service Regulations periods of hours and days are specified or implied, periods of weeks and months must now be substituted; while in considering distances it is necessary to calculate in hundreds of miles where formerly the problem was one of tens of miles.

These differences do not alter principles, but merely modify their application.\textsuperscript{65}

Haig appreciated how immensely greater the scale of the Western Front was when compared to prewar expectations. At a conference on 8 January 1916, he gave his initial instructions to his army commanders regarding the summer offensive that was to become the Somme. He “directed each army to work out schemes for (a) preliminary operations to wear out the enemy and exhaust his reserves and (b) for a decisive attack in the hopes of piercing the enemy’s line of defence.” Haig envisaged a build-up of activity, commencing in the winter and continuing until the start of the offensive, through which the British would wear down the Germans
with a series of raids and minor operations. Robertson agreed with Haig and maintained the advisability of employing wearing-down attacks, slowly building to a crescendo, to prepare the enemy for the decisive battle.\textsuperscript{66} Instead of the battle for fire superiority lasting a few hours, it would rage for months.\textsuperscript{67}

However, one must still ask whether the British insistence upon these principles limited the intellectual advancement of the army and promoted tactical stagnation. The answer is a categorical no, for the image of stalemate as the nature of warfare on the Western Front is a myth. Although it is true that during the years of trench warfare the combatant's lines did not move appreciably, within the trenches a dynamic, experimental, and innovative war was taking place. Trench warfare was not the mode of warfare that officers of the period considered normal. It was an aberration, a temporary impasse, whose solution lay in the application of new techniques. While the British remained steadfast to their principles there was no prohibition against developing new tactics or weapons that would lead to the restoration of mobility. Consequently, the British were extraordinary inventors who constantly tinkered with existing ways or sought out entirely new ones. As the war progressed they showed great imagination in inventing novel methods, especially in battlefield survey, aerial reconnaissance, tanks, and gas.

Yet to present change of scale as the explanation only fineses the question, for it does not address the issue of why they held so tenaciously to their prewar concepts. Furthermore, the mere raising
of this question implies that the army's leadership should have changed their methods and they are then condemned by their failure to conceive new principles. This work does not share the philosophy of the "donkey" school of British Army historiography which suggests that the officer’s allegiance to their principles, in the face of horrific casualties, was due to their excessive stubbornness and mental dullness. Rather, it accepts by default this allegiance as one of the key determinants of the British Army and instead of condemnation it will seek the reasons for their loyalty.

Like many institutions that have faced a difficult problem, the British Army assumed that its failure was due to inadequate resources, not faulty technique. As the war progressed the British, along with the other combatants, instinctively applied ever increasing quantities of men, munitions, and materials to the pursuit of victory on the Western Front. As early as January 1915, French declared that, "if the attempt fails, it shows, providing that the work of the infantry and artillery has been properly coordinated, that insufficient ammunition has been expended." Reinforcing this phenomenon were Britain's pitiful preparations for war when compared to the continental powers. The shell crisis of 1915 was not merely a shortage of munitions but a reflection of the inadequate stockpiles of all tools of war that Britain held in its arsenal. Throughout the war Britain struggled to gain parity with France and Germany in the quantity of materials on the Western Front. Furthermore, since their lack of preparations forced them to play catch-up, it made it harder to determine just what was the
exact volume of materials needed for the job. Finally, the combatants may merely have been responding to a cultural imperative of modern industrial society. C. R. M. F. Crutwell has suggested that advanced technological societies, if they have access to raw materials, have the ability to create a virtually limitless supply of war resources which reinforced the practice of using brute force to secure a decision. However, there is some pre-war evidence to suggest a pre-existing latent preference towards the application of ever increasing mass in the British Army’s literature. A future army commander, C. C. Munro, wrote in an article on tactics that if the enemy’s defensive fire checked the advance, the solution lay in augmenting the British fire line to provide the volume of fire power necessary to subdue that of the enemy’s and ensure the resumption of the assault.

A further explanation for the army’s unwillingness to rethink their principles lies in the nature of its relationship with the government’s political establishment. Civil military relations in Britain in the years preceding the war were often quite strained and there was a long-standing pattern of misunderstanding. Lord Kitchener’s rejection of Lord Haldane’s reserve system after Britain’s entry into the war, and the even more extreme Curragh Mutiny, were symptoms of a professional officer corps which distrusted the judgements of their civilian masters. The running battle between Prime Minister Lloyd George and his senior officers during the second half of the war suggests that politicians also had doubts about their military experts. Furthermore, the British tradition of
Treasury interference with even the most minuscule military expenditures promoted an environment of confrontation and mistrust between the military experts and their amateur opposites in Parliament. Given all this, it is easy to imagine the reluctance of the officer corps to admit any failings that might lead to a strengthening of government control over the internal workings of the army. For officers to have suggested that their prewar principles were in need of reassessment, particularly in light of the heavy casualties they had incurred, would have risked an incursion of civilian participation into the intellectual and operational domains of the army.74

Yet the reasons presented so far are tangential to an explanation of why the British did not change their methods for the reasons are much more closely related to the army’s institutional culture. Foremost, they simply believed their methods were effective and that they would eventually bring victory. Although it took much longer than they had anticipated, they were right in the end. It was the German Army that became demoralized and it was the British Army that pushed on to victory in the final months of the war. Expensive, yes, but the casualties that the French and Germans incurred were non-trivial, and no army during the war possessed the ability to secure victory cheaply. For example, while the German spring offenses of 1918 did achieve dramatic gains of territory they did not bring victory, and they cost Germany nearly one million irreplaceable soldiers.75 Nor is it clear that if the British had modified their principles their casualties would have been any less.
Britain went to war with a tiny professional force and few of the "Old Contemptibles" survived past 1st Ypres of November 1914. In effect Britain had to create an entirely new army from the military neophytes of its untrained population and one could suggest that inexperience was also a factor in causing casualties.\(^{76}\)

Finally, the culture of the army inhibited any major changes in operational principles. As the previous chapter has suggested, the British Army did not encourage self-criticism. Without a mechanism to encourage its members to perceive and debate flaws, except at the price of their careers, an institution is handicapped in its ability to be honest with itself. French, in his guide-lines for contributors to the *Army Review*, asked to what extent submissions should conform to the army's principles. His answer was that a great aid to military efficiency was an officer corps that guided itself by identical principles, and that the army should be a band of brothers united together by a community of ideas. French went on to admit that contrary ideas were welcome in the journal but he also provided a series of restrictive tests that they had to pass before being accepted. Finally, he concluded that until the regulations had incorporated any new ideas, the existing principles must be the guide for everyone.\(^{77}\) Thus, while he allowed for criticism of established ideas, it was not a process that he encouraged, signaling clearly that conformity was the accepted route to publication.

Having established that the British Army went to war in 1914 with a clear and accepted method of how it would fight World War I, it is now important to show how it put these principles into effect.
In other words, what preconditions on the Western Front did the British perceive as necessary for the launching of the decisive attack, and what values did they stress in determining the moment for releasing the general reserve which would break through the enemy’s lines and lead to victory? These are the subjects of the next chapter - Asymmetry.

1 General Staff, War Office, FSR, 107, [emphasis in the original].


3 Boraston, Sir Douglas Haig’s Dispatches, 325.

4 “Notes on the Lessons of the Operations on the Somme as Regards Infantry Attack Formations and the employment of specialists,” 1 December 1916, Fourth Army Records War Diary, 17 (17 November 1916 - 30 April 1917), Rawlinson’s Fourth Army Records, IWM.

5 Boraston, Sir Douglas Haig’s Dispatches, 319-20.

6 “Strategy II,” Haig Collection, 3155/20, NLS. Although undated, the notebook contains references to the Boer War and the Russo-Japanese War.

7 “1st Army Conference,” 6 September 1915, Haig Collection, 3155/174, NLS.


9 Haig has attracted both the umbrage and praise of many historians. For a negative interpretation of Haig see, Denis Winter, Haig’s Command: A Reassessment (London: Viking, 1991) and for a positive evaluation see, Terraine, Douglas Haig. For a well reasoned


11 For example, in Haig’s library one finds a copy of Colmar Freiherr von der Goltz’s The Conduct of War. According to von der Goltz, the objective of modern war is the complete defeat, if not destruction of the enemy. He continues, “The victor must compel his enemy to accept the desired terms of peace as rapidly as possible. But this is only possible when one of the parties has lost all prospect of success, here again is an argument for the necessity of defeat or destruction.” Von der Goltz concludes that defeat requires the annihilation of a portion of the enemy’s force so that they despair of victory and feel unable to continue the struggle. See, Colmar Freiherr von der Goltz, The Conduct of War: A Short Treatise on its Most Important Branches and Guiding Rules, trans. Major G. F. Leveson (London: Kegan, Paul, Trench, Trübner & Co. Ltd., 1908), 5, 7-8, in Haig Collection, NLS. There is also a similarity of language between some British concepts and the ideas of Karl von Clausewitz. However, Christopher Bassford maintains that Clausewitz’s influence is superficial and that it is Britain’s domestic and imperial conditions that were largely responsible for the determination of British principles. This author agrees with Bassford. See, Christopher Bassford, Clausewitz in English: The Reception of Clausewitz in Britain and America, 1815-1945 (New York: Oxford University Press, 1994), 73-77, 109.


13 Quoted in H. Langlois, Lessons From Two Recent Wars [the Russo-Turkish and South African Wars] (London: HMSO, 1909), 113,
in White Collection, Box 22, NLA.

"General Staff, FSR, 107. At a training lecture in 1915 on “The Spirit of the Attack,” the instructor emphasised that “decisive victories can only be won by vigorous attack” and that “a determined and steady advance lowers the fighting spirit of the enemy.” See E. M. Colston, Lectures by Commandant School of Instruction, Zeitoun (n.p., 1915), in White Collection, Box 22, NLA.

"Strategy II,” Haig Collection, 3155/20, NLS.

"General Staff, Assault Training (London: Harrison & Sons, 1917) in AWM355 422 w253 a s 1917, AWM.

"1st Army Conference,” 6 September 1915, Haig Collection, 3155/174, NLS.

General Headquarters, BEF, Training of Divisions for Offensive Action (GHQ, 8 May 1916), 3.


"Artillery in Offensive Operations,” Staff College, Cambridge, 29 August 1918, Uniacke Collection, Folder XI, RAI.

Curiously, his belief in the phases of battle is perhaps the only aspect of Haig’s personality that Terraine and Winter agree on in their respective biographies. See, Terraine, Douglas Haig, 47-48 and Winter, Haig’s Command, 157-67.

"Tactics, Staff College Books 1896-97,” Haig Collection, 3155/17, NLS.

"The Present Situation and Future Plans,” 1 May 1917, OAD 428, Haig Collection, 3155/113, NLS. At the Paris Conference of 4 May 1917 Haig used nearly identical language for the justification of British Expeditionary Force operations in France. See, Terraine, Douglas Haig, 310.

"Report on Army Exercise, 1913,” Haig Collection, 3155/91E, NLS.
25 Colston, Lectures.

26 "Haig's Great War Diary," 18 January 1916, Haig Collection, 3155/97, NLS.

27 "The Present Situation and Future Plans," 1 May 1917, OAD 428, Haig Collection, 3155/113, NLS.


29 Archibald Montgomery, "Traditions," (unpublished autobiography, n.d.), 32, Montgomery-Massingberd Collection, 159, LHCMA. General Erich Ludendorff would have agreed with Montgomery's assessment having declared that, "...August 8 was the black day of the German army in the history of the war." Quoted in, B. H. Liddell Hart, The Real War, 1914-1918 (Boston: Little, Brown and Company, 1964), 430.


31 Sometimes this interest was based upon information that was, at best, hopeful. For example Haig observed in his diary that captured correspondence revealed that the Germans were examining sailors at Cuxhaven for their suitability for transfer to the army. He was also interested in a report of enemy pay books that showed a high percentage of Landstrum in some divisions. See, "Haig's Great War Diary," 2 November 1916, Haig Collection, 3155/97, NLS.

32 For examples of Foulkes' interest see, C. H. Foulkes, "Gas!" The Story of the Special Brigade, (Edinburgh and London: William Blackwood & Sons Ltd., 1936). Foulkes' intelligence department also published a series of reports that estimated the effect of gas on the enemy's manpower, reserves, and morale. See, Gas Warfare, Monthly Summary of Information, nos. 1-12, Auld Collection, IWM.

33 General Staff, FSR, 113.

34 General Staff, War Office, Infantry Training (London: HMSO, 1914), 133.

35 "Strategy II," Haig Collection, 3155/20, NLS. Although reinforcements could come from the supports. See, J. Cambell, "The

36 General Staff, *FSR*, 111, 119. Haig wrote in a staff college note book that “Superiority of Fire is essential before the assault.” See, “Tactics, Staff College Books, 1896-7” Haig Collection, 3155/17, NLS [underlining in original]. Shortly before the war another officer identified the struggle for fire superiority as the critical period of the battle. See, Campbell, “The Training of Infantry in the Attack,” 431.


38 Report by OC 11th Infantry Brigade to HQ 4th Division, 3 November 1916, Montgomery-Massingberd Collection, 48, LHCMA.

39 “Report of a Conference of General Staff Officers at the Staff College,” 17-20 January 1910, Haig Collection, 3155/81, NLS.


42 The manuals clearly envisioned the infantry starting their advance at some distance from the enemy’s position, a situation trench warfare obviated.


44 Ibid., 230.

45 Ibid. The *FSR* summed up the artillery’s objective simply as to assist the infantry advance. See, General Staff, *FSR*, 115.


For example, during the Somme Haig ordered the CO Cavalry Corps (Lieutenant General C. T. McM. Kavanagh) to be ready for the breakthrough and pursuit phases of battle. See, "Haig's Great War Diary," 9 September 1916, 3155/97, NLS. Also in the same entry Haig sketched a plan of his cavalry exploiting in the enemy rearward positions.

"Strategy II," Haig Collection, 3155/20, NLS.

1st Army Conference," 6 September 1915, Haig Collection, 3155/174, NLS.


General Staff, FSR, 132.

Ibid., 133. [Emphasis in original.]

Ibid., 119.

Ibid., 111-12.


General Staff, FSR, 121. [Emphasis in the original.]

Ibid., 108, 122.

On one occasion when writing to Robertson concerning the upcoming Somme offensive, Haig remarked that the British ought to

61Lupfer suggests the difficulties the Germans had in implementing doctrinal change in the middle of World War I. Though the Germans succeeded in retraining their army in new methods, one should note that it did not bring them victory. Thus, while one should commend the Germans for their efficiency in retraining, their new offensive tactics assured their defeat. See Lupfer, The Dynamics of Doctrine, viii-ix.


65General Staff, The Training and Employment of Divisions, 1918 (France: Army Printing and Stationary Services, January, 1918), 5.


67“Haig’s Great War Diary,” 8 January 1916. Haig Collection, 3155/97, NLS.

68A reference to Alan Clarke’s The Donkeys (London: Hutchinson, 1961) and works of similar bent.

69For a discussion of the general constraints to innovation, such as the need for a generational change, or the difficulty of assessing the performance of weapons outside the parameters of existing missions see, Rosen, Winning the Next War.

70Quoted in David French, “The Military Background to the Shell Crisis of May 1915,” Journal of Strategic Studies 2, no. 2 (September
1979): 197. French, as did many of his colleagues, deplored the government’s efforts to divert men and materials from the Western Front to other theaters.


74Only after the reforms of 1901 were the regiments relieved of the burden of accounting for every pence. Ibid., 41-47, 197, 221.

75Travers provides estimates of German losses in How the War Was Won, 108.

76Some leaders of the time and some contemporary historians have raised the issue of whether other strategic options - Gallipolli and the east - would have purchased victory at a cheaper price. The debate, however, is moot as it is impossible to analyse the potential effect of Gallipoli since it did not succeed, either operationally or strategically, and to do so requires a great deal of speculation and anticipation of the German reaction.

77French, “Memorandum,” vii-ix.
CHAPTER IV
ASYMMETRY

"So long as the opposing forces are at the outset
approximately equal in numbers and moral and there are
no flanks to turn, a long struggle for supremacy is inevitable."
Sir Douglas Haig, 1919¹

"When determined and equally matched opponents
meet there is no short cut to victory;
the struggle must be long; the way hard . . . ."
General Jack²

Asymmetry is the seeking of an advantage over one’s enemy in
the pursuit of a decisive victory. As with the contemporary concept
of combat multipliers, asymmetry allows commanders to enhance
the fighting strength of their army. More importantly, it is an
indicator of the relative strength of two opponents, and a
commander can gain an advantage by not only increasing the
potential of his own force but also by decreasing the potential of his
foe’s. Hence, asymmetry, although it includes the simple comparison
of numbers, is an extremely broad concept that requires
commanders to pay attention, in their calculations, to the intangible
aspects of war, such as morale and fighting spirit, when assessing
the threat posed by the enemy and the potential for victory or defeat.

The kinds of asymmetry that combatants pursue can be extremely complex and the struggle for ascendency in the relative balance of strength can occur on the strategic, operational or tactical level. Some forms of asymmetry, such as surprise, are readily understandable and have effects that come into play only on the battlefield, while others, such as the integration of arms, require considerable training and pre-planning as a prerequisite for success. However, whatever their nature, asymmetric relationships rarely come about by chance; they are usually the result of careful and long-term analysis and study and require not only an understanding of the enemy's strengths and weaknesses but also an honest assessment of one's own capabilities.

The desire to achieve an asymmetric relationship over one's opponent was not an innovation of the Great War. Perhaps the oldest known example is of the Theban general Epaminondas who crushed the Spartans at Lecutra (371 BC) and Mantua (362 BC). Instead of distributing his soldiers evenly throughout his phalanx, as was customary, Epaminondas heavily reinforced one flank while leaving the rest of the line considerably thinner. When his troops collided with the Spartans the increased combat powers from the reinforced wing burst through the enemy's line. With their formation shattered the Spartans were helpless, and the Thebans quickly overwhelmed their opponent while suffering virtually no losses themselves.³
Clausewitz also discusses asymmetry in *On War*, although he uses the term superiority. He believes that "victory normally results from the superiority of one side; from a greater aggregate of physical and psychological strength." Clausewitz, who clearly understood the intangible aspects of war, goes on to explain that:

As a war unfolds, armies are constantly faced with some factors that increase their strength and with others that reduce it. The question therefore is one of superiority. Every reduction in strength on one side can be considered an increase on the other. It follows that this two-way process is to be found in attack as well as in defense.

Clausewitz also believed that superiority was not an end in itself but rather the means to bring the enemy to its knees. He emphasises that the objective was "not to improve the current military position but to improve one's general prospects in the war and in the peace negotiations...[and that] it [battle] must be risked for the sake of the end."

Some examples might be useful to further explain this concept. The Schlieffen Plan represented an attempt by the Germans to secure strategic asymmetry. By holding off the Russians with minimal troops the Germans hoped to concentrate their strength against the French, and crush their opponent in a giant pincer, one arm sweeping across Belgium and Northern France and the other acting as an anvil in Alsace and Lorraine. Schlieffen intended to by-

pass France’s border fortresses and maneuver his army into the enemy’s rear, capture Paris, and place the French at a terrible disadvantage. The plan, a modern day Cannae on a grand scale, was at first glance a bold, strategic move that promised a quick and decisive end to the war, but from the beginning it was a hopeless conception that ignored fundamental military and diplomatic principles such as logistics, friction, and Belgian neutrality. The British invention of the tank is an example of the use of an innovation to secure operational asymmetry. Even though the surprise factor was lost due to its hasty introduction in insufficient numbers during the Somme the tank continued to confound, terrify, and overrun German defenders and its presence was a factor in every success. German tactical adjustments, the use of field guns in an anti-tank role, failed to narrow the imbalance the British had established. However, it was only in the last year of the war that the tank gained sufficient mechanical capability to consistently and reliably contribute to victory. The gradual conversion of infantry formations, by both sides, to a self-sufficient fire and movement pattern represented an attempt to achieve tactical asymmetry. Attacks, centered on the platoon, or even the section, sought to overcome the superiority of the defense by infiltrating small bodies of men into the enemy’s position to take their opponent in the flank or rear, thus negating the defender’s advantage while enhancing the attacker’s potential and restoring a degree of mobility to the trench-locked battlefield.
Despite one side's attempt to achieve asymmetry it is not axiomatic that the other side will try to counter its opponent's efforts. Furthermore, a response to an asymmetric challenge need not be reflective to succeed. In fact, it is more likely that the countering mechanism is only indirectly related to the enemy's superiority. The German failure to detect, for nearly two years, the enormous tunneling activities under Messines Ridge allowed the British to achieve a major asymmetric imbalance that resulted in their dramatic and relatively cheap victory in June, 1917. Had the Germans discovered the tunnels they could have closed the asymmetric gap and averted the disaster either by exploding counter-mines, shelling the enemy's densely packed trenches as their troops prepared for the assault, or by simply withdrawing their garrison on the eve of the attack. Each of these potential responses caused the British considerable anxiety and they initially feared that the German's gas shelling of Australian positions, just prior to the attack, was a sign that the enemy had caught on and that the battle would fail. GHQ's concern demonstrates the fleeting nature of asymmetry; once the enemy has equalized the relationship the advantage is lost. The German submarine campaign against the British Isles is such an example of this fleeting advantage. Initially the British dedicated their resources to offensive techniques such as hunter-killer patrols of ASW vessels. However, the ability of a surface vessel to locate and destroy a submarine, prior to the invention of ASDIC, was, at best, ineffective and Britain continued to incur severe merchantmen losses to the U-boats. When the British
switched their emphasis to protecting shipping by introducing the convoy system, they succeeded in negating the submarines' advantage and won the battle for the Western Approaches.

The potential fields for establishing an asymmetric relationship are considerable but not infinite as an institution must necessarily narrow its range of options. This occurs not only because of limitations on resources but also because integral to one's culture is a predisposition to certain areas in which an army believes itself capable of exploitation for advantage. The British and the Germans struggled fiercely for asymmetry in a number of areas. However, each chose particular venues for their priority of attention and the British chose to specialize in two - morale and maneuver. For the war's duration in France, all British operations revolved around these two interrelated concepts, the pursuit of moral supremacy, so as to achieve the conditions necessary for a decisive battle, and the ability to maneuver so as to launch the blow which would lead to the pursuit phase and the destruction of the enemy's army.

Developments in the prewar period reinforced existing beliefs held by British society and played a critical role in the Army's decision to adopt morale and maneuver as their focus for superiority. The evolving military technology and the increasing tensions in Europe all contributed to a reappraisal of the British methods of war, culminating in Haig's ESR and the other manuals which disseminated the British ethos, the phases of battle and the pursuit of decisive battle. The British realized that the new weaponry and tactics of the Boer War and the Russo-Japanese War conferred upon the defender
significant advantages that made the defense stronger relative to the offence, a conclusion Callwell reached after studying the tactics of these conflicts. He believed that it was not the mode of Boer fighting - mounted infantry - that was important since it was unsuitable to a European environment. Instead the lessons of the conflict lay in the weapons the Boers used, which were common to all modern armies and responsible for the greatly increased power of the defense.9 While the British highlighted the potential of machine guns and quick firing artillery they did not ignore the value of field works. French, while discussing the Turkish defense of Plevna against the Russians in 1877, observed the additive strength of field works to the defense and suggested that in modern war they would pose almost invincible obstacles. He ironically concluded that, “If these lessons could be clearly evolved from operations which took place thirty-four years ago, how much more striking must they be to the student of war as it is in 1911!”10

According to British principles, however, it was axiomatic that one could only achieve victory through the attack.11 The inherent conflict between the vitality of the offense and the supremacy of the defense posed a dilemma for British theorists. If the defense is superior, how can a combatant achieve victory? Would not war become trapped into a cycle of perpetual stalemate? This fear, of course, was realized in the trenches of the Western Front and in the long struggle to counter the defender’s advantages and establish the prerequisites that would make decisive victory possible. One historian of the British Army believed that the nature of combat in
France confirmed the theory of the superiority of the defender over the attacker quite early in the war. He wrote, "from 1914 until the end of the war the history of the various offences in the west is one long account of the different attempts to place the power of the offensive on terms with that of the defense." However these fears of defender-induced stalemate only served to refine their intellectual belief in superiority as an essential pre-requisite for success.

The British colonial experience suggested another problem that might prevent a decision in modern war. Since the end of the Napoleonic Wars, Britain had generally fought wars in which it held a massive superiority in weapons, technology, and tactics, even if its forces were heavily out-numbered. There were a few debacles, such as in Zululand and Afghanistan, but the stereotype of a few red coats triumphing over a greatly larger but technically inferior force was a true image. However, against a Continental opponent, not only did the British expect to field the smaller army but they would also have to face an enemy who had equivalent armaments, training, and organization. This scenario suggested that future war would describe a struggle between equals, and as such there was a grave risk that neither side would gain the advantage necessary for a decisive victory. Finally, if the British could not achieve victory quickly then the possibility existed that the conflict would become a long, drawn-out battle of exhaustion.

The British also considered the implications of limited size of their army relative to continental powers, and the difficulty it posed
for securing an asymmetric advantage. Theorists raised the question of how the six division British Expeditionary Force was to negate the advantage of size that its continental rivals possessed. Even against a modest sized opponent, such as the Boer Republics, the British had to increase massively the size of the army. Against Germany the manpower discrepancy would be even greater. The difficulties posed by the strength of the defense and the inferiority of numbers had, for Britain, a single solution. It needed to exploit an asymmetric advantage to compensate for its liabilities and to find weaknesses in the enemy’s situation over which the British Expeditionary Force could gain a superiority.

These fears found expression in the literature of the British Army in the years between the Boer War and the Great War. Some authors approached the shortfall of numbers directly and called for increases in military training in order to create a large reserve of civilians with some experience at arms whom the army could rapidly mobilize. Hamilton demanded “compulsory cadet training in all schools, public or private. The majority of the voters want it and they ought to have their way.” He also discussed his interpretation of the nature of the social contract and concluded that citizens owed their country their life and should be prepared to sacrifice it when called upon.13 Lord Roberts went even further, and in a series of speeches in 1912 he built the case that Lord Haldane’s creation of the part-time Volunteers was inadequate and that the nation required conscription, and thorough military training of all able-bodied men.14 Certain sections of society warmly welcomed these
suggestions, however, they were politically unfeasible from the beginning. The Treasury did not want to incur the additional expense that an increased army size would require, nor did the leaders of the Liberal party believe that the voters would reward them if they substituted compulsion for volunteerism.\textsuperscript{15}

Although the army could not address manpower levels directly, some officers did advance theories that would allow the army to compensate for its numerical inferiority relative to the continental powers. Fuller believed Frederick the Great’s victory over the Austrians at Leuthen in 1757, where the enemy outnumbered the Prussians by 90,000 to 33,000, contained pertinent lessons for Britain. Fuller credited Frederick with a superior ability to discern weaknesses in the enemy’s dispositions and thereby out-maneuver his opponent and gain an advantage. Fuller believed that Frederick understood how to identify the decisive point in his opponent’s position and channel his forces upon that location. Furthermore, since the enemy did not understand this tactic, Frederick also gained the element of surprise. His skill in establishing an asymmetric relationship with his opponent through superior maneuver and the concentration of all his strength on a critical point made-up for Prussia’s shortage of manpower to the extent that it assured a great success.\textsuperscript{16}

Fuller also put forth the idea that novel weapons would form the basis of success in a future conflict. He predicted that:
... the general who makes the truest use of these weapons, that is, so deploys his men that their fullest power is attained will win, unless he is hopelessly outnumbered. If this general further devise[s] a system of deployment which will not only accentuate the power of these weapons, but also the defects in his opponent's formations, he will win irrespective of numbers ... This is a certainty.¹⁷

Fuller continued:

That the grand tactics of an army will chiefly depend on the value its commander sets on any particular weapon ... and that the commander who first grasps the true trend on any new, or improved, weapon, will be in a position to surprise an adversary who has not.¹⁸

After examining Fuller's ideas of 1914 it is not surprising that during the war he became an ardent advocate of the tank, a novel technology whose introduction surprised the Germans and one in which the British and French maintained a huge superiority until the armistice. Fuller clearly grasped the nature of asymmetry and the ability of weapons and maneuver to counteract the numerical superiority the British Army expected to face. He closed his discussion with the dictum, "know your weapons, understand your enemy," a final reminder of the interplay between two sides in war
and the need to use your resources to exploit the enemy’s weaknesses.\textsuperscript{19}

Robertson also reflected on the likelihood that in the next war Britain would face a European foe with superior numbers. His recommendations were less specific than Fuller’s but he believed that the ingredients to beat a more numerous force included a good commander, a dedicated staff and a well-trained and confident army. However he also suggested that the army give some thought to the technical aspects of how to disengage and retreat from the face of a stronger opponent. Robertson wrote that the commander in the inferior position should retire and thereby not risk the demoralization and loss of offensive spirit that would result from a defeat. Instead, the commander should use maneuver to establish a more favorable opportunity that would negate the advantages formerly enjoyed by the enemy.\textsuperscript{20}

Fuller and Robertson were not alone in addressing the complexity of modern war, particularly in the context of an intra-European conflict. Another officer, W. D. Bird, in discussing the need for fire superiority, wrote that if "two forces, absolutely identical in every respect, meet on absolutely equal ground, and are both equally will led, neither side will gain fire supremacy, except by pure accident."\textsuperscript{21} To avoid such stalemate, Bird suggested that if a commander could maneuver his troops so that a greater number of rifles were made to bear upon a portion of the enemy’s line, a local superiority would result, and by following up this advantage, victory, instead of stalemate, would become possible. His idea is reminiscent
of the strategy used by Thebes to defeat Sparta. Epaminondas increased the concentration of spears, while Bird raised the density of rifles, but the principle is the same: the deliberate establishment of a local superiority in order to create an advantage which the attacker can exploit. Bird’s lesson is quite clear: when faced with symmetry, create asymmetry.\textsuperscript{22}

The future army commander General C. C. Monro advanced a related conclusion in his own article on fire supremacy. He believed that “when... [the advance of the fire line] is checked by hostile fire, the firing line must be strengthened in order to provide the volume of fire necessary to master that of the enemy and ensure progress.”\textsuperscript{23} Monro actually reiterated a principle of the FSR that mandated an intimate connection between fire and movement and the need to close with the enemy in order to gain a decisive victory. In addition, he also recognized that the British must avoid symmetry, not only would equality be expensive, it would also not lead to success.

As with the phases of battle, Haig’s also discovered the principle of asymmetry while at the staff college. In his notebook on strategy Haig posed the question, “What are the elements of superiority?” He provided the answer:

- Numbers.
- Quantity of artillery.
- Value of the individual, moral worth and technical skill.\textsuperscript{24}
Elsewhere in this notebook he reaches a slightly different conclusion, superiority of force was more than just a comparison of numbers but also included the efficiency of the armies, the ability of a body of troops to succeed. Haig drew similar ideas from his study of Napoleon's method of war. He concluded that the Corsican's success lay in his ability to upset his opponents equilibrium by maneuvering against a flank or line of supply or by concentrating fire upon a single weak point in the enemy's dispositions. Both methods would create an opportunity for superiority which would increase the power of the French while hastening the collapse of the enemy.

During the war it became clear that the British had realised their prewar fears of becoming involved in a protracted struggle between comparable opponents. Haig believed that the combatants were of approximately equal strength, an observation that reinforced his faith in the necessity of the wearing out phase of battle. To achieve decisive victory the opposition had to be worn down until they were on the verge of collapse so that the British could launch the decisive blow that would break the German Army, lead to the pursuit stage and the total defeat of the enemy. Haig understood that as long as the sides were comparable in fighting ability victory would remain elusive.

Historians, however, have frequently described Haig's plans as merely attritional, an unfortunate label that does not fully appreciate the complexity of his objectives. Interpreted simply, British plans were attritional because GHQ did perceive the struggle as a contest between two titans, the winner being the last one left standing.
Haig's "Back to the War Order of the Day" of 11 April 1918 certainly supports such a conclusion, "many amongst us are now tired, to those I would say that victory will belong to the side which holds out the longest." A few months later the tide had turned and Montgomery could point out that while Fourth Army had lost 27,000 men during the Battle of Amiens the enemy's casualties were much greater. He accepted this as a satisfactory result, and believed that if the trend continued, the Allies would outlast the Germans. Using attrition the Western Allies would inevitably succeed due to the greater materials and manpower of the British and French Empires, Italy and eventually the United States. However, Haig's ideas were more sophisticated than mere wastage. The wearing down phase of the war had as its real objective the establishment of an asymmetric relationship with Germany that was favorable to the British. At a meeting with his staff in January, 1916 Haig outlined his preliminary plans for the Somme which illustrate his acceptance of the idea of asymmetry. He noted:

1) Employ sufficient force to wear down the enemy and cause him to use up his reserves.
2) Then, and not till then, throw in a mass of troops (at some point where the enemy show himself to be weak) to breakthrough and win victory.

The key is to recognize the relationship that existed between the weakening of the enemy and the identification of a point at which
the British would gain a superiority that they could then exploit. The perception of this transition period was an extremely difficult task, requiring a precise assessment of not only one’s own army but, more importantly, the condition of the enemy’s forces as well. The ability of World War I intelligence officers to accurately make such estimates remained limited, and the exaggerated reports of the decline of the enemy partially accounts for Haig’s misplaced enthusiasm during the first few days of the Somme and Arras, and other occasions. After it became clear that the attack at Arras in April 1917 had failed, Robertson felt the need to moderate Haig’s expectations. He explained to his subordinate that the war had not yet reached its decisive moment and that Haig should give up on the idea of achieving a breakthrough, at least for now, and instead return to the principle of wearing down the Germans. Robertson wanted the British to inflict heavy losses and to make the enemy suffer with the objective of breaking the German Army, after which the breakthrough would be easy.\(^32\)

Haig’s outline for the Somme battle also shows that he too was addressing the inferiority of manpower problem under which his army suffered. Reminiscent of the recommendations of Fuller and Bird, the British strove to create an environment that would maximize the combat potential of their army by lessening the efficiency of the Germans and by providing a point asymmetrically favorable to attack. If successful, wastage would actually save lives by creating the environment in which decisive battle was possible.\(^33\)
In a discussion on manpower and the size of the calvary establishment, Robertson complained to Haig, that the situation on the Western Front was not normal and that he looked forward to a return to normality. One could interpret his objection as a nostalgic longing for the good old days when mobility was the reality, along with the romantic image of the mounted warrior sweeping across the battlefield. While Haig's continued obsession with the calvary suggests that there was an element of truth to this vision, it also suggests that the British focus upon mobility was not an end in itself, and represented a deeper concern for the realities of the Western Front and the need to create an environment in which the British could secure an advantage. Robertson and Haig objected to more than the inability to exploit maneuver; rather the abnormality of the Western Front, they rightly sensed, was one of symmetry. It was symmetry that created the stalemate, inhibited maneuver and prevented establishment of the conditions required for decisive victory.  

The process of gaining asymmetry was a gradual one. Prior success could lower the enemy's resistance and thereby make a positive contribution to a future contest. After the commencement of Arras, Robertson congratulated Haig on his successful start to the battle (its failure was not yet apparent). Robertson went on to confess that he had been afraid that the effects of the Somme might have worn off. He concluded, however, that the large numbers of prisoners indicated that the British now had a moral superiority over
the enemy. A few days later Robertson again commented on the incremental nature of superiority. He wrote optimistically:

Apart from the improvement in general fighting efficiency, tactics, administration, and training it seems to me that your success is largely due to superiority in morale and in artillery. As regards morale you are now reaping the fruits of the hard fighting on the Somme while as to artillery you have now not only practically unlimited artillery but a few larger number of guns that you had last year.

Robertson’s observations also revealed the material side of asymmetry. From 1914 through 1916 the British had contended with a German Army that was more richly endowed with munitions and the other tools of trench warfare. The shell crisis of 1915 was representative of the inadequacy of British preparation and the historian of the Ministry of Munitions admitted that the British Army was unprepared for trench warfare and that in many cases patterns did not even yet exist for needed equipment. By 1917, the expansion of Britain’s armament industries had largely closed this gap and negated one of the advantages the German’s had enjoyed.

British officers also recognized that the relative strength relationship between two forces was a fleeting comparison. One had to press one’s opportunities while they existed, as any advantage could quickly evaporate. The FSR intoned:
Time is an essential consideration in deciding whether an opportunity is favourable or not for the decisive action. A commander who has gained a strategical advantage may have to act at once in order to prevent the enemy bringing about conditions more favourable to himself.\textsuperscript{38}

Haig’s comments on the Somme showed the shifting tide of asymmetry. In August he wrote enthusiastically to the Chief of the Imperial General Staff that there was little doubt that the enemy was in a weakened state and that the “maintenance of a steady offensive pressure on the enemy’s main fronts will result in his complete overthrow.” He concluded his comments with the opinion that the British must continue to pursue the attack well into autumn.\textsuperscript{39} To Joffre, while asking for support, he pointed to the great losses and falling morale of the enemy, and his belief that the time was approaching when a determined effort might cause the enemy to collapse.\textsuperscript{40} In September the troops received an order announcing that:

For the last two and a half months we have been gradually wearing down the enemy. His morale is shaken, he has few (if any) reserves available, and there is every probability that a combined and determined effort will result in a decisive victory.\textsuperscript{41}
Robertson, also commenting on the Somme, urged Rawlinson to keep methodically hammering away at the Germans so that they would eventually crack because he believed that the situation was the most favorable since the start of the war. Shortly afterwards he noted that the politicians wanted to shut down the battle for the winter but he hoped to keep up the pressure for as long as possible, since in 1914 they had fought until nearly Christmas. Two months later the tone changed and a dejected Haig would report that “the moment for decisive action was rapidly passing away.”

The following year Haig once again anticipated the decisive battle and the collapse of the enemy. As Passchendaele approached Haig wrote to the commanders of the British armies to report that:

After careful consideration . . . . I feel justified in stating that the power of endurance of the German people is being strained to such a degree as to make it possible that the breaking point may be reached this year.

Shortly thereafter he reiterated that the German Army showed unmistakeable signs of deterioration and that further defeat may yield greater results than we can absolutely rely on gaining. Haig hoped that if they hammered the Germans sufficiently hard the result might be the collapse of the enemy and an end of the war by the new year on allied terms. A few days later he announced to the War Council that the German Army had, “already lost much of that moral force without which physical power, even in the most
terrible form, is but an idle show. After the battle began he pleaded to Robertson for more men and materials because of the poor state of the enemy's soldiers, especially when compared to the high efficiency of the British troops. Finally, to Petain, he wrote that they had to press the attack in Flanders because the enemy had lost heavily and had few reserves and that another assault might achieve great results.

This optimism reappeared more appropriately during the war's final campaigns. Writing to the commanders of his five armies, Haig noted that the enemy's ability to defend itself after its recent defeats had diminished. The German troops were disorganized and worn out. Haig concluded that the British should keep up the pressure and increase the scope of their attacks. He told his army commanders to assign distant objectives to their units and to instruct their subordinates to press on without worrying about maintaining contact with adjacent units. Haig rightly perceived that the enemy was on its last legs and the following day he wrote again to his army commanders and suggested that they should reinforce success and press the enemy relentlessly. Anticipating the pursuit phase Haig goes on to say that advances should be directed at points of strategic importance such as road and rail centers. Their capture and the effect upon the enemy's line of communications would further demoralize the Germans and increase the superiority of the British.

Montgomery believed that by mid-August it was obvious that the German Army's entire Western Front force was in poor condition and, if pressed, their complete collapse was probable. Maj. Gen. T.
G. Matheson, the commander of the Guards Division, also sensing victory, issued orders in October 1918 strictly forbidding fraternization with the enemy on the grounds that any respite would give the Germans a chance to recover. The end came quickly. Montgomery realized that the attacks of 4th November had broken the enemy's capacity for organized resistance. The British had kept the enemy continuously engaged since 8th August with little chance for rest or refit. The Germans no longer possessed fighting qualities sufficient to stem the allied advance and they had lost their faith. Montgomery concluded that "the moral[e] of the German Army had been shattered." The British understood that the Germans must have no opportunity to restore the equilibrium between the combatants and thereby negate Britain's asymmetric advantage. Commenting on the Hundred Day Campaign Montgomery believed that the Germans could have prevented their collapse if they had succeeded in withdrawing behind a defensive line which they could have held for the winter. This would have given them time to reorganize and close the superiority gap that the British enjoyed. However, Haig and Foch, he continues, were determined to prevent the Germans from consolidating, and the Allies continued to attack relentlessly.

The need to achieve superiority affected the strategic options available to the Allies and also helps to explain the virtually single-minded focus of the British leadership on the Western Front. To Lieut.-Gen. G. F. Milne, Robertson explained that the Balkans could never be an important sector because the Allies could only achieve
victory by beating the German Army and that they would never face
significant numbers of Germans at Salinaka.\textsuperscript{55} Haig shared this view
and in the same month that Robertson corresponded with Milne, he
wrote in his diary that the Western Front was “the main theatre and
resources elsewhere should be reduced to minimal levels.”\textsuperscript{56} The
next year, fed up with demands for more troops for the Balkan and
Italian fronts, he wrote testily to Robertson that:

\textbf{\ldots the only sound policy is for the Government to support me
whole heartedly, and concentrate all possible resources here.
And do it now while there is time, instead of continuing to
discuss other enterprises.\textsuperscript{57}}

Later in 1917 Robertson again complained to Haig about the War
Policy Committee’s focus upon Palestine and their desire to divert
resources there. He believed the committee ignored the principles of
time, space, human strength and the concentration at the decisive
point.\textsuperscript{58}

At the Chantilly Conference of December, 1915, the Allies
agreed to intensively pursue the wearing down process, and
recognized that decisive results would only be gained by
simultaneous offenses.\textsuperscript{59} A month later, Haig wrote to Kitchener and
repeated this theme. The Allies had to conduct the wearing out fight
simultaneously, he believed, and it would not be possible to launch
the decisive blow until the attackers had drawn the enemy’s
reserves into the struggle. In his plans for the Somme, Haig
anticipated coordinated offenses that would use up the enemy's strategic reserves. Haig and Joffre agreed on simultaneous offences although the Verdun battle lessened the anticipated French contribution. As the Somme raged, Robertson defended GHQ's conduct of the battle to the War Committee and explained that victory would only be achieved if the Allies followed a policy of relentless pressure on all fronts.

While the British acceptance of the principle of asymmetry was fundamental to their conception of the nature of war, it is obvious that no nation has the resources to achieve superiority in all areas of competition with the enemy. Therefore, it is necessary to discuss why the British chose to make morale and maneuver their areas of specialization. Maneuver is the easier of the two to explain since there is a vast literature that recognizes the increased potential the offense gains by a sudden movement against an enemy's flank or rear. British theorists could point to innumerable practical examples, from their own history, and from that of the continental armies, the United States and the classical era which illustrated the devastating effect upon the enemy's resistance when the attacker threatened the defender's line of communications. Morale, while an equally basic and ancient aspect of war, is an intangible condition and considerably more difficult to define. However, for the British, its selection was simple. Moral courage was at the core of their definition of national survival and its manifestations were an essential feature of the nation's culture. The incorporation of morale into the army's most critical functions, and its transference from the
public to the military sphere, highlighted the officer corp’s, NCOs’, and other rank’s reliance on its attributes for their code.

Before, during and after the war, military authors continually reiterated the vital role morale played in determining success in war. For most, high morale, along with its component traits discipline, efficiency, and offensive spirit, was the single most important characteristic that a soldier could possess. It was not a quality endowed by chance, but instead the army cultivated it through training, tradition, and leadership to the highest degree possible. The army leadership believed it essential that the morale of the troops must be higher than that of the enemy, and, recognizing the relative nature of asymmetry, no opportunity could be lost to raise its level within the British soldiers while lowering their opponent’s.

The British theorist Henderson, while commenting on morale, believed that the greatest of generals were those who constantly observed the intangible, not just the physical, factors of war. Every movement they made had as its objective the destruction of the enemy’s morale. One of the Duke of Wellington’s great strengths, according to Henderson, was his acceptance that the issue of battle lies in the hearts of men. Henderson’s pupil Haig reached a similar conclusion on the value of moral forces. While discussing strategy at Camberley, he noted that, “in battle moral factors are of the very greatest importance.” Another officer, Colonel Haldane, concluded that in war the nation with the highest morale was almost sure to win and that in a long war it was essential to sustain the morale of one’s men. Denouncing those who thought modern war was only a
question of weight of lead and numbers, Chetwode maintained that above all other factors, "soars the sovereign power of the moral element." He continued that while the body controlled the soldier's weapons the brain remained susceptible to moral forces.68 Lastly, French, while expressing his concern on the small size of the army, added:

Armed forces, imbued with whole-hearted belief in themselves and their cause, are unconquerable, even if inferior in numbers, whereas forces without this confidence are destined for defeat, no matter how strong.69

The British were not unique in such beliefs; their dominion partners shared this ethos. General Sir John Monash, the leader of the Australian Corps in 1918, wrote that "it is an axiom of the art of war that moral considerations count for much more than material ones." He concluded that, "it was thus necessary to build up and sustain the fighting moral[e] of the troops." Recognizing the vital presence of intangibles in war, Monash believed that a commander should never risk battle without absolute guarantee of success because defeat would risk a lowering of the morale of ones troops.70 Another senior Australian, the divisional commander Maj-Gen. Sir J. Gellibrand, in a comparative study of recent campaigns concluded that the chief lessons of these conflicts concerned the personality of the leaders and the morale of the troops.71
The British also recognized a connection between morale and the nature of the human spirit. Haig believed that, the “psychological element - human nature with its infinite versatility - plays the chief position in war, and there is no end to the study of man!”  

Henderson saw an understanding of the human spirit as a critical aspect of good leadership. He wrote:

... the art of generalship, the art of command, whether the focus be large or small, is the art of dealing with human nature. Human nature must be the basis of every leader's calculations. To sustain the moral[e] of his own men; to break down the moral[e] of his enemy - these are the great objects which, if he be ambitious of success, he must always keep in view.

Montgomery, who credited Napoleon’s brilliance to the Corsican’s understanding that human nature was the key concern of war, would certainly have shared Henderson’s analysis.

British manuals regulated the role of morale and disseminated its value throughout the army. The FSR explained:

Success in war depends more on moral[e] than on physical qualities. Skill can not compensate for want of courage, energy, and determination; but even high moral qualities may not avail without careful preparation and skillful direction. The development of the necessary moral qualities is therefore the first of the objects to be attained; the next are organization
and discipline, which enable those qualities to be controlled and used when required.\textsuperscript{75}

The general instructions on training declared that modern war required not only numbers, organization, and armament, but also the mental, moral and physical development, to the highest level possible, of every individual in the army. It identified the most important objective of training as the cultivation of a soldier's moral force.\textsuperscript{76} It continued that, "however well trained an army may be it will lack one essential if it does not possess moral force. Moral force in modern war preponderates over physical force as greatly as formerly."\textsuperscript{77} The field artillery also incorporated the value of morale into regulations. Its manual stated that "the moral effect of batteries advancing boldly in support of their infantry may decide the issue, when success or failure hang in the balance."\textsuperscript{78}

As the war approached, the language of the manuals changed to reflect a greater insistence on the importance of morale. The 1905 version of \textit{Infantry Training} declared that:

The object of the recruits course of training at the depot is to fit the soldier to take his place in the ranks of his company on joining the battalion.

For this purpose the recruit must be developed by physical exercises, and be trained in squad drill, rifle and firing exercises, in the estimation of ranges, and in skirmishing.\textsuperscript{79}
Surprisingly, this declaration of purpose refers exclusively to the practical side of the recruits transformation into a soldier. However, the manual’s 1914 edition refocused the objectives onto the intangible aspects of war. The same section now read:

The object of infantry training is to make a soldier mentally and physically a better man than his adversary on the battlefield.

The preliminary steps in training are:
- development of a soldierly spirit
- training of the body
- training in weapons

The army had dramatically changed the emphasis of the purpose of training.

The manual clearly expressed the importance of asymmetry and the army’s selection of spirit, or more properly, morale as the priority of training, at the expense of physical skills. Field Artillery Training, also published in 1914, again suggested the growing awareness and importance of moral superiority. It declared that the training of artillery recruits had to include both moral and physical instruction and, furthermore, it was only after the development of the qualities of the mind and the physical fitness of the body that field instruction could commence.\textsuperscript{81} Both of these manuals suggested that the advancement of moral forces had precedence over training with one’s weapons.
Once the war began, British manuals continued to emphasise the central importance of morale. The divisional training manual claimed that "too great stress cannot be laid on developing good moral[e], a soldierly spirit, and a determination in all ranks to achieve success at all costs."82 The publication issued to platoon leaders noted that "moral[e] must be heightened by every possible means; confidence in leaders and weapons goes a long way toward it."83 In the final year of the war the Headquarters of Fifth Army could still declare that "unit commanders can not pay too much attention to raising the morale of their troops."84

A number of studies of the British Army have come to a similar conclusion as the officers regarding the importance of morale. Basil Williams identified the moral element as the most important aspect in the training of recruits as Britain created its New Armies.85 Baynes, in his book on the Scottish Rifles, declared that the maintenance of morale was the most important single factor in the war. He went on to explain that tactics were of less importance because ultimately the success of a maneuver depended upon the condition of the men intrusted to carry out the plan. If morale was bad the best plans would fail, while high morale might save a poor plan.86 Lord Moran, in The Anatomy of Courage, has suggested that in a conflict such as World War I, where the existence of great nations was at stake, moral factors determined the issue.87

The British selection of morale as an area in which they would pursue asymmetry was a logical choice, given their prewar inferiority in both men and material when compared to continental
rivals. However, even after the United States entered the war and its limitless troops began to arrive in France, assuring the Allies numerical superiority, the British Army continued to emphasize the centrality of morale in their methods. General Henry Wilson, in his paper on the future of British military policy in 1918, declared that:

More important even than the actual numerical superiority will be the ascendancy in moral which cannot fail to be acquired by the Allied armies as they realize the great numbers of young, vigorous and enthusiastic men that come steadily pouring in across the Atlantic, week by week and month by month. The enemy’s discouragement at seeing the balance turn against him at this late period of war, after all the sacrifices he has made, will be proportionately great.  

While Americans would contribute to victory by their ability to fight the Germans, their very presence was more important than their combat skills. Upon seeing the strength of the soldiers from the New World, the already strained morale of the enemy would collapse and usher in victory.

Wilson’s expectations pose a question; if the arrival of the Americans solved the numerical imbalance, why did the British continue to pursue morale as their primary area for asymmetry? Should not morale have become immaterial? Furthermore, since by early July 1918 the British had clearly gained the moral advantage, as the easy Australian victory at Hamel revealed, and because the
Allies had also equalized or gained ascendency over the material advantages formally enjoyed by the Germans, why did the means of achieving decisive battle not devolve to a simple issue of numbers? Travers posed a related question in *How the War Was Won*. The British held a massive superiority in tanks and yet they continued to rely on moral qualities, rather than technology, during their march to victory in the war’s final battles. Major General E. A. Altham, on the eve of the war, provides the beginning of an answer; the British did not select moral values because they believed brave men could advance across the fire-swept fields that modern weapons created. Rather it became the heart of the army’s way of war because moral values were also at the core of how society defined national survival.

Altham observed that modern war was not a struggle between sovereigns but between peoples. It was a clash of two great ambitions, each compelled by natural forces to thrust the other aside. It would only be won when the nation’s moral qualities, organization, discipline and leadership were such as to compel the enemy to conform to its will. The clash on the battlefield was only one aspect of modern war. Nations also waged decisive battle on the level of character. Altham continued:

... victory or defeat depends not so much on the size of armies and fleets as on their fighting efficiency, and that this efficiency is directly proportionate to the moral force of the nation and to the extent to which the nation realizes its
responsibility, individually and collectively, for its own preservation.93

From this Altham concluded that "preparation for war is a national duty, the neglect of which involves humiliation and disaster."94

The Anglo-Boer War and the Russo-Japanese War, besides being an exhibition of modern weaponry, confirmed the British faith in national character and also they served as a clarion call for the reassessment of society's moral strength. The British difficulty in defeating the Boers came as a rude shock that only reinforced fears that Britain was in a state of decline, both physically and morally, an anxiety to which the 80 percent rejection rate of volunteers from Manchester and the 40 percent overall national rate seemed to confirm. Additionally, observers tended to credit the Japanese success over Russia to the supremacy of their moral fortitude. Insecurity about its declining economic presence and angst over the increasing threat of German militarism combined to create in Britain a movement for national rejuvenation, both in spirit and in industry. Taking up the call of efficiency, reformers urged a widely aimed program of change which crystalized around a belief in a direct correlation between the moral condition of a nation and its military power. The need for efficiency, or the improvement of the condition of the British race, was essential for the survival of the independent nation. Theorists, military and civilian, readily saw the link between morale, efficiency, and discipline, and incorporated these terms into
their quest for supremacy over the enemy and their pursuit of the decisive battle.

The British Army became renowned for its attention to discipline during the war. Certainly their emphasis upon saluting, cleanliness, demeanor, and the employment of harsh punishments, both in the line and in the rear led to excesses but for commanders, discipline was not only a prerequisite to the creation of an efficient fighting machine but also an essential ingredient for instilling into the troops a level of morale that would assure superiority over German soldiers. To some extent, discipline is an essential means to instill in soldiers the willingness to expose themselves to the dangers of combat. The Australian Gellibrand identified discipline as the highest military virtue and believed that it implied obedience even unto death. Elsewhere he commented that discipline was not an irrational restraint and subordination of the will to others. Instead, its goal was to instill in the minds of every soldier the determination to die in order that victory might rest with one’s comrades. Uniacke perceived discipline as the British soldiers greatest combat virtue and he declared that, “discipline helps us to endure - and endurance which refuses to give in until the breaking point has been reached and passed leads to the greatest soldierly qualities - self sacrifice.” At its ultimate it might be responsible for the recognition that brigadier H. C. Rees gained for the performance of his 94th Infantry Brigade during the Somme. An observer reported that he was:
... enthusiastic over the behavior of the men of this brigade. They advanced in line after line, dressed as if on parade and not a man shirked going through the extremely heavy barrage, or facing the machine gun and rifle fire that finally wiped them out. 99

Perhaps Rees' handling of his men is also an example of poor tactics but as another commentator noted, self-discipline is synonomus with high morale and that the "first test of a unit's quality was the state of its discipline." 100

However, discipline is more than just the willingness to die. Henderson, commenting on discipline, wrote that contemporary warriors had to be made of sterner stuff than their predecessors due to the increased lethality and range of modern weapons. Soldiers, he continued, must be highly disciplined and motivated if panic was to be avoided. 101 The conditions of the Western Front certainly underscored that a high level of discipline was essential if the troops were to survive. One manual declared that the:

... hardships, discomfort, and dangers of life in the trenches make great demands upon the endurance of the troops; the frontal attack on an enemy in a position strengthened and defended by every device that ingenuity and forethought can conceive calls for exceptional resolution and determination, and the defense of trenches against an attack, ... requires the utmost steadfastness and devotion. 102
While Henderson suggests that morale can be used to compensate for an opponent’s technological superiority or to acclimate to situations of extreme strain or danger, his analysis is overly narrow. British society saw discipline as a measure of national character. In 1916 the Fourth Army confronted the issue directly in a pamphlet on tactics. It stated that:

It has been rightly said that this war will be won by superior discipline and moral. We undoubtedly started with the disadvantage of putting an undisciplined nation against a disciplined one; but this advantage is rapidly disappearing, thanks to the self-sacrifice of the best elements of the nation. This self-sacrifice, however, is not enough unless we attain a high standard of military discipline. No opportunity, therefore, must be lost of inculcating discipline into the troops, whether in the trenches, on the march, or in the billets.¹⁰³

Mere bravery would not be enough, all soldiers had to be exposed to rigorous discipline so as to ensure high morale and the character necessary to defeat the enemy.

The British emphasis on discipline reached its most fantastic tone on the issue of protection from the enemy’s poison gases. While vapors provided the same threat of death of which all modern weapons were capable, the British credit gas with virtually supernatural ability, its very nature had the capacity to dramatically
and rapidly destroy morale. Haig believed that the threat of the unknown or the invisible posed particularly dire consequences for morale. At the Staff College he wrote:

... of all things the most disturbing is long-range fire. Because it is unknown, an enemy is there whom one does not see, bullets arrive from no one knows where! It is impossible to fight against an invisible enemy.\(^{104}\)

Perhaps Haig reached this conclusion under Henderson’s instruction who defined moral force as “the art of trading on the fears and susceptibilities of the opponents.”\(^{105}\) However, without anticipating the future of Chemical Warfare, Haig accurately described the unseen nature of gas and the terrifying reaction it invoked in many troops when it interfered with essential functions such as breathing.\(^{106}\) The British Army sought protection from its effects, both physical and psychological, through the observation of rigorous discipline.\(^{107}\)

The British response took two directions, first they had to gain the confidence of the troops that their equipment would protect against gas, and second, they had to train the men in the rapid and efficient donning of their respirators. They achieved both goals by constant improvements in anti-gas devices and by frequent inspection and training drills. While this subject lies outside the boundaries of this work, some exploration of British anti-gas methods is essential since defensive attitudes are usually a reflection of offensive expectations.\(^{108}\) After its surprise introduction, the
British reaction regarding defensive appliances was virtually immediate. From London came the suggestion to breathe through a bottle, filled with earth, that had the bottom broken off or a handkerchief moistened, if necessary, with one’s urine. More practical supplies, however, arrived soon, and the British Army underwent an evolution of anti-gas breathing devices that culminated in the Small Box Respirator (SBR), probably the war’s finest mask.\textsuperscript{109}

The training and instilling of the men’s confidence in their anti-gas equipment was, however, a more difficult task, one that they pursued relentlessly. Some appeals were direct:

There are two kinds of men in gas attacks:
The quick and the dead.

Others tried a humorous approach:

It’s all right to cook with gas, but who wants to croak with it?
Get that mask on quick!

or

The hard-boiled guy said gas was “Bunk,”
said it was harmless; only stunk;
And that the cock-eyed world he’d tell
that all gas masks could go to . . . well
they sent hard-boiled up to the line;
Fritz spilled the "Mustard" good and fine;
And yet some folks still wonder why
twas "Flowers" for the hard-boiled guy.110

British training publications and orders repeatedly stressed the need for speed and accuracy in donning one's mask. Defensive Measures Against Gas intoned:

In the absence of suitable means of protection the poison gases used in war are extremely deadly and the breathing of only very small quantities of them may cause death or serious injury. This being the case it is essential that not the slightest time should be lost in putting on the box respirator or helmet on the gas alarm being given.

It continued:

It cannot be too strongly insisted on that the measures which have been elaborated to meet hostile gas attacks afford perfect protection, and if they are carried out properly no one will suffer from gas poisoning.111

A document issued by VIII Corps recommended that, "the only protection against gas is the instantaneous application of the necessary precautions and the only danger is delay in taking these
precautions and in warning every man in the neighborhood.” The VIII Corps also warned its troops that while only a few mouthfuls of gas might prove fatal the mask provided perfect safety. It recommended that units included anti-gas procedures in their regular trench discipline.

The British instituted a policy of daily practice and inspection by local commanders and periodic reviews by representatives of the gas service. Official policy established that “it was essential for all ranks to be highly trained in defense against gas.” Policy also required troops to wear their masks for at least one hour per week and to practice their normal activities in order to acclimate themselves. Gas officers were kept quite busy by their inspection duties. The gas officer for the 1st Australian Division inspected five battalions in a one week period in August 1918, while the 2nd Australian Division representative processed thirteen battalions during the period 3 April through 10 May, 1918. This was in addition to their other responsibilities as lecturer and instructor at the divisional gas school. By the end of the war gas officers were inspecting over 250,000 gas masks a month. This focus upon discipline and the mask bore fruit. During the British retreat in March 1918, in a survey of 10,000 stragglers, soldiers abandoned 6,000 rifles, 4,000 helmets, but only 800 masks.

This emphasis upon discipline found its greatest practical application during the war but the demand for increased efficiency existed before the conflict began. Lord Roberts, a leading voice in the call for improvement and conscription, railed against Haldane’s
volunterism scheme because it left the majority of the population without exposure to military training and discipline. At a speech in 1912, Roberts explained that men could not suddenly acquire discipline. Instead, it required a period of continuous training in order to instill soldiers with the self-confidence and cohesion necessary for success. Later that year, to the people of Manchester, he again called for conscription and he complained that since the South African War the army had implemented only cosmetic changes and that in regards to efficiency and preparedness for war they had made little progress. Furthermore he suggested that the entire empire was wholly unprepared for war, an opinion that Gellibrand also shared.  

Nicholson, as Chief of the Imperial General Staff, went even further. He believed that patriotism was the foundation of high morale and that the nation had to instill it at an early age. He wanted children, from age four on, to be taught to carry flags and sing patriotic songs and thereby cultivate a pride in their nation. He concluded that morale is not a natural trait but that it must be taught.

Hynes, in *The Edwardian Turn of Mind*, observed a change in the nature of invasion literature that suggested an increasing British preoccupation with their lack of military preparedness and an increasing fear of Germany. As one might expect, the works of this genre originally featured the French as the enemy, but by the time the nineteenth Century had passed, Germany had become the invader. As war approached, the plots of these works underwent a curious evolution. In the earliest examples the British discovered
the plot well in advance. Later they were still able to repel the invasion with ease, but as international tensions increased they were doing so with some difficulty, and finally in those works written on eve of war, the Germans succeeded in conquering Britain. The increasingly dire expectations correlated with the rising tensions between the two nations and the demand for Britain to do more to improve its security.\textsuperscript{120}

Just beneath the surface of this perceived relationship between national survival and the concepts of morale, efficiency and discipline, lurked the pseudo-science of Social Darwinism. The application of Charles Darwin’s theory of survival of the fittest to include competition between nations was, by the outbreak of war, a widely held belief, both within the army and throughout British society. Paralleling the growing fear of German invasion was a concern that the stock of the British race was deteriorating, especially relative to that of Germany. In an address to army officers, T. Miller Maguire asserted that:

\begin{quote}
We are told everywhere we go that the race, if not exactly deteriorated already, is certainly deteriorating . . . .

Unless radical reforms are forthwith introduced, Britons won’t be fit for their responsibilities.\textsuperscript{121}
\end{quote}

He continued that the mass of Britons were in danger of losing their manhood, their womanhood, and of becoming unable to reproduce a fighting race. Maguire further claimed that in war readiness was
everything and that there was no choice between preparation for war or ruin. If the nation failed to stem its decline the armed forces would be unable to find the necessary sturdy recruits. He continued:

... unless we are able to secure a breed of healthy men and sound women, and to secure the conditions of life in which the childhood of the people, the very soul of the people, may be trained to be useful, strong, energetic and valient.

Maguire did not provide a plan but Captain H. T. Cantan saw salvation in the increased physical fitness of the nation. He suggested that officers should "encourage men to spend more time on physical exercises, such as running, jumping, obstacle climbing, bayonet fighting, hockey, football, cricket, etc." Furthermore, he continued, if officers "tire men at work, games ... they lose their liking for the city, its public houses, [and] prostitutes." For Cantan the problems were obvious, modernism and urbanization lay at the heart of the race's decline and to counter-balance these features he prescribed that:

Both sexes should strive to be physically fit for the sake of their children and future generations.

Children born of women distorted by the calls of fashion, such as corsets, and men weakened and effeminated by the abuses in large towns, drink, etc., and want of physical training
in both sexes, cannot possibly be strong and healthy. It is against all laws of nature to expect other than puny mites of babes, who grow up to be weak and unwholesome beings.\textsuperscript{124}

Integral to both morale and discipline was the need to cultivate an offensive spirit. Among the war’s combatants, the British were exceptionally aggressive in harassing the enemy and controlling No Man’s Land. This was a result of deliberate policy. Commanders kept their men engaged so as to prevent a loss of efficiency and the consequent decline of morale.\textsuperscript{125} To relax the aggression, they believed, would give the enemy a chance to recover and thereby lengthen the process of gaining moral ascendancy over the enemy. Haig believed that the efficiency of the men depended upon the activity that the wearing out phase provided and that without such actions the men would deteriorate.\textsuperscript{126} The commander of XI Corps also required constant offensive action by his troops. Lieut. Gen. Richard Haking accepted that only, “by constantly harassing the enemy . . . can [we] greatly improve the morale the morale of our own troops and wear out and depress the enemy . . . .”\textsuperscript{127} A 1916 training manual formalized these ideas. It concluded that to successfully assault the defenses of the Western Front, commanders had to instill in the ranks a sense of “dash and gallantry of a very high order” and in subordinate leaders the abilities of “quick perception, rapid decision, and intelligent initiative.” The publication continues that a condition of inactivity in the trenches is unfavorable to the development of these qualities and instead it calls for all units
to cultivate an offensive spirit. Finally it declares that the organization of minor local enterprises is the best way to maintain the efficiency of the troops.\textsuperscript{128} Another publication, in the section on offensive spirit, recommended that, "all ranks . . . be taught that their aim and object is to come to close quarters with the enemy as quickly as possible so as to be able to use the bayonet. This must become a second nature."\textsuperscript{129} The British issued the definitive opinion of the role and value of the offensive spirit in September, 1917. \textbf{Assault Training} explained:

- Every form of battle training must be founded on the offensive spirit.
- The chief duty and thought of all should be to kill as many of the enemy as possible, and during periods of training the aggressive spirit and the desire to kill should be impressed on all ranks.
- No pains should be spared by instructors to cultivate this spirit and to emphasis its importance in a vivid manner.\textsuperscript{130}

Monash identified as a prerequisite for success the need for commanders to animate their subordinates with a spirit of determination to overcome unexpected obstacles. No matter how tired and weary the troops were they had to seize every opportunity for hurting the enemy.\textsuperscript{131} Others put it more crudely. "Be bold, offensive, determined and above all, bloodthirsty - especially the
latter,” and “the only way to make the Prussian really respect you is to treat him with brutality.”

The pursuit of morale was the primary focus of the British in their efforts to attain superiority over the Germans, but of nearly equal importance, or at least effort, was their desire to restore maneuver to the battlefield. As Russell Weigley has explained, mobile forces possess greater power of shock than infantry and combined with the power of maneuver can seek out the enemy’s vulnerabilities. “The military commander,” he continued, “in quest of decisiveness needs an effective arm of mobile war.” Although Weigley is referring to cavalry, an arm whose effectiveness had been severely restricted due to the rise of modern weaponry, his comments still have application for the Great War. Between the Boer War and the outbreak of World War I, British theorists intensely debated the future role, if any, of cavalry. Although there remained traditionalists, most officers, the mounted arm included, accepted that the cavalry could no longer act in the manner epitomized by Napoleon’s bold horseman, Marshal Joachim Murat, and survive. Opportunities would still occur to influence the course of battle but reformers recognized that the principle roles for the cavalry were reconnaissance and pursuit. It, therefore, fell to the infantry to provide the necessary shock to expel the enemy from their positions and precipitate a retreat which the cavalry could turn into a rout. In modern war, it was the infantry who would seek advantage by penetrating the enemy’s dispositions, by turning their flank, by suddenly appearing in their foe’s rear, and, finally, by
threatening their line of communications. Additionally, the ability of
the British to capitalize upon the enhanced striking power, gained by
attacking from an unexpected or superior direction, would help to
compensate for its weaknesses, especially in manpower. A
successful maneuver upon an enemy’s flank or rear would create an
enormous asymmetric advantage. As the Field Artillery manual
explained, the role of the infantry was to conquer ground. The
responsibility of the guns, when used in a defensive role, was to halt
the advance of the infantry, but once the enemy had lost their power
of forward movement it was no longer capable of forcing a
decision.137

To deprive the infantry of the power to maneuver was to rob
them of the means to achieve a decisive victory. Yet when World
War I settled down into its trench warfare phase this was precisely
what happened, and the restoration of mobility became the British
Army’s ultimate objective, a goal in which the battle for moral
supremacy played a key role. The British never accepted that trench
warfare was the normal condition of modern war and instead
insisted that it was a temporary aberration. The opinions of
Robertson and Haig on the proper nature of war gained codification
with the publication of Notes for Infantry Officers on Trench Warfare
in 1916. Intended as a training manual on how to conduct trench
warfare, its first paragraph contained the disclaimer that:

It must, nevertheless, be clearly understood that trench
fighting is only a phase of operations, and that instruction in
their subject, essential as it is, is only one branch of the training of troops. To gain a decisive success, the enemy must be driven out of his defenses and his armies crushed in the open.

The aim of trench fighting is, therefore, to create a favorable situation for field operations, which the troops must be capable of turning to account.\textsuperscript{138}

During the war schools for officer instruction, in addition to trench combat, continued to teach their students how to fight and maneuver in the open, since positional warfare was not the only method of fighting.

It remains to clarify the role gas played in the battle for asymmetry. After the war, Foulkes, arguing for the establishment of a Chemical Warfare Service, summarized the asymmetric struggle as it applied to gas. He believed that:

Gas warfare resolves itself into a contest between offensive materials and protective devices and there is no finality in regard to either: so that chemical substances employed must necessarily vary from time to time as well as the tactics adopted in utilizing them.\textsuperscript{139}

A number of scholars, however, have suggested that soon after its introduction, the combatant’s countermeasures made the pursuit of superiority futile. Haber believed that since limitations existed on
the range of toxic materials and due to the introduction of ever improving defensive appliances, the belligerents soon reached the same level of technical competence. Henceforth, neither side was able to gain a significant advantage. Also, by 1918 the Allies had achieved parity with the enemy in quantity, thereby negating one of the Germans’ principle advantages.\textsuperscript{140} Fuller goes even further by dismissing any tactical or practical benefit for the continuation of chemical warfare once the scientist had developed an effective gas mask.\textsuperscript{141} In one sense these authors deny gas any useful role and consign it to the status of simply another horror of war which created great discomfort for little effect.

Yet the objections advanced by these authors are unfair, for they suggest that for gas to be of any value, it must achieve superiority to such an extent that it provides decisiveness on its own. Few weapons, perhaps only one - the atomic bomb - could possibly measure up to such a demand. Gas, as with the war’s other innovations, was part of the system by which the combatants fought. The true measure of whether gas accomplished anything of significance in the struggle for superiority is whether it was successfully incorporated into the ethos of the British Army. Haber’s and Fuller’s arguments therefore fail, for they have applied the wrong standard in evaluating the efficiency of chemical warfare. Rather than measure its effectiveness in isolation, it is necessary to study gas within the context of the army’s culture and battlefield experience. It is to this process that this work will now turn.
1Boraston, *Sir Douglas Haig's Dispatches*, 323.


4In their writings, British theorists also tended to use the term superiority to describe the relative strengths of combatants, but this author believes that asymmetry provides a better indicator of the comparative power relationship between two forces.


6Ibid.

7Ibid., 570.

8The Germans caught the assaulting units of the 3rd Australian Division in a gas barrage as they moved up to their assembly positions. The Australians suffered about 1,000 casualties from the gas. See, "Report on Attack at Messines, 26 June 1917," Monash Collection, Folder 962, Item 493, NLA.

9Callwell, *The Tactics of To-day*, 3-5.


11The *FSR* state that “Decisive success in battle can be gained only by a vigorous offensive. See General Staff, War Office, *FSR*, 107. Lord Roberts declared that “every general engagement should have for its objective a decisive victory.” See, Langlois, *Lessons From the Two Recent Wars*, 113, in White Collection, Box 22, NLA. Major C. Ross at a lecture at Aldershot concluded that if overpowering force at a vital point is a true principle, then the offence is the only safe defence. See, C. Ross, *The Principles of Success in War - The Application of Overpowering Force at the Vital Point* (np, Aldershot Military Society, 1906), 8, in White Collection, Box 21, NLA.
chapter three for a fuller discussion of British principles.


13Ian Hamilton, National Life and National Training (London: P. S. King & Son, 1913), 14, 20, 22.

14Lord Roberts, Lord Roberts' Message to the Nation (London: John Murray, 1912), 11, 33.


16J. F. C. Fuller, “The Tactics of Penetration: A Counterblast to German Numerical Superiority,” Journal of the Royal United Service Institution 59, (November, 1914): 378. Fuller based this article on a lecture he first gave in April, 1914. At the beginning of the published version, Fuller noted that, “the present war, will, no doubt, cause me to modify many of the opinions expressed in it, up to the present date (September 23rd, 1914) it has rather strengthened than weakened them.” See, Ibid.

17Ibid. , 379-80.

18Ibid. , 379.

19Ibid. , 389.

20Robertson, “Final Address to the Officers of the Senior Division,” 334-35.

21Bird’s beliefs also suggest a rationale for the British emphasis upon musketry accuracy. He claimed that if two armies were identical, except for skill with the rifle, than the side possessing the better marksmen would rapidly gain superiority. See, Bird, “Infantry Fire Tactics,” 1181.

22Ibid. Bird suggested elsewhere that the side which had the smaller force would try to compensate for its inferiority by skillful
use of the ground, the construction of field fortifications, or by practicing economy of force on one part of the battle field so that equality or superiority might be obtained on another portion of the field. See, W. R. Bird, "Some Notes on Modern Tactics," Journal of the Royal United Service Institution, 53, no. 374, (April, 1909): 492.

23Monro, "Fire and Movement," 93.

24"Strategy II," Haig Collection, 3155/20, NLS.

25Ibid.

26"Strategy I," Haig Collection, 3155/19, NLS.

27See chapter 3 for a discussion of the "phases of battle."

28Bidwell and Graham suggest that Haig was dedicated to attrition from before the start of the war. See Bidwell and Graham, Firepower, 70.

29Quoted in Terraine, Douglas Haig, 432-33. Bidwell and Graham concluded that Haig believed victory went to the one who stuck it out. See, Bidwell and Graham, Firepower, 69.

30Montgomery, The Story of the Fourth Army, 70.

31"Haig's Great War Diary, 18 January 1916," Haig Collection, 3155/97, NLS.


33Boraston, Sir Douglas Haig's Dispatches, 323; see also chapter 4, note 1. Of course the first day of the Somme shows the extent by which plans could go wrong, but although implementation failed, the initial idea illustrated Haig's attempt to resolve the difficulties of trench warfare.

34Robertson to Haig, 14 January 1916 in, Woodward, Robertson Correspondence, 28. In another letter, six months later, Robertson wrote that, "no war was ever so peculiar as the present one." See, Robertson to Rawlinson, 26 July 1916 in, Ibid., 73.
“Robertson to Haig, 10 April 1917,” in Woodward, *Robertson Correspondence*, 168.

“Robertson to Haig, 14 April 1917,” in Ibid., 170-71.

*History of the Ministry of Munitions*, IX, (Oxford: The Harvester Press, 1976), 3. Many of the requirements of trench warfare had to be created by the soldiers themselves, the manufacturing of Jam Pot grenades being a case in point. The evolution of a number of weapons, such as tanks, gas and the Stokes Mortar, provide particularly good case studies on the role of weapons development in the contest for asymmetry. This work, however, is not the place to discuss the scientific and engineering side of the struggle for asymmetry, although scientists and engineers did play a vital role. The historian of the 33rd Division believed that the trench warfare forced the combatants attention to their nation’s non-military supports - the inventors, engineers, chemists and other scientists in order to provide the infantry with new methods to break the enemy’s lines. Sometimes, however, the pursuit of material asymmetry had expensive consequences. Chemical warfare advanced so quickly that frequently a costly plant became obsolete before production had barely begun. See, Graham Seton Hutchison, *The Thirty-Third Division in France and Flanders, 1915-1919*, (London: Waterlow & Sons, Ltd., 1921), 5; *History of the Ministry of Munitions*, 9:46.


“War Diary, Volume X, Haig to CIGS,” 1 August 1916, Haig Collection, 3155/107, NLS.

“Haig to Joffre,” September 1916, Haig Collection, 3155/108, NLS.

*Quoted in J. R. Byrne, New Zealand Artillery in the Field, 1914-18*, (Auckland: Whitcombe and Tombs, Ltd., 1922), 130.

“Robertson to Rawlinson, 26 July 1916; Robertson to Gen. Sir A. J. Murray, 1 August 1916; Robertson to Haig, 29 August 1916,” in Woodward, *Robertson Correspondence*, 73-75, 84-85. Robertson substantiated his claim by quoting grossly inflated casualty figures
for the Germans.

41Byrne, *New Zealand Artillery*, 146.

42"Haig to GOC British Armies," 5 June 1917, Haig Collection, 3155/114, NLS.


44Ibid. , 334.


46"Haig to Petain," n. d., Haig Collection, 3155/117, NLS.

47"War Diary, Haig to G. O. C. Armies, 22 August 1918," Haig Collection, 3155/130, NLS.

50"War Diary, Haig to G. O. C. Armies, 23 August 1918, OAD 912," Haig Collection, 3155/130, NLS.

51Montgomery, *The Story of the Fourth Army*, 72. It is also clear that the collapse of the Germans came suddenly. Rawlinson observed that as late as July 1918 the German losses of their Spring offensives and the wearing down battles of 1916-17 had not yet been revealed, and the fact that the enemy's morale was at the breaking point was not apparent until Amiens. See, General Lord Rawlinson, "Forward," in Ibid. , vii.


54The transitory nature of asymmetry also helps to explain Haig's preference for aggressive commanders, the "thrusters." In part it derived from his cavalry background and the image of a bold commander but it also reflected the reality of superiority, one had to pursue an advantage while it existed. See, Ibid. , 240.

55"Robertson to Milne, 7 November 1916," in Woodward,
Robertson Correspondence, 102.

56“Haig’s Great War Diary, 16 November 1916,” Haig Collection, 3155/97, NLS.

57“Haig to Robertson, 13 August 1917,” in Woodward, Robertson Correspondence, 215.

58“Robertson to Haig, 6 October 1917,” in Ibid., 233.

59Terraine, Douglas Haig, 182-183.

60“War Diary, Haig to Kitchener, 19 January 1916,” Haig Collection, 3155/104, NLS.

61“War Diary, Haig to Joffre,” 1 February 1916, Haig Collection, 3155/104, NLS.

62“Robertson to Haig, 1 August 1916,” in Woodward, Robertson Correspondence, 76.


64On this point, Colonel J. A. L. Haldane declared that in war, successful attacks will increase the morale of your troops and lower that of the enemy, while defeats have the reverse effect. See, J. A. L. Haldane, Some Lessons From the Russo-Japanese War (London: Hugh Rees, Ltd., 1906), 4, in White Collection, Box 21, NLA.

65Henderson, The Science of War, 97, 175.

66“Strategy II,” Haig Collection, 3144/20, NLS.

67Haldane also called for improvements in the condition of the soldier and urged that the troops had to be cared for, well fed and provided with adequate medical attention. See, Haldane, Some Lessons from the Russo-Japanese War, 2, 5.


69French, “Memorandum,” 1. The most common declaration of
support for moral forces in the literature of the British Army took the form of Napoleon's dictum that moral to physical in war is three to one. For an example see, Bird, "Infantry Fire Tactics," 1182.

70 "Personal Notes, 4/10/18," Monash Collection, 3DRL2316, Item 35, Part 1, AWM.

71 "The Strategical and Tactical Lessons of the 1815, 1862, 1866 and 1870 Campaigns in the light of Manchurian Experiences," unpublished paper, 1907, Gellibrand Collection, 3DRL1473, 79, AWM.

72 "Strategy II," Haig Collection, 3155/20, NLS. Haig's statement also reveals another reason for the army's opposition to doctrine. If human nature is infinitely versatile, the ability of the General Staff to produce a manual covering every variable is, obviously, impossible.

73 Henderson, The Science of War, 101. [Emphasis in the original]

74 Montgomery, The Story of the Fourth Army, 2.

75 General Staff, War Office, FSR, 11.


77 Ibid., 4.

78 War Office, General Staff, Field Artillery Training (London: HMSO, 1914), 259. It in not surprising that the Royal Artillery would associate a moral advantage to the advancing of the guns, just as they considered the loss of a piece a disgrace. For similar reasons, late in the war, the Special Brigade developed tank drawn - sled mounted - batteries that would enable the gas troops to advance in support of the infantry. See Foulkes, Gas!, 289.


84 "Notes and Hints on Training," HQ 5th Army, January, 1918, in White Collection, Box 19, NLA.

85 Williams, *Raising and Training the New Armies*, 43.


88 Henry Wilson, "British Military Policy, 1918-1919, 25 July 1918," War Diary, Haig Collection, 3155/129, NLS, [emphasis in original].

89 Major C. Ross, in a lecture at Aldershot proposed the principle that "when the martial qualities and armament are equal, numbers become decisive. See, Ross, *Principle of Success in War*, 2.


92 Ibid., 6.

93 Ibid., 35.

94 Altham, in part, drew this conclusion from his analysis of the Franco-Prussian, Russo-Japanese and Anglo-Boer Wars. See, Ibid., 34.

95 A training manual explained that in order for men to face the rigors of trench warfare and combat it was necessary to instil a high level of discipline. It continued:

To attain this there is no other method than constant and
percise drill, strict enforcement of march discipline, insistence on a rigid exactness in the performance of even the dullest details of camp and barrack routine, an unceasing attention to apparently trifling detail in time of training. Without such previous preparation the silent and thorough execution of work and performance of duties . . . are impossible of attainment.

See, Great Britain, War Office, *Notes for Infantry Officers on Trench Warfare*, (Washington, DC: GPO, 1917), 11-12, [Reprint of the British edition of November, 1916]. Similar attitudes came through clearly in the peacetime *Infantry Training* manual which insisted that, “Drill in close order is of first importance in producing discipline, cohesion, and the habits of absolute obedience to the orders of a superior.” See, General Staff, War Office, *Infantry Training*, 2. Although the Australians had a reputation for laxness, their commander, Monash, emphasised discipline as much as a British officer. As a divisional commander, he stressed the need for an increasing standard of efficiency and ordered his brigade commanders to enforce regulations and maintain a close supervision over their men when not in the line. When the troops moved to the rear, Monash desired the reinstatement of regimental standing orders, frequent kit inspections, improvement of march discipline, inspections of quarters, and the maintenance of animals and vehicles in “show” order. While one can make a case that this insistence upon discipline allowed the troops no rest, even when out of the line, it remains true that the British, along with their Dominion partners saw a direct connection between the smartness of a unit and its efficiency. See, “Monash to GOC Brigades, 19 August 1917,” Monash Collection, 3DRL2316, Item 25, Book 16, AWM. The Fourth Army codified Rawlinson’s attitude towards discipline in its tactical notes. See, “Fourth Army Tactical Notes,” Rawlinson Collection, 5201-33-70, NAM.

96“Futility of Substitutes, (n. d.),” Gellibrand Collection, 3DRL1473, Item 88, AWM.

97“The Foundation of Military Efficiency, (n. d.),” Gellibrand Collection, 3DRL1473, Item 88, AWM.

98“Lectures,” n.d., Uniacke Collection, Folder XI, RAI [Emphasis in original].
"Notes as to the Battle West of Serre on the Morning of 1st July 1916," in Woodward, *Robertson Correspondence*, 63.


Great Britain, General Staff, *Notes for Infantry Officers of Trench Warfare*, 11.

From a section entitled Discipline and Moral in *Fourth Army Tactical Notes*, (n. p., May 1916), 4-5, in printed collection, AWM.

"Strategy II," Haig Collection, 3155/20, NLS. The quote is from a section of his notebook entitled "Fear and Moral[e] Factors in Battle."


"Lecture at Staff College," 18 February 1928, 16-17, WO188/213, PRO.

Haber in *Poisonous Cloud* also saw the threat gas posed to morale. He wrote that:

Chemical Warfare was unanticipated danger, and the novelty of gas necessarily caused apprehension if not fear. The troops confidence must not be undermined by gas. If men thought they were defenceless they might panic and retreat.

See, Haber, *Poisonous Cloud*, 47.

The definitive history of anti-gas methodology remains unwritten, however, Haber's *Poisonous Cloud* does provide a useful introduction. During the war the British produced a considerable body of training materials on anti-gas techniques. For a sample of the literature see, “GHQ Notes on Protection Against Poisonous Gas,” 20 May 1915, WO95/2, PRO; “Instructions for use of Respirators and Smoke Helmets,” 4 June 1915, in Haldane Collection, MS20233, item 186, NLS; *Defensive Measures Against Gas Attacks*, Dec 1915, NAM. Also, “Typical General Staff Standing Orders on the Action To Be Taken During “Gas Alert” and During Hostile Gas Attack,” Sept 1916,
in Gilliat Collection, IWM; General Staff, Drills With Small Box Respirators, n. d., in NAM; General Staff, Standing Orders For Defence Against Gas (France: Army Printing and Stationery Service, October, 1917), NAM; General Staff, Defence Against Gas (March, 1918), Bunker Collection, REM. For an outline of the development of the Gas Masks see, "Diary of Development of British Respirators," WO142/267, PRO. Also of interest, in the Odlum Collection, MG30/E300, Volume 23, NAC, are, "Memorandum on the Use of Respirators, Smoke Helmets and other devices against Poisonous Gas" 4 June 1915; "Protection Against Gas" n. d. but 1915; "Instruction to Officers as to Care and Inspection of the Tube Pattern Smoke Helmet" 7 Sept 1915; and "Precautions to be Taken Against an Hostile Gas Attack," 21 April 1916.

109 "Lecture given at Armentieres," 7 June 1915, WO158/124, PRO; Transcripts of Notes Dictated by Lieut. Col. Cummins, Assistant DGS, 12 December 1917, WO142/266, PRO. The efficiency of the combatants' masks has never been satisfactorily resolved. The British and the German devices had both pluses and minuses. However, the SBR did provide protection from all German respiratory attacking gases. Additionally, the Italian and American armies issued this mask to their troops. British troops, from before Loos, actually carried two anti-gas devices, the most current respirator and the immediately preceding pattern. See, G. H. Q. "Instructions for Use of Respirators and Smoke Helmets," 4 June 1915, Haldane Collection, MS20233, Item 86, NLS. Sometimes the reaction was too quick. As a result of an appeal in the Daily Mail, millions of cotton wool pads were fabricated in early May 1915. These were withdrawn when they proved dangerous because the cotton wool became impermeable when damp. See, P-24, 8; "CA ANZAC to CA 3rd Australian Div," 24/5/17, II ANZAC Corps CA, AWM26/193/25, AWM; M231C "Detachments Instructional Memorandum No1," 5/11/16, Monash Collection, 3DRL2316, item 23, AWM.

110 All found in "47th Division Order," 7 October 1918, Item 8, LC. The Maxse Collection also contains a number of materials of a similar nature. See, Maxse Collection, 65/53/12, IWM.

111 Defense Measures Against Gas Attacks. 1915, 3.

112 "Precautions Against Asphyxiating Gas," (VIII Army Corps, 20 July 1915), AWM25/371/39, AWM.
114“Notes on Policy as Regards Training, etc., Whilst the Division is out of the Line,” 1 October 1918, Maxse Collection, 65/53/12, IWM.

115“Letter from HQ 2nd Australian Division Artillery,” 5 September 1918, 2nd Australian Division Ammunition Column War Diary, AWM4/13/75/30, AWM; “Sample for a Day’s Training for a Company,” I. G. Training, Leaflet No. 1, n. d., White Collection, Box 19, NLA.

116“Gas Officer’s Report for the Week 13-19 August,” 1st Australian Division, AWM26/510/11, AWM; “Defensive Duties of Gas Officers,” 3 April-10 May, 1918, 2nd Australian Division, AWM26/380/20-26, AWM; and “Gas Defensive Organizaton and Training,” n. d., AWM224/Mss56, AWM. The chemical advisor for Australian Corps reported for the week ending 4 November 1918 the inspection of 10,908 SBR, the giving of 31 lectures and the training of 27 officers and 68 NSOs at the Corps; Gas School. See, “General Weekly Report, Week Ending 4 November 1918,” AWM4/7/1/1, AWM.


118Roberts, Lord Robert’s Message to the Nation, 11-12, 33. For Gellibrand’s ideas see, “The Foundation of Military Efficiency, (n. d.),” Gellibrand Collection, 3DRL1473, Item 88, AWM.

119“Report of a Conference of General Staff Officers at the Staff College, 17-20 January 1910,” Haig Collection, 3155/81, NLS.

120Hynes, The Edwardian Turn of Mind, 42-43.


122Ibid. , 1580-3. Curiously some commentators blamed the growth of cities and industrial operations for the decline of the race, certainly a critique that the gentry minded officer corps would find reasonable. Maguire blamed the factory for rendering man an adjunct to machines. See, ibid. , 1594. Another observer, Capt. H. T.


124Ibid., 970.

125Haig required all units in the line to carry out raids of the enemy's trenches. The objective was not only to gain practice in maneuvering but also to gain an ascendancy over the Germans. As one divisional historian explained:

The moral effect of the raid was very good. It was the first fighting that this brigade had seen, and keen as the men were it was a source of great encouragement to them to prove by experience that man for man they were better than the Germans.


126"Haig to Kitchener, 19 January 1916," War Diary, Haig Collection, 3155/104, NLS.

127Headlam, History of the Guards Division in the Great War, 1:106.

128The pamphlet warns that the harrassing of the enemy might lead to some reprisals but if perservered in it would result in ultimate mastery of the enemy and at the same time achieve the double purpose of lowering the enemy's morale while raising that of the British. See, Great Britain, War Office, Notes for Infantry Officers on Trench Warfare, 10-11.


130General Staff, Assault Training.
131 “Personal Notes, 4/10/18,” Monash Collection, 3DRL2316, Item 35, Part 1, AWM.

132 “Lecture on Artillery Operations, Staff College, Cambridge, 29 August, 1918,” Uniacke Collection, Folder XI, RAI.


135 One officer who identified the primary role of cavalry as reconnaissance was Townshend who wrote:

Before committing his forces to any definite plan, the Commander-in-Chief will require reliable information on the enemy’s dispositions, his places of concentration, the direction of march of his forces, and the nature of the country between the two armies; for this information he trusts to the commander of his independent cavalry.


136 For a discussion on the role of infantry shock in the phases of battle, see Chapter Three.

137 War Office, General Staff, Field Artillery Training, 257.

138 Great Britain, General Staff, Notes for Infantry Officers on Trench Warfare, 7.

139 “Untitled Document by Foulkes,” 1 April 1919, WO142/266/H7, PRO.

140 L. F. Haber, Gas Warfare 1915-1945: The Legend and the

141 Fuller, The Army in My Time, 138.
CHAPTER V

INTRODUCTION AND REACTION

Gas! Gas! Quick, boys! - An ecstasy of fumbling,
Fitting the clumsy helmets just in time;
But someone still was yelling out and stumbling
And flound’ring like a man in fire or lime . . .
Dim, through the misty panes and thick green light,
As under a green sea, I saw him drowning.
- Wilfred Owen

As regards the gas question. I cannot see where the
difficulty lies in deciding! . . . with the very extensive
gas and smoke arrangements which have been prepared,
decisive results are almost certain to be obtained.
- Douglas Haig

The Arrival of Gas

In the early evening of 22 April 1915, at the Battle of 2nd
Ypres a new age in warfare made its debut. At 5 PM, German
pioneers opened the valves on their cylinders, releasing deadly
chlorine into the atmosphere. For five minutes the concentrated gas
poured forth, spread into a cloud of yellowish-green, and drifted
towards the 87th Territorial and the 45th Algerian Divisions, the
French troops who guarded the northern face of the Ypres Salient.
The French soldiers, engulfed by asphyxiating vapor, broke and ran,
some not stopping for over five miles. The men of the 1st Canadian
Division, to the right of the French, quickly surmised that something was up. The increase in the enemy’s bombardment and the rattle of musketry suggested a German attack, but it was the fleeing Algerians, ashen-purle of face, gasping for breath, and reeking of chlorine that signaled that something unusual and terrifying had occurred.4

The Allied position rapidly became grave. The Germans had blasted a hole in the Allied lines, and their advance threatened to trap the defenders of the salient, not only the Canadians but also the British 27th and 28th Divisions. The Germans had seemingly restored a mobility that had not been seen since the end of the war’s opening campaign, as their assault shattered the defender’s trench lines and threatened to break into the British rear. The Allied position was saved by only the narrowest of margins. The Canadians extended and echeloned their left to the southwest, while local reserves moved up to close the gap created by the French rout. The Germans had not anticipated the scale of the asymmetric advantage gained by their innovation. They failed to allocate strategic reserves for the attack, and although there would be further discharges of gas and additional assaults, they had spent the impetus of the offensive. 2nd Ypres continued to nearly the end of May, as the Germans tried to renew their drive and the Allies attempted to regain lost ground, but combat had again become a positional struggle.5 The Germans had demonstrated the ability to restore the equilibrium between the offence and the defence, but as soon as their troops over-reached the
protection of the gas, the enemy’s fire brought them to a halt and re-
exerted the dominance of the defender.\textsuperscript{6}

The French had cracked not only because they did not have any means of defense against the gas, but also because the psychological nature of chemical warfare was extremely debilitating, particularly against a surprised opponent. The Canadian official historian commented that gas increased the level of incalculability in warfare. Missiles followed a consistent and predictable trajectory, whereas gas was a weapon of variable speed, intensity and range. Furthermore, when a soldier perceived the arrival of a missile he could escape its danger by seeking the cover of the trench. Gas, however, followed him down into the previously safe hollows and attacked by striking at a basic physiological imperative, that of breathing. The poison guaranteed a slow choking death to everyone who inhaled the deadly vapors.\textsuperscript{7} A number of British soldiers left memoirs of their initial exposure to this new form of warfare. Gas engulfed Lieut. V. F. S. Hawkins and his battalion of Lancaster Fusiliers on 2 May. He wrote:

I don’t know how long this asphyxiating horror went on. While it lasted it was practically impossible to breathe. Men were going down all about and struggling for air as if they were drowning, at the bottom of our so-called trench.\textsuperscript{8}
Sergeant Elmer W. Cotton recorded a similar impression on 24 May as he went into battle with the Northumberland Fusiliers. Moving forward he passed a dressing station and:

... propped up against a wall were a dozen men - all gassed - their colour was black, green & blue, tongues hanging out & eyes staring - one or two were dead and others beyond human aid, some were coughing up green froth from their lungs. As we advanced we passed many more gassed men lying in the ditches and gutterways ...

Exposed to gas himself, Cotton had to fall out and was left in a trench with some other gassed men, the wounded and the dead. However, he recovered and left a moving portrayal of what it was like to watch someone die from gas. It was, he said, a “fiendish death to die.”

Response

The reaction of the British to 22 April was virtually immediate. Recommendations on how to defeat chlorine poured into the salient, almost as quickly as reinforcements. The Oxford chemist, John Scott Haldane, suggested to breathe either through a bottle filled with earth that had the bottom broken off or a sock, moistened, if necessary, with urine. Millions of cotton waste pads to cover one’s mouth, hastily assembled by volunteers, soon arrived. Local officers seized the initiative and found their own solutions. Lt. Col. L. J.
Barley, a future chemical warfare officer, designed and had manufactured 80,000 respirators in local French villages for his III Corps, and he dispatched couriers to Paris to buy raw materials and goggles. Scientists identified the gas as chlorine, and the War Office quickly issued soldiers with bottles of hyposulphite solution which, when applied to the respirator, acted as a neutralizing agent. In May, another officer, Major Cluny McPherson of the Newfoundland Medical Corps devised a helmet consisting of a flannel bag with celluloid window, impregnated with glycerine, hyposulphite and bicarbonate of soda. It provided effective protection and proved superior to pads. The War Office authorized its mass production, the first in a series of helmets that would only be superseded by the Small Box Respirator in summer 1916.¹¹

Simultaneously with these physical improvisations, the British underwent a psychological adjustment. The initial response was unsurprising, the castigation of the enemy for its violation of the rules of war as defined by the Hague Convention of which Germany was a signatory.¹² The British commander-in-chief, General John French, wrote in an address to the 28th Division that the Germans “had recourse to the mean and dastardly practice, hither to unheard of in civilized warfare, namely the use of asphyxiating gases,” while Robertson described the German use of gas as the employment of an illegitimate means of warfare.¹³ Kitchener believed that the employment of gas showed “to what depths of infamy our enemies will go, in order to supplement their want of courage in facing our troops.”¹⁴ Sir Arthur Conan Doyle called the German use of gas at
Ypres a disgraceful victory and Rawlinson, commenting on the reaction of the men to this perceived villainy, expected his men to avoid taking prisoners.¹⁵ For others the response was a lowering of the enemy’s worth as an opponent. A junior officer in the 6th Duke of Wellington’s Regiment concluded that “we now know that they must be destroyed like the spawn of some venomous insect and not just kindly [put] to sleep like a dog which we loved before it went mad.”¹⁶

After the war British historians continued to express their disdain for German methods. The authors of the 5th Division’s history referred to gas as a barbarous means of war and explained that until 2nd Ypres the British soldier had treated the Germans as an honorable opponent. After this battle the attitude of the men changed and the Germans became detested foes.¹⁷ C. R. M. F. Crutwell, in his chronicle of the war, explained that soldiers found gas so repellent because they believed they would survive only if they had a chance. “If the very air which he breathes is poison, his chance is gone; he is merely a destined victim for the slaughter.”¹⁸ Edmonds, the official historian, summed up the army’s interpretation of the German introduction of gas as the use of a forbidden weapon, and its introduction suggested that “the Germans would stop short of nothing, either fair means or foul, in order to achieve victory.” He believed the Germans had tarnished their victory at Ypres because they had gained an “illegitimate advantage conferred by the use of gas.”¹⁹
French wrote to London on 23 April demanding retaliation. He asked the War Office, "that immediate steps be taken to supply similar means of most effective kind for the use by our troops." Kitchener replied tentatively, "before we fall to the level of the degraded Germans, I must submit the matter to the government."²⁰ However, French did not have to wait long as the cabinet shortly endorsed retaliation and ordered the specialists to prepare a response, while a report issued in June called for the production of a lethal gas.²¹ Robertson, meanwhile, announced the appointment of Foulkes to coordinate the chemical offensive, and the War Office sent a letter to fifty universities and public schools soliciting officers and men who had chemistry backgrounds who were to become the nucleus of the Special Brigade, the Royal Engineers chemical warfare troops.²² In late June the War Office authorized the creation of the first two companies dedicated to chemical warfare. Designated Special Companies, R. E., they would be joined by a third in July and a fourth in early September.²³ Writing to Maj. Gen. S. von Donop, the Master-General of the Ordnance, Robertson explained that he expected gas to develop into a big thing and that it might become the army's fifth arm.²⁴ The British reaction is not surprising. After all they could not let the German superiority in chemical warfare remain unchallenged due to the consequences for comparative asymmetry. Furthermore, the support of the troops demanded a response; left unattended British morale would inevitably decline if the Germans exploited their advantage.
While Foulkes settled in to put chemical warfare onto a proper basis, the army entered a short-lived period termed "The Annoyers" phase, as the War Office dispatched to France any substance that might have the slightest deleterious affect upon the enemy. The British filled grenades with small quantities of sulphur chloride, bromine, calcium arsenide, and even capsicin, an extract of hot peppers. Within a few days, they had designed and filled 10,000 glass bulbs with similar compounds and some even more exotic ones such as veratrin, a sneezing agent. By 20 June they had also shipped to France 26,000 one pound tins of bi-sulphide of carbon or sulphur dioxide, with a pinch of capsicin added to both. The artillery investigated the use of calcium arsenide, hydrocyanic jelly, phosphorus, and capsicin for use by the guns. By mid-May the first ordnance was in France, and by August they had started to put SK into shells. All of these efforts, however, proved almost comically futile and did not even minimally approach the efficiency of the German chlorine. French reported that the gas hand bombs were innocuous and far less effective than grenades filled with high explosives. Furthermore, the soldering on the tins was defective so that all the gas had leaked out before the troops could employ them. Attempts to use these weapons during the struggles for Festubert and Aubers Ridge were total failures and only generated bitter complaints from the infantry. By the end of June, French had had enough and he formally requested the War Office to halt the production of these materials.²⁵
While "The Annoyers" apparently had no affect on the enemy, the phase did establish the future basis of chemical warfare. The British envisaged a three tier response. The Royal Engineers would man the Special Brigade who were responsible for the release of, at first, cylinder clouds and later projector, mortar gas, and flame throwers; the artillery would employ gas filled shells; and the army would develop personal chemical weapons, in the form of grenades, for the infantry. At first it would be the engineers who would dominate, but as the British resolved production and technical problems for shell gases the artillery would emerge as the most important arm of chemical warfare. Britain had now clearly taken up the chemical gauntlet thrown down by Germany, and throughout the war British chemists would struggle to catch up to, and eventually surpass, their German competitors.

The British Army’s first serious attempt to use gas was their attack at Loos in late September, 1915. However their reading of the lessons of 2nd Ypres and their experiences at the battles of Neuve Chapelle through Givenchy shaped their understanding of the efficacy of gas and its role in their plans for Loos. The British derived their expectations and intentions for the use of gas from the lessons of these battles.

The most important and, perhaps most obvious, conclusion derived from 2nd Ypres was the image of those poor Algerians and Territorials fleeing before the cloud of chlorine. Panic struck a highly emotional nerve within the British hierarchy because of its fundamental association with their concept of war. Victory required
the destruction of Germany's ability to resist, and the most efficient means to achieve that objective was to cause the enemy to rout so that British cavalry and other advancing troops could destroy their opponent in the pursuit. Inducing panic also suggested a means to cut through the trenches and break into the enemy's rear, and at the same time return the proper and normal mobility to warfare. Additionally, panic represented the collapse of the enemy's will to continue the struggle, the collapse of their morale, and the supremacy of the British fighting man over their continental opponent.

Another German innovation reinforced the suggestion that novel or terrifying weapons could rapidly break down the defender's resistance and help the attacker gain its objectives. During the night of the 29th July 1915 near Hooge, pickets of the King's Royal Rifles noticed parties of enemy troops, carrying bulky heavy objects, working their way into No-Man's Land. Suddenly, there was a loud hiss of escaping air and the smell of petroleum. Long fierce jets of flame swept over the trench and men fell back with burned hands and faces and their clothes on fire. This new horror, for which there seemed to be no defense, utterly disorganised the British, and they fled as the enemy rushed the trench. Haig heard of the incident from Robertson and while the defenders had sustained few casualties, they had broken and abandoned their position from which, he consequentially concluded, that the weapons value lay in its moral effect, its ability to terrify.
British documents published in the aftermath of 2nd Ypres clearly stressed panic as one of the potential effects of gas. A memorandum from General Headquarters outlining what to do if caught in a chemical attack cautioned that gas was only effective in the offence when it resulted in panic amongst the defenders, and that good training and anti-gas discipline would eliminate the tendency to rout. The memorandum continued that troops in the affected area should seek higher ground or move back to the support line, but warned that the adjustment should not be so great as to leave the path of the gas uncovered by rifle fire. Finally, it optimistically noted that the enemy might interpret the stir accompanying these movements as being panic and the defenders should therefore hold themselves ready to punish the Germans if they attempted to seize the British positions. Another memorandum also declared that, “the employment of gas in offence is only effective when it results in panic amongst the defenders.” It continued that if British soldiers followed the recommendations regarding anti-gas drill, respirators, and wind measurements, they would be able to overcome the psychological threat of gas and remain in their positions unharmed. Finally, it warned:

The natural inclination on meeting poison gas is to run away from it; to do so is fatal. The gas travels as fast as a man can run, and he remains in the cloud instead of it passing over him. Moreover, when running the man finds he cannot breathe through the pad and so removes it, with fatal results.
While the British directed these instructions to the ANZAC forces at Gallipoli, they do reflect the degree of British concern for the moral element and the belief that a man fared better if he overcame his instinctive fear and stood his ground in defiance of this technology. To panic and run meant death, if not physically then certainly effectively, since a broken soldier had no military value. The troops on the Western Front received similar instructions. Defensive Measures Against Gas stressed an officer’s responsibility to inspire his men’s confidence in their ability to resist a gas attack. It declared that if the men understood the nature of the advancing cloud and if their training enabled them to immediately protect themselves, then the “moral effect of the gas becomes very small.” It too warned against fleeing and noted that:

It cannot be impressed too strongly on men that by moving to the rear they would move with the gas, and in breathing more deeply they would run more risk of being “gassed.” The protection provided by tube helmet is so complete that the material effect of a gas attack will be negligible . . . .

The dramatic German advance at the beginning of 2nd Ypres also affected the British interpretation of that battle and their hopes for Loos. While it was a gain of only a few miles, it was the most successful movement forward in France, by either side, since the failure of the opening campaigns of the war and the start of trench
warfare, a distinction it held until the battles of 1918. After the war
Montgomery commented that the Germans had succeeded in pushing
the French back so far that they had made the Canadian’s position
untenable, forcing them to either retire or face encirclement. He also
noted that a subsequent and heavier German gas attack along
Bellewaarde Ridge on the east side of the salient on 24 May pierced
the front in 4th Division’s sector, forcing another withdrawal. Gas
had achieved the two areas of asymmetry that the British most
favored. It altered the relative relationship of morale, and it restored
maneuver to the battlefield. Against both the Canadians and the 4th
Division, gas breached the front, opened flanks, panicked defenders
and established the preconditions which the British believed
essential for decisive victory.31

The Experience of 1915

The British keenly recognized the potential of gas for creating
superiority in morale and maneuver, but an additional factor in their
decision to let gas dominate the plans for Loos was the
disappointment they incurred and the lessons they learned from
their attacks at Neuve Chapelle, Festubert, Givenchy and Aubers
Ridge from March to June 1915. By the standards of the time, and of
the British Army, each of these was a major offensive, and each
sought to strategically alter the situation on the Western Front,
sufficiently, it was hoped to gain Britain and France a decisive
advantage and bring the war to an early conclusion. Each also failed
to achieve its objective, and thereby prodded the British towards the use of gas where men, guns, and shells had failed.

French’s plan for First Army’s attack on 10 March 1915 was not only to seize Neuve Chapelle and Aubers Ridge, just to the east of the town, but also to push through the cavalry to roll up the German flanks, press into the enemy’s rear and threaten their communications to Lille, upon which they depended for supplies.\textsuperscript{32} The ultimate objective was nothing less than the general collapse of the German line as British horsemen wrought havoc in the enemy’s administrative and support zones.\textsuperscript{33} Haig, then the commander of First Army, planned to surprise the enemy with a brief thirty-five minute bombardment, lasting only long enough to blast holes in the wire and to suppress the enemy’s batteries. The British would then advance quickly onto Aubers Ridge in one big push, and, once the situation became fluid, would exploit the success with mounted troops. Haig outlined his ideas at a conference on 3 March:

The advance to be made is not a minor operation. It must be understood that we are embarking on a serious offensive movement with the object of breaking the German line. . . . Very likely an operation of considerable magnitude may result.\textsuperscript{34}

The attack initially went quite well with units of the 8th and Meerut Divisions capturing Neuve Chapelle, and Haig requested French to move forward at least one cavalry brigade from the
general reserve to provide mobile support. However the British failed to press boldly forward, and command control problems resulted in a lengthy pause. This gave the Germans nearly five hours in which to reestablish their defence, strengthen their second line, and move up local reserves.35 When the British renewed their attack it was nearly dark and they faced an opponent who was fully alert and who repulsed the attempt.36 Haig continued the battle for two more days, but Aubers Ridge and the open country beyond remained an impossible goal; the attack had spent itself and the growing German strength made further efforts prohibitive.

While the British had occupied Neuve Chapelle and captured 4,000 yards of enemy line, the troops had only penetrated to a maximum depth of 1,200 yards, far short of the open fields beyond.37 After the battle the British examined their failure and focused upon material shortages as being the principle reason for the lack of success, not a surprising interpretation since they had already identified the artillery as the key requirement in their plans. While outlining the offensive, Rawlinson commented:

An undertaking such as that which is under consideration depends for its success almost entirely on the correct and efficient employment of the artillery. It is primarily an artillery operation and if the artillery cannot crush and demoralize the enemy’s infantry by their fire effect the enterprise will not succeed.38
French wrote to Kitchener that, "cessation of the forward movement is necessitated to-day by the fatigue of the troops, and above all, by the want of ammunition." During the three day battle the British used up one-third of their available gun ordnance and it would take seventeen days to replace the expended rounds at the then production rate. French planned to renew the attack on the 22 March but on the 15th he changed his mind due to the risk of depleting the supply of shells beyond the limits of safety. French wired Kitchener:

The supply of gun ammunition, especially the 18 pounder and 4.5" howitzer, has fallen short of what I was led to expect and I was therefore compelled to abandon further offensive operations until sufficient reserves are accumulated.

Rawlinson, the commander of IV Corps, also blamed the insufficiency of ammunition and hoped that for the next attack the guns would be well supplied. Those units attacking on the flanks in support of the main effort also experienced acute shortages of ammunition. I Corps, on the left of Indian Corps, reported that the lack of success was due to a relative shortage of artillery for the attack's frontage, the inability of the guns to sufficiently clear the wire, the absence of surprise and the enemy's well sited machine guns. Its commander concluded that without more heavy artillery the objectives were beyond reach.
While the shortage of high explosives was the principle explanation for the defeat, the British identified a number of other problems that needed attention, some of which they would solve over the course of the war, while others would remain problematic even after the armistice. The assault frontage proved too narrow, and defending German units on the flank of the attack could fire into the exposed flanks of the advancing British battalions thereby draining manpower from the primary thrust. The ability of commanders to receive timely intelligence and to control their subordinates had clearly broken down. The breakdown of communications between the infantry and the artillery also hampered the progress of the attack and exposed the vulnerability of phone lines. Reinforcements had also experienced great difficulty in getting forward especially through trenches that were full of wounded or across the torn up battlefield. However, Edmonds could still find a positive note, considering the battle "the first step in the gradual establishment of moral superiority over the enemy so essential to victory." 44

Rawlinson did propose a temporary expedient that would enable the British to continue to attack despite inadequate resources. His idea, which he termed "bite and hold," was an attempt to overcome enemy superiority through tactical innovation; he hoped to get the Germans to use their resources against themselves. To Clive Wigram, the Assistant Private Secretary and Equerry to George V, he pointed out that most of the British casualties at Neuve Chapelle had occurred during the second and third days and that instead of
continuing the attack the British should have consolidated their newly-won positions and met the German counter-attack. He expected the enemy to lose twice as many troops as the British as they attempted to regain the lost ground. The following month he wrote again and reiterated the two for one ratio, suggesting that these tactics could prove a useful means to wear down the enemy. To Kitchener he explained that with proper preparations the British could seize any trench they desired and, upping the ante, now claimed they could inflict four times as many casualties as they lost. However Rawlinson thought these tactics would be useful only for the next two months because by then the British would have sufficient stockpiles of shells for a major attack and the Germans would have been weakened by the minor operations. “Bite and hold,” he concluded, was useful, but it would not result in the decisive battle.

After a pause to recover from the German offensive in Flanders, the British returned to the attack on 9 May at Aubers Ridge. French planned to break through the enemy’s lines, sever the road linking La Bassée and Lille and press on to Bauvin to strategically dislocate the German position in the sector while also trapping the defender’s troops along the La Bassée Canal. General Headquarters defined First Army’s mission as:

... to break through the enemy’s line on its front and gain the La Bassée - Lille Road between La Bassée and Fournes.
Its further advance will be directed on the line Bauvin - Don.\textsuperscript{47}

Like the Neuve Chapelle operation, Aubers Ridge had both limited operational objectives and far reaching strategic goals.\textsuperscript{48}

French assigned the attack to First Army, and Haig conceived a two phase assault. In the first part, I, IV and Indian Corps were to breach the enemy’s lines and by rapid advance gain a footing on the ridge. Having secured their positions, the army would then press on to their ultimate objectives along the line Bauvin - Don, a distance of a further five to six miles.\textsuperscript{49} First Army would rely on surprise, allowing only a forty minute bombardment for destroying the enemy’s wire and parapet, annihilating their strong points that might contain machine guns, and suppressing the German artillery. The British anticipated success due to the ease with which the artillery had paved the way for the advance at Neuve Chapelle. General Headquarters optimistically believed that:

\begin{quote}
\ldots by means of careful preparation as regards details and through previous registration of the enemy’s trenches by our artillery, it appears that a sector of the enemy’s front line defence can be captured with comparatively little loss.\textsuperscript{50}
\end{quote}

British preparations, however, failed to consider that the Germans had also studied the lessons of Neuve Chapelle and had increased the strength of their fortifications to such an extent that
only heavy shells could breach them. The British bombardment began at five in the evening and the infantry attacked forty minutes later. The defenders met their charge with devastatingly accurate rifle and machine gun fire as the shelling had failed in its principle task, the neutralization of the enemy’s firepower. Furthermore, the guns had blasted few holes into the German’s six foot high breastworks and had left the wire largely intact so that it still formed a continuous obstacle. Few attackers made it into the enemy’s trenches, most being cut down as they crossed No-Man’s Land, and the Germans bloodily repulsed a second attempt in the afternoon. That evening, Haig cancelled the attack.

Haig blamed the battle’s failure on the quantity and quality of his artillery and ammunition. He complained of defective shells that failed to take the gun’s rifling and were therefore impossible to fire accurately. Haig also noted a report from the general staff that at present rates of consumption his army would soon run out of ammunition. It detailed that supplies on hand for 18 pounders, 4.5” howitzers, 6” howitzers and 9.2” howitzers were good for only three days or less. After the war Edmonds concurred with Haig and identified three reasons for the attack’s failure. He believed the factors were the strength of the German defenses and the clever concealment of machine guns; the British lack of sufficient shells of large enough caliber to deal with these positions; and the inferior quality of the British munitions so that gunners were neither able to suppress the enemy’s batteries nor silence the machine guns. In particular, he continued, many fuses were defective and shells failed
to burst on striking the ground. He concluded that the bombardment did no appreciable damage to the enemy, but instead alerted them to the immediacy of the attack, allowing them to man their positions in anticipation.\textsuperscript{54}

Yet the question remains as to what effect these deficiencies in artillery had on senior commanders' conception of the parameters of combat on the Western Front. At a conference at Lieut.-General Hubert Gough's I Corps headquarters in the aftermath of the battle, Haig discussed the requirements of breakthrough. He believed that the enemy's defenses were so strong and so carefully sited with mutually supporting machine gun fields of fire that a methodical bombardment was necessary. Furthermore, to annihilate the strong points it was essential to have observed shooting by heavy guns. Finally, to destroy the physical power of the enemy and shatter the nerves of the machine gunners the bombardment had to continue through the night.\textsuperscript{55} Maj. Gen. Richard Butler, Haig's Deputy Chief of Staff, formally disseminated these ideas to the First Army's corps commanders and wrote that the next attack would have recourse to more deliberate methods.\textsuperscript{56} Rawlinson, in command of IV Corps on the left of the attack, reached a similar conclusion:

\ldots the hostile fortifications were such that our artillery preparations, well directed as it was, had not the desired effect on the enemy \ldots he [the enemy] was able to man his parapets before the infantry could deliver their assault.\textsuperscript{57}
Rawlinson continued that the enemy had converted basements into fortified strong points and the artillery could not penetrate these defenses.\textsuperscript{58} He summarized his ideas in his diary, writing that it would require the entire effort of the empire to defeat Germany, and that:

\begin{quote}
We want more guns, more men, and above all more high explosives [?]. These we \textit{must} have if we are to beat the German field army. The way the enemy supply themselves with really good shell and fuses is quite marvellous for they are shelling us all along the line just as hard as ever with good stuff.\textsuperscript{59}
\end{quote}

These deficiencies, however, did not prevent French, under considerable pressure from Foch, from immediately ordering another attempt, in conjunction with a French attack, to gain the ridge and threaten German communications through Lille, even though his stockpiles of artillery and even small arms ordnance were at critically low levels.\textsuperscript{60} French identified the objectives of the Battle of Festubert as the general retirement of the enemy. “The idea was to employ the whole force at the First Army commander’s disposal and to fight a decisive battle.”\textsuperscript{61} Once again the task fell to Haig. Instead of a surprise attack following a brief bombardment, Haig now intended a more systematic approach. He proposed a multi-day barrage of heavy guns against the enemy’s strong points, both to
destroy the positions and to shake the morale of the defenders.\textsuperscript{62}

General Headquarters sanctioned the new method and wrote:

The Commander-in-Chief [French] considers that you should be prepared to prosecute a deliberate and persistent attack. The enemy should never be given a complete rest either by day or night, but be gradually and relentlessly worn down by exhaustion and loss until his defenses collapse.\textsuperscript{63}

The bombardment began on the morning of 13 May and the infantry attacked two days later. General Headquarters conceived the battle in greatness but with only limited means, especially compared to German resources. The battle continued spasmodically for 11 days and resulted in over 16,600 British casualties, but First Army never realistically had the strength for the task. Heavy guns and high explosives remained too scarce. The historian of the Highland Division blamed the inadequacy of the artillery preparation for the attack's failure.\textsuperscript{64} Stocks of shells reached such low levels that by 26 May the amount of ammunition under First Army's control had been practically exhausted. The number of rounds per caliber, per gun, was: 13 pounder - 2; 15 pounder - 4; 18 pounder - 40; 4.5" howitzer - 12; 5" howitzer - 13; 6" howitzer - 27; 6" gun - 0; 9.2" howitzer - 36 and 15" howitzer - 7. The army had not enough for its defence, let alone to attack successfully.\textsuperscript{65}

Another effort on 18 June at Givenchy resulted in a repetition of what had already become a distressingly familiar pattern. The
attack was again unsuccessful and Haig once more identified the villain as insufficient ammunition. Robertson visited First Army but all he could suggest was for Haig to economise on shells. Givenchy, however, also clarified one further tactical observation, the inadvisability of attacking on a narrow front. The Germans subjected the British jump off positions to a concentric ring of fire as batteries from positions on either side of the assault were free to fire upon the attackers. To prevent this the British would have to broaden their frontage so that the enemy’s guns in supporting sectors would lack the range to interfere.\textsuperscript{66}

In retrospect, the problem the British faced at these battles was considerable. How were they to launch attacks leading to a breakthrough when they had inadequate artillery resources to make the effort? Their principles of the phases of battle required a period of wearing down, during which they would reduce the enemy’s effectiveness, both materially and morally, as a preliminary to launching the decisive blow that would lead to the opponent’s collapse and their destruction during pursuit. However, the British could not compete against the German superiority in guns and shells, especially in 1915, when these materials were in such short supply. Eventually, British industry would produce munitions in abundance, but in the meantime the British needed to explore short-term steps that might correct the tactical imbalance, or even shift it into their favor.

Rawlinson’s idea of “bite and hold” tactics suggested another option but it was scarcely a viable choice. To nibble away at the
enemy’s lines might slowly regain France, although it was questionable whether the British could have achieved an adequate attrition rate, but even Rawlinson recognized that this would not bring about the opportunity for a decisive battle. Only maneuver, moral superiority and pursuit could achieve that objective. Furthermore, the Germans, with their abundance of materials could certainly “bite” harder and “hold” stronger if the British pushed tactics in that direction. If the Allies were to win in 1915, or at least set the stage for the war’s successful conclusion the following year, breakthrough and exploitation remained their only options. During the summer, Haig began to consider another means to achieve a local superiority that would enable his army to blast a hole through the German lines and release the cavalry into the enemy’s line-of-communications. Instead of the guns, Haig turned to gas.

In July, while planning another effort against Aubers Ridge, Haig met with Foulkes, his Gas Adviser, regarding the use of asphyxiating gas. Haig wanted to discharge it on a five mile front, but Foulkes thought supplies were inadequate for such a scale and advised that it would be better to wait and preserve the element of surprise. Two weeks later, Haig saw Robertson and, while reiterating the strength of the enemy’s defenses on his front, also claimed that with gas he believed it would be possible to seize the ridge. Shortly thereafter, at a General Headquarters conference to discuss these plans, he expressed his hope that gas would be
available. Rawlinson shared Haig's optimism about gas. On the failure of 10 May he wrote:

If we had some 1000s of gas cylinders we could get a move on them, for our trenches are close enough together to enable us to use gas on quite a wide front but it must be heavy and poisonous the better to reach the deep dug-outs - are you not going to send us out some proper gas?

Rawlinson then complained about the poor quality of the infantry gas bombs that London had provided for the battle of Aubers Ridge. He declared that "the stink bombs that have arrived are perfectly useless . . . . Until we get something effective in this direction we shall not get the Germans out of France."

Haig and Rawlinson would soon have their wish.

The Battle of Loos

The Battle of Loos of 25 September 1915 has engendered a great deal of controversy, both during and after the war. Edmonds describes the attack as the product of France's intractability winning over extreme British reluctance, a none too subtle attempt to lay the blame for the battle on Britain's Gallic ally. The attention of historians also typically focuses on the conflict between French and Haig over the employment of the general reserve, the reserve forces failure to intercede at the critical point on the first day, and its rout
on the second day when they attempted to breach the German lines. French would lose the argument, resulting in his dismissal and the arrival of Haig at General Headquarters. Those who fought the battle remember it for Britain’s first use of gas, an unpleasant experience for those who were poisoned by their own side. However, all these points obscure the most important aspect of the battle, the use of a new weapon to overwhelm the enemy in an attempt to gain a decisive success. Loos was the only battle in World War I in which the British sought decisiveness not by the dominance of their will over the enemy but by pure technology.

Edmonds is correct to a point, in that Loos did evolve from the strategic plans of Joffre and his hope of ending the war in 1915. Joffre’s conception was truly grand, nothing less than the nipping off of the great German salient, a 150 mile bulge of occupied territory from Verdun in the east to Loos in the west with Noyon at its apex. Joffre envisioned a two-pronged attack. The Second and Fourth French armies would strike northward from Champagne while the Tenth French and First British armies would attack eastward from Artois. Their objective was the dislocation of the enemy’s logistical system. The Champagne wing’s target was the rail center of Mezieres, while troops from Artois would sever the German supply connections leading to Lille on the Douai plain. Isolated, the three German armies in the salient would then have no choice but to retreat or face encirclement. Ultimately, Joffre hoped that in the ensuing crises British and French troops could push into Belgium, thus liberating most of Northern France, while compelling the
Germans to retreat beyond the Meuse River and possibly ending the war.70

Joffre and other senior French officers strongly pushed their plan on a reluctant British Expeditionary Force throughout the summer. Foch, who would command France’s effort in Artois, explained to French that if the British gained command of the hills around Loos and if his own troops seized Vimy Ridge then they would control the Douai Plain and force the enemy to retreat.71 At the Boulogne Conference of 20 July and the Frévent Conference of 27 July French attempted to cool his ally’s ardor for the attack, or at least substitute a more limited role for his army, but Joffre remained committed to the battle and insistent upon the necessity of British assistance. In early August he explained to French that, “the experience of this war constantly shows the importance of attacks on wide fronts as the only means of preventing the enemy from concentrating his artillery fire from both flanks.”72 The following week he reminded French that for the British support to be effective it had to take the form of a large and powerful blow, delivered by all available forces and carried through to the end.73 Joffre’s implications are clear. He required and expected a major effort from his ally.

British hesitancy was present from the beginning and was only overcome, and then not completely, in the final weeks before the battle.74 Haig, whose First Army would launch the attack, concluded that it would be extremely hazardous. The terrain featured numerous clusters of villages, along with fosses (mine pit-heads)
and crassiers (large piles of mine waste). The Germans had strongly wired their position and had excellent observation posts for their artillery. He continued: "the ground above is so swept by gun and machine gun and rifle fire that an advance in the open, except at night, is impossible."\(^5\) In a report to French, Haig attempted to dissuade him from the attack. He believed that an advance beyond the German front line was improbable because the terrain blocked fire beyond that point. Haig explained:

It is believed to be impossible to bring observed artillery fire to bear on the second line, or to cut the wire in front of it, from our present position; and it is doubtful if observation stations could be got for the purpose even if we occupied the German front line trenches.\(^6\)

Butler also reported that the supply of shells was insufficient to support an attack in the heavily defended sector.\(^7\) Haig therefore asked Gough and Rawlinson whether they thought it possible to carry out the proposed scheme with the ammunition available. If not, he asked them to prepare a plan for what they believed they could do.\(^8\) Haig raised the issue of munitions directly with French at their meeting on 23 June, suggesting that it would be most unwise to wage a battle without several weeks’ supply of shells, and that General Headquarters should postpone an attack if the ammunition was inadequate.\(^9\) At the end of the month, du Cane informed the Ministry of Munitions that a successful decisive attack
would need a large number of heavy guns, enough to engage the enemy on a twenty-five mile front.\textsuperscript{80}

In July Haig still objected to the plan and complained that he did not have the resources to permit an offensive on a large enough scale that would lead to freedom of maneuver. Instead he insisted that only a limited attack was viable.\textsuperscript{81} Material shortages certainly still plagued the British Expeditionary Force. The deficiency in heavy guns and shells revealed during the battles earlier in 1915 still awaited resolution. The War Office had accomplished much but shell availability for most calibers remained less than half of authorization and daily production of shells stood at 22,000 compared to 100,000 for the French and 250,000 for the Germans. British authorities had concluded that a major offensive, if it was to have a reasonable chance of success required 1,150 heavy guns. In June the entire British Expeditionary Force had only seventy-one howitzers and guns of 6" caliber or greater and by Loos the number had risen to only 147.\textsuperscript{82}

The British intentions, as conceived in early August, only served to annoy Joffre and to push the alliance into a crisis. General Headquarters had instructed Haig to draw up a plan in support of Tenth French Army that would limit itself to an artillery bombardment and not to risk British infantry. Haig’s role was to neutralize the enemy’s guns and to hold their reserves on his front. First Army was to advance only if the opportunity presented itself.\textsuperscript{83} At a conference with his corps commanders on the 13 August, Haig reiterated the same limited operational objectives, along with the
possibility of an advance as far as Hill 70 several miles to the east. However, orders received from Butler on the same day authorized a minor assault to secure the German front line trenches west of Loos and to capture the Hohenzollern Redoubt. The seizure of Hulluch, Loos, and Hill 70 was contingent upon French success. As late as 22 August Rawlinson would propose to Haig a IV corps advance of two stages that aimed in the initial drive only to seize the German front line. After a pause of between seven to ten days his command would drive on Loos and possibly press on to the enemy’s second line. None of these exchanges called for the British to break through.  

However, British policy would shortly and dramatically change. As Rawlinson was submitting his limited objective proposal to Haig, French was agreeing, at a meeting with Joffre, that the attack would be “pushed through to the utmost of our power.” By the beginning of September, at a First Army conference, Haig would declare that, “it is not enough to gain a tactical success,” and that “regardless of fatigue and losses all must press forward in a great combined and continuous effort, until the enemy’s strength is broken.” The “General Principles for the Attack,” outlined the objectives and means in greater detail. It required that:

The enemy is to be beaten on a certain length of front and driven out of it, and must not be allowed time to reform in rear of the captured trenches.

For this a violent and continuous action is required.
Commanders must bear in mind that, once the enemy's line is broken, it is the intention to follow up such actions as will cause a general retirement of a great part of the enemy's line. Thus the operations will be continued during a considerable period.\textsuperscript{87}

Haig concluded that the British must strike into the enemy's rear to cut his communications and force him to retreat.\textsuperscript{88}

Edmonds accounts for this sudden reversal by pointing to the tremendous pressure put upon General Headquarters by Joffre, Kitchener, and the British government. On the 19 August Kitchener agreed that, as the French commander-in-chief, Joffre would have the power to set objectives and dates for operations by the British Expeditionary Force, while the British commander would retain the choice of means of execution. The War Minister's concession to the French was apparently dictated by the worsening condition on the Eastern Front. The Russians had suffered a series of defeats during the summer and seemed powerless to prevent the loss of Poland. Compounding the situation was the failure of the Italians to make any progress on the Isonzo, and the lack of success at Gallipoli. Kitchener and Asquith's cabinet had favored a policy of defense on the Western Front until 1916 when the New Armies would be ready. However, the poor strategic situation and the need to relieve the pressure on Russia forced a political crisis and led to the decision to support Joffre's plan. News of Russia's loss of their last foothold on the Vistula tipped the balance, and Kitchener telegraphed French
to confirm his conversation with Joffre and to tell him to "take the offensive and act vigorously."99

Edmonds' recognition of the political context of the decision-making does reflect the pressures the Allies were under that summer. However, the implication that the politicians foisted the offensive upon a completely reluctant General Headquarters is not nearly as convincing. British field commanders eagerly awaited the arrival of large quantities of deadly gas so that they could not only pay back the Germans for 2nd Ypres but also use it to break through the enemy's lines. Coincidentally, on 22 August, the same day that French conceded to Joffre's demands, twenty to thirty senior generals attended the chemical specialists' first gas demonstration at their depot at Helfaut. Haig, Rawlinson, Gough, Pulteney, and Willcocks, among others, left the trial, Foulkes recalled, most impressed.90

British interest in the offensive employment of gas had accelerated as the summer progressed. The first cloud gas experiment occurred on 4 June near Manchester at the Castner Kellner chemical works when workers released chlorine from cylinders. Foulkes witnessed it along with observers from the War Office and military attachés from Japan, Russia, Italy and Belgium, and reported his satisfaction with the test to General Headquarters. He then received a free hand in organizing the personnel who would form the nucleus for the Special Brigade. Later that month French drew upon Foulkes' report, and announced his conclusion to the War Office regarding the use of gas against the enemy. His proposals
stressed the need for surprise, a wide frontage, a large quantity of gas and a discharge of at least thirty minutes, as well as the need to supplement cylinder gas with more poisonous materials and means of deployment, such as shells from guns and mortars and bombs dropped from aircraft. His ideas represented the first theoretical statement of how the British would employ the new weapon and his outline was to prove similar to the principles they would use at Loos.91 B. B. Cubbitt, at the Ministry of Munitions, replied that they hoped to send over 1,600 cylinders (forty tons of chlorine gas) by 17 July, enough for a half-hour attack on a 5,000 yard front. He went on to say that they hoped to produce 150 tons a week by the end of July, and that would be enough for two half-hour attacks a week.92 French deemed this production target acceptable for his army’s needs.93 He next discussed the possibility that the Germans had issued respirators which were proof against chlorine and that it would be necessary to produce gasses from which the enemy did not have protection.94 Gas was also on the agenda at the Boulogne Conference of 19 June, and topics discussed included the procedures necessary to make a cloud gas attack, the anticipated effectiveness of artillery gas shells, and the need to replace chlorine with a more lethal substance. Foulkes, who attended, suggested the value of phosgene and recommended its production. Much more deadly than chlorine, phosgene would become the principle killing agent of the British Army’s chemical warfare establishment and its adoption reflected a willingness to raise the stakes and to fully participate in a chemical war.95
Gas also figured in the ideas of a widening circle of General Headquarter and First Army planners. Rawlinson complained to Braithwaite, in late June, of the inability of the artillery, even the 9.2" howitzers, to destroy the enemy in their dug-outs. He concluded that “what we want is a favourable wind and plenty of good strong chlorine and bromine gas which will sink right down into the deep trenches.” In early August, Haig met with Foulkes to discuss the arrangements for the use of gas on his front and he requested his gas adviser to provide an estimate of requirements. Foulkes replied shortly thereafter that First Army needed at least 3,000 cylinders to launch a proper gas assault. Later in the month they met again and this time Haig requested even more gas, enough for 6,300 yards of front by 15 September. Foulkes believed that there would be no difficulty in providing the materials. Rawlinson, who was supposed to be planning a limited attack, was in actuality also considering a bigger operation with the aid of gas. Although he had some doubts, he commented, “I fear heavy losses and doubt if we will get through unless the gas turns up trump which it may do, but we are not very good at these improvisations.” Clearly First Army and General Headquarters were playing a double game. On the one hand they strongly protested their inability to support Joffre with a major push, yet on the other they were quietly ascertaining the availability of gas and considering its use to enable a broad, aggressive thrust at the enemy.

Gas next crept into the official instructions for the battle. Most significant were Maurice’s orders to First Army on 7 August. While
largely concerned with authorizing Haig to draw up plans for a limited, principally artillery, attack in support of the assault by Tenth French Army, he also included a curious clause which noted that, "it is anticipated that an ample supply of asphyxiating gas will be available should you think desirable to make use of it on this occasion." Haig shared the hint with his corps commanders at their meeting on the 13 August, and Butler, in the orders to I and IV corps, reminded them of its availability and suggested that they consider its employment in their attacks.

The use of gas in what was still intended to be a limited attack is rather strange because its suggestion contradicts the intent of the main part of Maurice’s instructions, the reliance upon the artillery to hold the enemy’s reserves on the British front. How could gas, released from cylinders in the British front line and which the wind would carry over to the German lines, possibly have any affect on the status of the enemy’s reserves? The gas would have to travel over several lines of enemy entrenchments, all the while dissipating and gradually losing its toxicity. While chemists had not yet determined the specifics of gas cloud dispersal, the British must have observed, based upon their experimental discharges of chlorine and from experience gained at 2nd Ypres, that gas diminished in strength the further it travelled and that the effects upon the enemy’s reserves would be, at best, minimal.

It would be the German front line defenders who would feel the full blow of the poison. One could still conclude that the British hoped to fulfil their mission of keeping the Germans occupied by
using gas as a diversion, dealing the enemy a quick, deadly blow that would cause them to keep their reserves nearby in case the British infantry started to advance. This argument also fails, on two counts. First, General Headquarters had already decided that it would be desirable for their first use of gas to be a surprise and thereby gain the full benefit of the innovation. The British certainly understood that to waste the weapon on a mere diversion would cost them a major advantage when they seriously employed gas. When they did use it at Loos they went to extraordinary lengths to hide its arrival. Second, the use of gas in support of a limited attack also violated their intellectual understanding of the weapon’s role in their method of war. As explained above, the primary lesson they had learned from 2nd Ypres was the ability of poisonous vapors to instil panic, and the British went to great lengths to equip and train their troops with anti-gas devices and to imbue their men with the confidence necessary to resist the terror induced by gas. If the British believed that gas would cause the defenders to break and abandon their positions, thereby creating the opportunity for an advance, even possibly into the open, there would be no benefit to use it in a supporting attack for which they anticipated little or no forward movement. The inclusion of the announcement of the availability of gas in an instruction that otherwise mandated minimal assistance to the French suggests that General Headquarters was making a subtle point, one that did not escape Haig’s attention. Joffre and the others may have succeeded in pressuring the British field leadership to increase their participation in his great plan but
the British Expeditionary Force, with the assistance of gas, was on the verge of making that same decision on their own.

The speed with which the British incorporated gas into their plans for Loos offers further evidence that General Headquarters had considered the option for some time. On 22 August Haig received French’s order to support Joffre with a bold breakthrough. The next day First Army announced that they had “decided that gas will be employed to assist the offensive on the first day of the infantry attack.” A circular by Butler worded the decision more strongly. He reported that Haig had decided to employ all the resources of gas and smoke at all points simultaneously along the whole line prior to the first assault of the infantry. At a conference on the 24th Haig told his corps commanders that he aimed “to use gas lavishly and to attack to the utmost of his resources.” Both Gough and Rawlinson replied that they would have their infantry follow the cloud and push on as far as they could go. On the 25th, Haig wrote to Foulkes at General Headquarters to report that he intended “to make the fullest use of gas and smoke on the first day of the infantry attack,” and requested over 7,000 cylinders of chlorine. He explained that he wanted “a gas cloud . . . sufficiently strong and of sufficient duration to make absolutely sure of knocking out the Germans for a depth of 800 yards.” Haig explained to his subordinates on 6 September that the conditions of the attack were different from any other. He argued that:
In view of the great moral effect which the gas may have on the enemy, it is absolutely essential that the attacks be everywhere pushed forward to gain as much ground as possible in the first advance.\textsuperscript{108}

Haig reinforced his point by reminding his officers of what Henderson had taught at Camberley, the necessity of cutting the enemy’s line of communications and forcing them to retreat.\textsuperscript{109} Haig could have changed gears so quickly only if he had already been considering the subject for some time. The deciding factor was not pressure from outsiders but availability. Once it became clear that sufficient cylinders of chlorine would be available there was no longer any rationale to insist upon limited participation in Joffre’s plans. Gas would permit the British to bid for decisive victory.

On 18 September General Headquarters issued the “General Instructions for Commander of Armies and G. H. Q. Reserve,” which identified the objectives of the battle as:

(i) Breaking the enemy’s front.
(ii) Preventing him from reestablishing his line.
(iii) Defeating decisively his divided forces.\textsuperscript{110}

The instructions went on to conclude that:

Once the enemy’s defenses have been pierced a situation must be created in which manœuvre will become possible, and
to do this, the offensive must be continued with the utmost
determination directly to the front in the first instance . . . .
The advance must be made in depth so that rapid manoeuvre
may be possible.\textsuperscript{111}

Thus French had committed the British to a breakthrough attack,
but it fell to Haig to deal with the specifics of the offensive. First
Army planned to begin the battle with a preliminary bombardment
on day X-4 with the intention of cutting the wire along their
opponent's entire front, destroying the enemy's observation stations,
and shelling the Germans defenses and communications. The
bombardment would continue deliberately up to the infantry
assault. During days X-2 and X-1, gunners north of the La Bassée
Canal would secretly move their pieces to prepared positions to
assist the attack south of the waterway. On X day the infantry
assault would take place, immediately preceded by a half-hour gas
discharge. The infantry would advance as soon as the gas ceased
and smoke bombs would cover their flanks. Significantly, Haig
made no provisions to cut the wire protecting the German defenses
around Loos and in front of their second line.\textsuperscript{112}

Rawlinson's IV Corps composed the right wing of First Army's
attack. Its three divisions, from south to north, the 47th London,
15th Scottish and 1st Divisions, would secure the enemy's front line,
push on to Loos and Hill 70 and break through the German 2nd line.
To Rawlinson's left was Gough's I Corps which also planned to attack
with three divisions abreast. The objectives of the 7th, 9th
(Scottish) and 2nd Divisions were to occupy the German front line, advance through the fosses and quarries between the enemy’s defenses, breach the German second line, and gain possession of the town of Hulluch laying just beyond their opponent’s organized defenses. The southern border of the attack was the built up area around Lens and the boundary with the Tenth French Army, and the northern perimeter lay along the La Bassée Canal. Further to the north the Indian Corps and III Corps would make small attacks at various points, supported by limited amounts of gas, to secure parts of the German line and to provide a diversion. Once the first wave had breached the enemy’s defenses it fell to the general reserve, composed of XI Corps, Cavalry Corps and the Indian Cavalry Corps, to press into the open, widen the attack and bring about the pursuit. Anticipating victory, the British made arrangements to augment the pursuit with divisional motorized machine gun units, the mobile batteries of guns detached from the 19th and 20th Divisions, along with the army level companies of bus-borne infantry. Logistically, Butler made sure the engineers were ready to join up the British railroads with those in German hands and to open the blocked canal to barge traffic.¹¹³

Having made their decision, gas became the central, controlling feature of British planning. Pre-eminently, Haig hoped to outdo the German success at 2nd Ypres, with the rupture of the enemy’s front and a swift advance onto their lines of communication leading to the collapse of the enemy’s position on the Western Front. However, Haig did not plan a lengthy battle for fire supremacy as a prelude to
the launching of the decisive blow which would lead to victory. Instead, gas would strike at the enemy’s morale and create panic within their ranks. First Army Headquarters suggested that “Corps commanders should remind their subordinates of the great moral effect which attended the use of gas by the enemy on the first occasion near Ypres.”114 At a subsequent conference with his corps commanders, Haig identified morale as the heart of the British attack. He went on:

In view of the great moral effect which the gas may have on the enemy, it is absolutely essential that the attack be everywhere continuously fed from the rear and rapidly pushed forward to gain as much ground as possible in the first advance.115

The 47th Division Headquarters instructed its units to avoid communication trenches and other sheltered features and stressed “success will depend upon the infantry following up the gas at a rapid pace over the open.”116 Gough added his own suggestion that they discharge the gas at or just before dawn, because the enemy would be more likely to be tired and more susceptible to panic. He also recommended that the British discharge the gas along the entire First Army front and not just on the I and IV corps positions who were responsible for the attack. He believed that the preliminary artillery preparations might alert the Germans to the threat and they would concentrate their reserves opposite the I and IV corps
sectors, thereby denuding their defenses along the rest of their line.\textsuperscript{117}

Post-battle assessments reiterated the importance the British placed upon the terror effects of gas. The First Army's weekly operation assessment immediately after the battle reported that, "owing to the extent of the front of the attack, and the limited amount of heavy artillery and ammunition available, considerable reliance had to be placed on the effect of the gas and smoke."\textsuperscript{118}

Headlam, in his history of the Guards Division, reported that the British had high hopes for gas at Loos and they hoped it would demoralize the enemy and thereby lessen the task for the attacking infantry.\textsuperscript{119} Ewing also considered the role of gas in his work on the 9th (Scottish) Division and concluded that the plan was to use gas to demoralize the defenders so that the advancing British could get all the way through the enemy's second line.\textsuperscript{120}

The critical issue for British plans was the availability of Red Star, the code name they gave to chlorine cylinder gas. Haig had called for over 7,000 cylinders, but production difficulties made the attainment of that figure impossible. Late arrivals of gas meant that the British would rush gas to the front and install cylinders into the front line right up to the eve of the battle. Haig complained on the 26 August that the number of cylinders on hand was far less than promised and warned that if the situation did not improve he would have to either postpone the attack or modify his plans.\textsuperscript{121} On the 20th the Ministry of Munitions promised between 4,000 and 5200 cylinders by 6 September and a further 1500 by 11 September, but
by 1 September only 3,337 had arrived and even as late as 7 September First Army still did not have an exact figure on how much gas it would have by the time of the attack. A revised plan now distributed the cylinders as follows:

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<tr>
<th>Sector</th>
<th>Number of Cylinders</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Corps</td>
<td>2,850</td>
</tr>
<tr>
<td>IV Corps</td>
<td>2,250</td>
</tr>
<tr>
<td>Indian Corps</td>
<td>800</td>
</tr>
<tr>
<td>III Corps</td>
<td>600</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,500</strong></td>
</tr>
</tbody>
</table>

By the 15th another 900 had arrived but it was clear that Foulkes would have to reduce the allocation of cylinders. III Corps would now have none and Indian Corps only 160. The final shipments began to arrive on 17 September. Special trains rushed the gas to the front, and the engineers installed the final lot on the night of the 24th. In the end, the Special Companies had only 5,500 cylinders to open, containing 150 tons of chlorine, and the British had to rely upon a ruse to convince the enemy of the deadliness of their cloud. Foulkes arranged for smoke candles to supplement the chlorine emission. The Gas Adviser provided his men, who were manning
the cylinders in the British front line, with the following instructions:

<table>
<thead>
<tr>
<th>Time</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (Zero Hour)</td>
<td>Start the gas and run six cylinders one after the other at full blast until all are exhausted.</td>
</tr>
<tr>
<td>0.12 to 0.20</td>
<td>Start the smoke. The smoke is to run concurrently with the gas if the gas is not exhausted at 0.12.</td>
</tr>
<tr>
<td>0.20</td>
<td>Start the gas again and run six cylinders one after the other at full blast until all are exhausted.</td>
</tr>
<tr>
<td>0.32 to 0.40</td>
<td>Start the smoke again. The smoke is to run concurrently with the gas, if the gas is not exhausted by 0.32.</td>
</tr>
<tr>
<td>0.38</td>
<td>Turn all gas off punctually. Thicken up smoke with triple candles. Prepare for assault.</td>
</tr>
<tr>
<td>0.40</td>
<td>ASSAULT\textsuperscript{124}</td>
</tr>
</tbody>
</table>

To increase the density of the cloud, the Special Companies would also fire smoke bombs from the newly arrived 4-inch Stokes Mortar\textsuperscript{125}.

Haig also realized that technical or meteorological problems might prevent the discharge of the gas and, since it played the key role in the attack, he had his corps commanders draw up plans for a
modified attack without the assistance of chemical substances. There was no denying Haig’s keenness to use gas. On 16 September he wrote to Robertson at General Headquarters that he believed there was no question regarding the use of gas and that he anticipated decisive results with its assistance. However, if conditions prevented the use of gas he intended to revert to an attack similar to the plan for the limited offensive that he had proposed earlier in the summer and which had so annoyed Joffre. He concluded to Robertson that, “under no circumstances should our forthcoming attack be launched without the aid of gas.”126

In essence, the British had recognized one of the inherent problems of gas when it is released as a cloud, the impossibility of controlling the weapon. Haig understood that cylinder gas was dependent upon the direction and force of the wind, and chemical warfare would be responsible for the creation of a front line weather reporting network and the instruction of company-level gas officers in the art of measuring wind velocity and direction. However, the question remained as to what to do if the wind was nonexistent or if it was blowing from the wrong quarter. The quandary Haig faced was, having designed an attack dependent upon gas and linked to two French attacks, could he still launch his own attack without the weapon upon which his success depended?127

Haig corresponded with General Headquarters on the 13 September to strongly advise the postponing of the attack, from day to day if necessary, in order to gain a favorable wind. He also
expressed his belief that without gas it would only be possible to secure the enemy's front system of trenches. The days later he met with Rawlinson and Gough and formally asked them what modifications they would have to make if they had to attack without gas. Both corps commanders replied that they could only seize part of the enemy's front line. Rawlinson did not have enough guns and ammunition to bombard his entire front to the extent of destroying the enemy, so that without gas he could not contemplate attacking on a wide front. He believed it would be necessary to cut back the scale of the attack. The commander of the 7th Division, General T. Capper, also opposed attacking without gas, particularly since he needed it to neutralize the powerful Hohenzollern Redoubt on the left flank of his attack. Haig then reported to French that without gas he would have to limit his attack to a two, not six, division assault and again urged the necessity of postponement if the weather was unfavorable.

On the 21st Gough issued orders limiting his corps' role to the seizure of the Hohenzollern Redoubt if he could not discharge the gas, while Rawlinson noted that if need be only his 15th division would advance to pinch off the Loos Salient. Further arrangements depended upon the progress of the French. Montgomery then informed the IV Corps divisional staffs that if the weather was poor the attack would no longer be an attempt at breakthrough. Instead, he wrote, "the advance will be made in stages until the final objectives are reached, but each stage will have to be systematically prepared." Haig had failed to gain the right to change the date of
the attack. This remained the prerogative of French and, ultimately, Joffre. Without gas First Army’s support would revert to a limited nature. Montgomery’s observations reflected reality when he wrote that without chlorine “the great moral effect of a surprise gas attack will be eliminated, and it is not intended to attempt to carry the whole of the enemy’s defenses in one great rush.” Having spent all summer moving from a limited to a breakthrough attack, the British, on the eve of the battle, had come full circle. Their reliance upon gas was complete. The attack depended on the fickleness of the wind to carry their essential weapon to the enemy, and the weather would determine if the British would have their chance at decisive victory.

An important factor in the battle’s planning was the British understanding of the enemy’s anti-gas arrangements. The British naturally assumed that the Germans would also have made defensive adjustments after the arrival of chemical warfare, but needed to know whether the equipment was effective and whether the soldiers were well-trained in its use. Experience from 2nd Ypres showed that subsequent gas discharges, even with the primitive protection then available, were not as successful as the first. The British, therefore, had a great incentive to determine the efficacy of German anti-gas measures. From late August into September, British intelligence interviewed a series of prisoners to determine the status of the enemy’s gas protection. A prisoner from the 16th Bavarian Reserve Regiment possessed a make-shift respirator but he was ignorant in its use and in any case it was not proof against
asphyxiating gas. An Alsatian prisoner reported that a bullet pierced a bottle of lethal gas in his trench and killed eleven soldiers, an indication of poor anti-gas discipline. An unidentified prisoner possessed a new model respirator which did protect against chlorine, but his captain considered it inferior to the British helmets. Another prisoner believed that he could not rely on his equipment. Others stated that they had received cotton wool respirators and bottles of solution, certainly inferior to British standards at that time. Finally, another reported that the regiment had issued respirators but they were kept with the trench stores and were only to be passed out in case of a gas attack. Based upon sources such as these, along with the examination of the enemy’s protective devices by British experts, Haig concluded that the enemy had inefficient respirators and was greatly distressed by the battle’s postponement because it gave the enemy more time to issue better gas helmets. Just before the battle, from First Army’s Advanced Headquarters, Butler reiterated this point and advised:

There is reason [to believe] that the Germans have not got an effective smoke helmet and, as we have not yet made use of gas in our attacks, it is likely that its use by us may come as a complete surprise to the enemy.

Even if the enemy had improved their equipment, the British had another reason to believe that their gas might still prove effective. At 2nd Ypres on 1 May the Germans attacked the 15th
Infantry Brigade on Hill 60 with chlorine. The troops did have respirators but they still suffered heavy gas casualties. An investigation concluded that the men were not adequately trained in the use of their equipment and recommended that commanders needed to give special attention to the hasty adjustment of respirators by their men. It also noted the need to keep cotton pad devices moist throughout the day since during a attack there would not be time to apply the protecting chemicals.\textsuperscript{140} Butler, in his circular, wrote:

\ldots experience has shown that, if men are not prepared for a gas attack, and if they are not wearing their gas helmets or have not time to put them on properly, the effect of a sudden cloud of gas may be very great indeed, not only in the front trenches but also in the support and reserve trenches for some considerable distance in rear.\textsuperscript{141}

As Loos approached, the British hoped that the Germans had not yet institutionalized thorough anti-gas training. Furthermore, prisoner interrogation had demonstrated that some Germans still possessed the inferior cotton pad devices which the wearer needed to keep moist, a liability if the owner was not well trained. The course of the battle would prove the British gamble correct. The Germans had neglected to issue all their troops with effective equipment, nor had they seriously addressed the importance of defensive gas training. The Germans would have to experience the harshness of chemical
warfare themselves before they could absorb the lessons that they had taught the British at 2nd Ypres.

The British still envisioned an important role for the artillery but they limited its objectives, both due to resources and design. The guns would facilitate the attack, but it would be gas that would make victory possible. The artillery’s role fell into several basic categories. The guns were to physically destroy the enemy’s defenses such as the wire or parapets, and fire counter-battery missions to neutralize the enemy’s batteries. Additionally, the British expected the four-day bombardment to lower German morale and planned to exacerbate the enemy’s panic by having the gunners fire into any fleeing troops.\(^{142}\) The British did not expect great things from their guns, principally because of the limited number of heavy pieces and the paucity of rounds. Table 5.1 illustrates this point by comparing shell expenditure at Loos in September 1915 with the Battle of Messines in June 1917.
Table 5.1

Comparison of Shell Expenditure Between Loos and Messines

<table>
<thead>
<tr>
<th>Artillery Caliber</th>
<th>Battle of Loos</th>
<th>Battle of Messines</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-pdr.</td>
<td>203,124</td>
<td>1,977,499</td>
</tr>
<tr>
<td>4.5-inch howitzer</td>
<td>30,568</td>
<td>642,246</td>
</tr>
<tr>
<td>60-pdr.</td>
<td>4,937</td>
<td>175,479</td>
</tr>
<tr>
<td>6-inch howitzer</td>
<td>11,241</td>
<td>540,541</td>
</tr>
<tr>
<td>6-inch gun</td>
<td>340</td>
<td>13,647</td>
</tr>
<tr>
<td>8-inch howitzer</td>
<td>3,218</td>
<td>120,934</td>
</tr>
<tr>
<td>9.2-inch howitzer</td>
<td>2,239</td>
<td>83,664</td>
</tr>
<tr>
<td>12-inch howitzer</td>
<td>nil</td>
<td>6,717</td>
</tr>
<tr>
<td>15-inch howitzer</td>
<td>216</td>
<td>803</td>
</tr>
</tbody>
</table>

Total 256,483 3,561,530

Further complicating the difficulties for the British artillery were German defenses which, even at this early stage, were largely proof against all but a direct hit from the heaviest shell. Haig believed that it would be extremely difficult to knock out enemy positions because of their dug-outs and entrenchments. Therefore it fell to gas to silently sink into German strongholds and destroy their occupants.¹⁴⁴

The British did plan a modest contribution by the artillery with their use of gas shell. The Germans had first used this ordnance against the British at Neuve Chapelle in 1914 and they subsequently
fired large quantities during the Battle of 2nd Ypres. Shortly after Ypres the British began a program to produce their own chemical shells, however technical problems and the need to first address the critical shortage of high-explosive shells postponed large-scale production until 1917. On 16 August the British conducted tests of chlorine filled shells for the 4.5 inch howitzer and, while they were generally pleased with the results, there were some difficulties with excessive upward dispersion of the gas due to too much high-explosives in the bursting charge. Instead, at the end of the month, General Headquarters promised Haig 1,000 4.5 inch howitzer rounds, and possibly a second 1,000 filled with the lachrymatory agent SK. However, by the 24 September only a partial consignment had arrived and I Corps had only 250 rounds to divide amongst the howitzer batteries of the 2nd and 9th Scottish Divisions. Their targets would be the village of Auchy, located between the German lines, and the village of Haisnes, located just beyond the enemy’s second line. Rawlinson also noted the arrival of some lachrymatory shells but IV Corps records do not identify the quantity. Haig also received a small amount of chlorine filled lethal shells (CP or CPS) for his thirty-two 4.7 inch guns. Again, the exact number is difficult to determine but it may have been as many as twenty-seven rounds per gun for a total of 864. At a minimum each 4.7 inch gun had a combined total of 158 gas and high-explosive rounds. As with their role in the battle, the artillery’s employment of chemical rounds was not overly significant, especially when compared to the importance the British
place on the gas discharge. However, these new shells were a harbinger of the future and a representation of British determination to try to exploit all possible venues for chemical warfare.

Haig, at the First Army’s Advanced Headquarters, spent an anxious night watching the weather. Every hour forty gas officers, distributed along the assault zone, reported the estimated wind velocity and direction to Foulkes, while Captain E. Gold, the army’s Meteorologist, received bulletins from London, Spain and other weather stations. Foulkes plotted the reports on his map while Gold analyzed the data and developed his forecast. Haig still had to decide whether to use the gas and, if so, when to begin the attack. The weather for most of the 24th and the preceding days had been poor, but at 6 PM there was a slight improvement. Gold estimated that the wind was on the border-line between favorable and unfavorable. By 9 PM he could report that conditions were improving and he anticipated a shift of direction to the desired west by the morning. At 9:45 PM Haig sent the message confirming the use of gas and at 3 AM there followed the announcement to open the cylinders at 5:50 AM. The wind, however, proved fickle, and prevented the release of much of the gas, on average the Special Companies succeeded in opening only seven cylinders per emplacement or about half of the expected amount.

At 5:50 AM on 25 September the men of the Special Companies opened the cocks on their cylinders releasing the Red Star in Britain’s first chemical attack, while the Stokes mortarmen fired
10,000 smoke bombs. Members of the Special Companies, with assistance from the infantry, had cut over 400 gas emplacements into the front line parapet, each containing from eleven to thirteen cylinders. Working in their gas helmets, hampered by leaky pipes and frozen valves, they followed Foulkes’ program and released the chlorine, interspersed with smoke, generating a cloud that obscured the entire battlefield. However it proved more difficult to release the gas in the crowded, muddy trenches, while under an enemy barrage, than it had on the practice field. Corporal Charles Ashley of 186 Special Company explained that time was lost because the chlorine was terribly cold when released, causing the connector nuts to contract and thus making it virtually impossible to reattach the pipe to the next cylinder. Combined with the problems with the wind, they succeeded in releasing only about 80 tons of gas. Forty minutes later the infantry clambered out of their trenches and advanced toward the German lines.

The support offered by the gas was mixed. The right flank received its full benefit, the center had some assistance, and for the left flank it was a painful liability. The wind blew most favorably on the fronts of the 47th London and 15th Scottish Divisions and consequently their advance was the easiest. Major-General C. St. L. Barter’s Londoners left their trenches on time and within a few minutes had entered the enemy’s front line. By 7:30 they had reached their final objectives on the outskirts of Loos and the embankment of the Double Crassier, where they were to prepare a defensive flank for the 15th Scottish Division. The Division reported
that immediately after the discharge the Germans opened with heavy artillery, rifle, and machine gun fire, but as the cloud reached the enemy’s positions their aim became high and wild and then ceased. At 6:38 AM its War Diary recorded that the German rifle fire was dying down, and by 6:59 it had become faint.\textsuperscript{158}

The Scots also set out quickly, but their final objectives, the villages of Loison and Annay, lay a mile and a half beyond the German's last prepared defensive line, a distance of nearly six miles. The 15th Division's attack was critical, and it had to advance rapidly straight through the enemy's defenses in order to open the war for the general reserve. Emerging from Russian Saps, only 200 yards from the enemy, its troops plunged into the German positions. By 7 AM they had reached the Loos line, and although its defenders had fled, partially cut wire held up the British. As they forced their way through the wire several German machine guns opened fire, but once bombers had silenced them, the 15th again swept forward. Elements of the 44th and 46th Brigades then stormed up and over Hill 70 and rushed down the rear slope towards the Germans' final line. However during this final push their direction pulled towards the south and the village of St. Laurent instead of east and the village of St. Auguste. In the end it did not matter. The 800 to 900 men of the spearhead got within eighty yards of the German line, but then, caught by heavy rifle fire on an exposed slope, enfiladed by machine guns, and confronted by virtually intact wire, most were cut down. A few desperate parties attempted to work their way through the wire but they were either killed or taken prisoner. A
subsequent counter-attack by the Germans forced the British off Hill 70 and the Scots dug in on its forward slope. Those units that had reached the final German defenses suffered grievous casualties in their attempt to break through. When relieved during the night from Hill 70, Captain Duncan Stang, the senior officer of the 8th Seaforth Highlanders, withdrew with one other officer and thirty-five men.\textsuperscript{159}

The advance of Rawlinson’s third division, the 1st, was less successful, and gas proved that it could be a two-edged sword. The 1st Division’s distant objective was the village of Hulluch on the far side of the Germans’ last defensive line. At 5:50 AM the wind was light and variable but generally in the correct direction. However, ten minutes later it shifted and gas poured back over the British positions, causing heavy casualties in the 2nd King’s Rifle Regiment. The assault was delayed a few minutes to allow the gas to drift away and the 1st Division went over the top at 6:34 AM, four minutes late. The men had to advance through the gas, and as they did so, they came under enemy machine-gun fire. When they reached the German line they then discovered that the artillery had done a poor job and the wire was largely intact. The Germans thus had time to emerge from their dug-outs and man their positions. The division took heavy casualties but it succeeded in breaching the German line and pushed on to the outskirts of Hulluch, but once again they faced intact wire and only a few British temporarily penetrated the position.\textsuperscript{160}
The situation further north, in I Corps' sector, proved more problematic. As for IV Corps, Gough's final objectives lay more than a mile east of the German's last defensive position. The troops of the 7th and 9th (Scottish) Divisions were to press forward in one great rush in order to clear the way for XI Corps in the general reserve. The 2nd Division, the northernmost, was to straddle the La Bassée Canal and form a defensive shield to protect the flank of the other attackers. The 7th Division along with the 26th Brigade of the 9th (Scottish) Division succeeded in overrunning the Hohenzollern Redoubt, got as far as the German final line, and even occupied parts of it for a little while, but the rest of the attackers, to the north, were unable to penetrate the enemy's front line, a failure which allowed the Germans to enfilade and heavily punish the advancing British. The contributing culprit was gas. The gas in front of the 28th Brigade, the leftmost Brigade of the 9th (Scottish) Division, at first seemed to move into No Man's Land, but it then blew back, tumbling into the packed British trench, and continued on to the west. Seriously depleted, the battalions emerged from the trenches promptly at 6:30 AM, but had to traverse the intervening ground between their lines and the enemy's fully exposed, without the cover of the cloud. Immediately raked by machine guns the Scots suffered heavily, the German fire virtually annihilated the 10th Highland Light Infantry within twenty yards, and the 6th Kings Own Scottish Borderers would lose 605 of the 650 men they sent forward. Those who managed to reach the German position found it protected by broad belts of heavy, un-cut wire. On the far left of
I Corps was the 2nd Division, the northernmost unit to participate in the attack. Assigned the relatively minor task of securing the offensive’s flank, the division would fail in its task and, at the day’s end, its battalions would be back in their jump-off positions. Again, instead of proceeding across No Man’s Land, the gas drifted back into the British positions, and without its assistance the Germans mowed down the attackers, even before they reached the enemy’s virtually intact wire.

Encouraged by the swift advance of IV Corps, and sensing the possibility of breakthrough, Haig asked for the transfer of control of the general reserve from General Headquarters to First Army, a request French agreed to at 9:41 AM. Haig ordered the 21st and 24th Divisions forward to attack between the 1st and 15th Divisions, aiming at breaking the German line between Hulluch and Cité St. Auguste. Meanwhile, in preparation for the pursuit, he instructed other units to prepare crossing points for the cavalry and field artillery over the captured German trenches. However, French had positioned the reserves too far away and the New Army troops, only recently arrived in France and already exhausted from almost a full night of marching, could not get through the choked roads quickly enough. Haig had to postpone their attack until the 26th when they advanced into their maiden combat and attempted to smash their way through the Germans’ final line while the 15th and 1st Divisions tried to retake Hill 70 and Hulluch. Their task was impossible. The reinforced Germans, still protected by intact wire, wrought havoc in the advancing lines. The men of these green divisions wavered and
then broke under the pressure. Only the advance of the Guards Division stabilized the British line and prevented disaster.¹⁶⁴

On the 27th, the Guards Division renewed the attack but it too was repulsed, while variable winds forced the British to abort a gas discharge on the 2nd Division’s front near Cuninhy. The reinforced Germans now launched a series of local counter-attacks and retook the Hohenzollern Redoubt which diverted British attention to this critical position. The loss of the position, along with the increasing strength of the enemy, forced Haig to change his approach. For the attack on 13 October he set limited objectives, including the regaining of the redoubt along with the tactically important locations of Fosse 8, the Quarries and The Dump. The plan called for a gas discharge at 1 PM, and the Special Companies opened 1,217 of the 3,170 Red Star cylinders they had prepared. An uncooperative wind prevented the opening of the rest. The infantry assaulted an hour later but the Germans repulsed them. Haig next proposed for the 16th a night-time gas discharge followed by a broad surprise assault, but the worsening autumn weather forced its cancellation and the battle effectively came to an end. The French offensives, for which the British fought in support, also ended in failure. General d’Urbal’s Tenth Army moved forward on the afternoon of the 25 September but stalled after occupying parts of the enemy’s front line, and Joffre’s other thrust from Champagne also failed to secure its objectives. The French renewed their attacks the next day but there was no longer any sense of coordinated purpose. Instead the
battle had become a series of limited attacks and the opportunity for a decisive outcome had past.\textsuperscript{165}

With the battle’s conclusion commanders began the process of learning its lessons. While gas had been the battle’s primary focus, there were important issues for the artillery to consider. Brig.-Gen. C. E. D. Budworth, Rawlinson’s gunner, noted that the objectives of a preliminary bombardment were:

1) [To] Demoralize the enemy.
2) To subjugate the hostile artillery.
3) To destroy hostile personnel, material, and all kinds of obstacles to the infantry advance.\textsuperscript{166}

These themes would be codified in \textit{Artillery Notes} in 1916 and they would form the basis for the employment of shell gas.\textsuperscript{167} Budworth also recommended an increase in the assignment of artillery to counter-battery and suggested that artillery planners should assign as many batteries as possible to this task. As well he observed the inadequacy of siege batteries in dealing with the enemy’s deep dug-outs, and suggested that the benefit of these weapons when aimed at German infantry was primarily moral. Finally, he believed that in future gas discharges it would be valuable to have the field artillery fire shrapnel upon the enemy’s parapets and communication trenches, both to catch the defenders who manned their positions in anticipation of an assault and to eliminate those who had fled before the cloud.\textsuperscript{168}
Another officer concluded that "the chief hope in future operations lies in greater development of artillery power rendered possible by an increased supply of guns and ammunition, and a greater experience in the handling of them." He added that a really crushing artillery bombardment had not yet been seen and it would require heavy howitzers, heavy guns, and enough ammunition to obliterate the opposition. At the moment of assault the guns would proceed the infantry like a wave and overwhelm all in its path. While the British would compete directly with the Germans in the struggle for artillery dominance by building enormous quantities of materials they reinforced their efforts by perfecting the techniques of air-ground control, indirect fire accuracy, gunnery intelligence command centers, and shell gas. All of these approaches would play a role in the eventual supremacy of British artillery over the enemy.

For those concerned with gas the lessons were equally far reaching. An analysis of the effects of gas on the 25 September stressed the primacy of cloud gas' dependence upon the wind which made its co-ordination with an infantry assault extremely problematic. To achieve a safe and successful discharge the wind had to be perfect, a condition that the planners could not guarantee. Gas could therefore never be a dominant battlefield weapon because its use was too unpredictable. Never again would the British precede an attack with a discharge of gas from cylinders. They would continue to make use of chemical weapons, and in increasing volume, but if the infantry were to advance they would invariably
use a different method of delivering the vapor to the enemy. The report also made other observations that were of a more practical nature. For a cylinder discharge they believed that the wind needed to be a steady four to sixteen miles per hour, and that thirty minutes was an insufficient length of time. While the gas did not kill many Germans directly, the enemy did suffer considerable shrapnel casualties when the gas forced them from their shelters into the open. Finally, the report noted the need for considerable training by the chemical warfare troops in order to perfect their art. Problems, such as leaky apparatus and the damage of outlet pipes by the enemy’s gun fire, required improvements in equipment, and the slow, labor intensive opening of cylinders one by one needed to be changed to a group discharge system.¹⁷¹

Capt. P. R. Sanders, R.E., the commander of 187 Special Company R.E., also submitted an analysis of his experiences before and during the discharge. He observed that the method of moving the cylinders, which weighed over 100 pounds, from the supply head into the trenches was extremely arduous. On one night alone nearly 4,500 men were engaged in bringing some of the cylinders used on the IV Corps front into the trenches, and the work was so exhausting that a man could make only a single journey. The demands for labor required the Special Companies to seek assistance from the infantry, a task that did not endear the foot soldiers to cylinder attacks. He also reported a need for improvement in quality control. A number of cylinders arrived either empty or leaking, and the filling plant had put on the cylinder caps so tightly
that the engineers had to loosen them with blow torches. He also complained of faulty valves and joints, leaky tubes, and the length of the vent pipes being so long as to be practically immovable in the trenches.¹⁷²

The reaction of officers varied with their location and the success of the gas. Foulkes, the enthusiast, believed that the Germans were completely surprised by the gas and that it caused a panic. After the war he wrote, "contrary to the general impression at the time, the gas attack was a complete success and it is probable that without it no ground would have been gained that day."¹⁷³ Foulkes’ comments certainly applied to IV Corps’ front where Rawlinson also reported success. His troops, except for those affected by the blowback along 1st Division, moved forward quickly and experienced little resistance.¹⁷⁴ In his diary he recorded his impressions:

The morning of the 25th was far better than one could have possibly expected. . . . It was a wonderful sight - the cloud was 2[00] to 300 feet high and extended from La Bassée Canal down to our junction with the French.¹⁷⁵

The final issue remaining is an assessment of the role of gas in the battle’s failure. The accepted consensus was that gas had done its expected part where the wind had blown correctly, as it did in the IV Corps’ sector, and though the blowback was painful on the I Corps’ front, the chlorine was not responsible alone for the inability
of the British to break through. The British attack was simply too ambitious for the resources available, and the Germans were too strong. The power of the defense to overwhelm the offensive remained unresolved, while the German Army was still morally a match for the British and would require considerable wearing down before the British Expeditionary Force gained their essential advantage in that relationship. Furthermore, even if the wind had blown in the correct direction and at the right velocity, and even if General Headquarters had properly controlled XI Corps so that it closely followed behind I and IV Corps and interceded at the crucial point, the potential for the British to have secured a breakthrough was, one can speculate, remote. Overshadowing the failure of the gas was an even more serious problem, the failure of the guns. Throughout the battle zone, the advancing infantry had to work their way through intact German wire. Worsening the situation, those areas in which poor conditions impeded the discharge also tended to have large belts of uncut wire. Astute observers realized that success was impossible without more artillery, as well as advances in firing procedures, reconnaissance and coordination with the infantry, all future innovations.176

Yet on the 47th London and 15th Scottish Divisions fronts the gunners had done a good job in destroying the wire, and the defenders had panicked and run before the cloud, a combination which Rawlinson claimed allowed his infantry to reach their objectives without undue loss.177 Why then did these units fail to breakthrough the Germans’ final position? After a rapid advance
through Loos and over Hill 70 the British troops were simply exhausted and their numbers too greatly reduced. Furthermore, the farther they advanced the weaker the chlorine became, due to its dispersion into the atmosphere. Then, as they came down the far slope of the hill they confronted an alert enemy who had not faced the full effects of the deadly vapor and whose position a dense belt of wire protected. British guns had not even attempted to systematically destroy the wire because it lay beyond the range of the field batteries and there were too few heavy pieces for the task. Even if the latter had existed, the position lay far beyond the gunners ability to observe and correct the shooting. Gas did not substitute for the British shortages in artillery because it could not fulfil one vital function, the physical destruction of defensive emplacements which impeded maneuver on the battlefield and contributed to the stalemate that was the Western Front. Thus, in the end, it was British over-ambition and the acute shortage of guns that doomed Loos to failure, for success unreasonably required virtually every German to flee before the cloud.

However, did the failure at Loos also mean that gas had not fulfilled its expected role as a guarantor of massive asymmetric superiority? Was it unable to create a morale advantage for the British of such stature that the enemy would simply collapse? The answer to these questions is mixed, although it is clear from the battle's result that chlorine did not possess sufficient asymmetric properties to gain a strategic advantage. Yet there is also little doubt that where the wind blew as desired, it achieved a tactical
superiority. The British discussed the effectiveness of gas in some detail after the battle and concluded that while disappointing in its material effect it had had a great moral effect. A report by the 47th London Division noted that it was impossible to ascertain with any degree of certainty what effect the gas had on the Germans, nor whether it was directly responsible for any casualties, but, it concluded, there was no doubt that its moral effect was great.\(^{178}\) While the gas discharge did not kill many Germans outright, the absence of German bodies in the captured positions suggested that the remainder retreated rapidly and that the demoralizing effect of the cloud had thoroughly cowed the enemy.\(^{179}\) Foulkes also concluded that, “on a whole the gas attack came as a surprise and caused a panic opposite 4th Corps.”\(^{180}\)

The gas and smoke cloud also provided an important screen from enemy observation. The commanding officer of the 47th London Division believed that it was this cover which enabled his battalions to safely cross the 400 yard gap that separated his position from the enemy.\(^{181}\) Rawlinson also commented on the need for attacking troops to take advantage of the cloud. He observed after the assault on 13 October that:

In these attacks, if the infantry are not keen to take every advantage of the smoke and gas, and if they do not advance to the assault the moment the smoke has finished, they are practically certain to fail: for once the enemy is given time to man his defenses with rifles and machine-guns, no assault is
likely to succeed in getting across the 150 yards which nearly always intervenes between the two trenches.\textsuperscript{182}

Thus gas had shown itself to possess considerable tactical value which the British would exploit in the future.

Conclusion

The Battle of Loos, initially brought forward as a limited attack to hold the German reserves on the front while the French sought a breakthrough elsewhere, soon evolved into the largest British undertaking of the war up to that point. While to some extent one can label it a political battle fought to appease the allied French, Loos was also Britain’s last attempt to win the war quickly and cheaply. With its failure, British commanders resigned themselves to a long war of relentless wearing down as they sought the superiority necessary for victory in the crushing of the enemy’s morale. After Loos, morale, always a vital priority in their thinking about war, achieved paramount importance in the quest for victory. Loos was not so much a turning point, for it assured that the British would pursue decisive success by the means they had intellectually anticipated in the prewar years, but rather an anomaly, in which a novel technology played a critical role.

It might be convenient to regard the British use of gas as merely a necessary retaliation, or an effort to compensate for their lack of artillery. In fact it was neither. Haig’s use of gas was an attempt to compress the “struggle for supremacy” phase of battle
down to an instant. Instead of the extended battle for fire
superiority codified in their prewar manuals, gas, they gambled, due
to surprise and its huge innovation asymmetry, would sweep the
enemy from the field, allowing the British to combine the advance of
the fire line and the launch of the decisive blow into a single phase,
leading to breakthrough, pursuit, and decisive success. The British
were well aware of the asymmetric potential of the weapon. One
post-battle evaluation noted that the success they did enjoy was due
not to the destructive value of the gas, but to its novelty. It further
recognized that “it is possible that a more destructive auxiliary
means maybe found in the future; it is doubtful whether the total
effect produced will be greater.”

Therefore, in reality Loos was an innovation, a battle that combined not only a novel weapon but also
employed it in a means that stretched the existing intellectual
conception of the nature of war. To Haig and the British, the belief
in the sanctity of the principle of the phases of battle was
axiomatic, yet, while they did not change the sequence, they did
virtually eliminate one of its phases. Loos represented a willingness
to experiment with the army’s operational parameters. While the
British stayed within the bounds of their prewar principles, they did
show the ability to define their parameters in the broadest possible
way. Loos showed that the operational principles of the British
Army were not rigid or nonreactive. Rather, as the prewar theorists
had believed, the institution’s ethos permitted wide latitude and
encouraged initiative and interpretation which readily allowed the
incorporation of novelties and new ideas.
The British paid a heavy price for their support of their ally. Including the subsidiary attacks on the Indian, III, and V Corps fronts, Loos cost the British over 59,000 casualties, of whom 7,766 were dead and another 18,486 missing, a figure more than double Edmonds' estimate for the German "butcher's bill."\(^1\) For their effort, the British could claim the village of Loos, an assortment of mine works and pit towers and about 8,000 yards of the enemy line, but they had fallen far short of their strategic goals, breakthrough and decisive victory. Loos, despite the initial optimism created by the rapidity of the 15th (Scottish) Division's advance, was a costly failure. Yet Loos had great significance. Its lessons not only molded the future role of gas, but also confirmed the British faith in the veracity of their prewar conceptions and shaped their methods for the rest of the war. The battle's failure renewed Haig's belief that there could be no shortcuts. The way would have to be long and hard in order to change Britain's position of inferiority into one of superiority so as to achieve the asymmetric relationship necessary for decisive victory. The use of gas had been a technological attempt to short-cut the methodical progress that modern war required and which the phases of battle demanded. Gas was simply not technically effective enough at Loos to gain the advantage necessary to garner success. Its failure meant that the British would return to the intellectually agreed upon parameters which would produce both the Somme and eventual victory.

\(^1\) From "Dulce Et Decorum Est," in C. Day Lewis, ed., \textit{The}

2"Haig to Robertson," 16 September 1915, WO95/158, PRO.

3Technically speaking, 2nd Ypres was not the first use of gas during World War I, as the Germans had employed it on at least three previous occasions. On 27 October 1914 the Germans shelled British positions at Neuve Chapelle with dianisidine chlorosulphonate, a sneezing agent, on 31 January 1915 they fired xylyl and benzyl bromide (T-stoff, both are tear gases) at the Russians, and in March 1915 it was the turn of the French as the Germans shelled their positions around Nieuport with T-stoff to which they had added bromacetone (B-stoff). In each instance, the attacks failed for technical reasons, and the defenders were not aware that the Germans had used chemical weapons. Historians have therefore identified The Battle of 2nd Ypres as the commencement of gas warfare because this was the occasion of its first effective use. The suggestion that Chemical Warfare has an ancient or medieval origin is also incorrect. While one can identify instances of the burning of sulphur to produce a noxious cloud during a siege or the catapulting of a diseased carcass into the enemy’s camp, chemical warfare is clearly a product of modern industrialized warfare. Harold Hartley, one of the leaders of Britain’s chemical warfare establishment, acknowledged in a post-war lecture that, "no nation entered the war prepared to use gas or equipped with any defense against it. The German chemical works were not even included in their mobilization scheme . . . ." See, “Hartley Lecture,” WO188/213, PRO. Haber discusses these issues in Poisonous Cloud, 15-25. After the war the Germans attempted to place the onus of the introduction of chemical warfare onto the Entente, particularly the French who did have some tear gas grenades in their establishment before the war. However no evidence exists of their use, nor of French research into the subject before April 22nd. The British pre-war research into chemical weapons is more overt. In the 10 years before the war the British investigated substances that could incapacitate or render defenders incapable of resistance without any long-term effects. Compounds included benzyl bromide, methylidooacetate and monochloracetone, none of which fell under the ban as defined by the Hague Convention. In early 1914 the British also conducted some tests with
chemical shell. British scientists conducted their first experiments with ethyl iodoacetate (SK) which would become one of their major war gases. But, again, this was a lachrymatory agent which posed no threat to life. In December 1914 General Headquarters inquired into the availability of "stink pots" to help clear trenches and dug-outs. In response the first SK grenades were filled in January 1915 and the results were satisfactory enough for the British to recommend the manufacture of this substance. However the general staff proved reluctant to employ it and in April 1915 General Headquarters informed the Trench Warfare Department that they did not want the materials. Thus, although the British clearly entertained the idea, it remained for the Germans to break the spirit of Hague and to introduce not just a lachrymatory agent but a lethal gas. For the British research see, Capt. J. Davidson Pratt, "Historical Account of Offensive Chemical Warfare Research up to the date of the Formation of the Chemical Advisory Committee, February, 1916," MUN5/385/1650/9, PRO.


8V. F. S. Hawkins, Ref. 55, LC.

9Cotton Collection, IWM
10Ibid.

11The pads, made by civilians across England from a design published in the Daily Mail, actually proved quite dangerous. When dry they did nothing to prevent passage of chlorine and when moistened, the fibers swelled and formed a barrier impermeable to air. See, “Transcripts of Notes Dictated by Lt. Col. S. L. Cummins,” 12/6/17, 1, WO142/266, H.7. GI, 1-5, PRO. Cummins was the Assistant Director Gas Service, Defensive. In early May Haldane also designed an effective respirator, the Black Veil design, so named because the cotton pad was held in place by black cotton netting used for ladies’ veils. See, Ibid., 6. For Barley’s work see, “Field Respirator - May 1915,” WO95/158, PRO and “Barley to Hartley,” 4 July 1963, Hartley Collection, Box 31, CAC. For McPherson see, “Transcripts of Notes Dictated by Lt. Col. S. L. Cummins,” 12/6/17, 3, WO142/266, H.7. GI, 1-5, PRO; Edmonds, Military Operations, France and Belgium, 1915, 1:217. Also see, Haber, The Poisonous Cloud, 41-82.

12The 1899 Hague Convention mandated that the contracting powers, “abstain from the use of projectiles the object of which is the diffusion of asphyxiating or deleterious gases.” The anti-gas clause was not a part of the main text but was added on as a separate declaration. Interestingly, although the Hague Convention contained this prohibition against gas there is no evidence that any power had actually considered the creation of any chemical weapons at this stage. See, James Brown Scott, Texts of the Peace Conferences at the Hague, 1899 and 1907 (Boston: Ginn & Company, 1908), 81-83.

13Edmonds, Military Operations, France and Belgium, 1915, 1:326, 357. The belief that certain methods of warfare were uncivilized was an of- heard refrain of the British Army. During a lecture in 1913 at Quetta, Montgomery commented that the use of starshells for illumination was rare in civilized warfare. See, “Artillery 1913 - Lectures at Quetta,” Montgomery-Massingberd Collection, 95, LHCMA.

14“Kitchener to French,” 24 April 1915, Hartley Collection, Box 42, CAC.

15Arthur Conan Doyle, The British Campaign in France and
Flanders (London: Hodder & Stoughton, 1916-18), 3:49-50; and “Rawlinson to O. A. G. Fitzgerald,” 29 April 1915, Rawlinson Collection, 5201-33-17, NAM.


20 “French to War Office,” 23 April 1915 and “Kitchener to French,” 24 April 1915, Hartley Collection, Box 42, CAC; “Gas in Trench Warfare: Summary of What we have done to Date,” 27 June 1915, WO32/5171, PRO.

21 Haber, The Poisonous Cloud, 81.


23 The War Office identified them as 186, 187, 188, and 189 Special Companies, R. E. In fact they tended to be rather large organizations for a company designation. On 12 January 1916 their complement was: 186th Special Company - 7 officers and 373 men; 187th Special Company - 8 officers and 369 men; 188th Special Company - 9 officers and 442 men; and 189th Special Company - 9 officers and 335 men; for a total of 34 officers and 1519 men. For a discussion of the formation of these units see Richter, Chemical Soldiers, 24, 107 and Foulkes, Gas, 46.

24 Robertson to von Donop,” 26 May 1915, Foulkes Collection, 6-1, LHCMA. Foulkes’ first assignment was to report on what steps the British had taken to wage chemical warfare. Foulkes would go on to command the Special Brigade and simultaneously serve as Gas
Adviser at General Headquarters. For a description of the organization of Britain’s chemical warfare troops see, Foulkes, *Gas!* and Richter, *Chemical Soldiers*.

25"Memorandum on the Use of Gas, etc., in Trench Warfare," 27 June 1915, WO32/5171; Maurice Hankey Diary, 14 May 1915, 1/1, CAC; Haber, *Poisonous Cloud*, 51; Richter, *Chemical Soldiers*, 18. Some of the bombs were designed to be thrown by catapults or spring guns. See, "Memorandum on the Letter of F. M. C.-in-C.," 20 June 1916, MUN5/198/1650/16. The memorandum also makes reference to the use of gas in artillery shell, mortar ammunition, and airplane bombs. The British response also touched off a wave of suggestions for exotic or fantastic weapons, that in most cases were simply the product of overly imaginative minds, although some did suggest a willingness to raise the ante. Hankey suggested the sowing of German agricultural districts with incendiary pellets to destroy the harvest, and Churchill was impressed enough with this idea to recommend the production of the materials. See, Maurice Hankey Diary, 23, 27 April 1915, 1/1, CAC. Other schemes included underground pipelines charged with gasoline or alcohol, exploding cartridges filled with secret substances that would prove absolutely fatal, artillery shells filled with cayenne pepper, dust based explosives, and airplane bombs of chloroform. See, Douglas Haig, *The Haig Papers From the National Library of Scotland*, part 1, Haig’s Autograph Great War Diary (Brighton: Essex, Harvester Press Microfilm, 1987), 15 August 1915; “Meeting of the Scientific Advisory Committee,” 10 August 1915, WO142/52, PRO; A. Fortescue Duguid, *Official History of the Canadian Forces in The Great War 1914-1919*, General Series, vol 1., Chronology, Appendices and Maps, From the Outbreak of the War to the Formation of the Canadian Corps August 1914-September 1915 (Ottawa: J. O. Patenaude, I. S. O., 1938), 309-10. One is tempted to theorise that the British interest in pepper-based weapons was an exaggerated reaction to the absence of spice in English cuisine, or perhaps the result of a promoter’s unfortunate encounter with hot curry.

and 15 August 1915. On another occasion, a British memorandum stressed the fear that the Germans were filling artillery shells with an invisible gas, for which there was no antidote, a reference to Haig’s belief in the power of the unseen to affect morale. See, “Untitled Memorandum,” 20 July 1915, Rawlinson Collection, 5201-33-67, NAM. See, Chapter 4.

27“Australian and New Zealand Army Corps Memorandum on Gas Attacks,” 11 July 1915, AWM25/371/8, AWM.

28“Instructions for Defence Against Asphyxiating Gas,” 9 June 1915, 38/3DRL8042, Item 101, AWM.

29Perhaps these materials emphasised the threat of panic because the foothold at ANZAC Cove was so small that there was nowhere to run and a collapse of the line would lead to the total loss of the position.

30Defensive Measures Against Gas Attacks, 1. The prohibition against attempting to outrun the gas cloud also had a physiological component. A fleeing man breathes more deeply and rapidly than an individual at rest, therefore exposing the lungs to a higher degree of toxicity. After the introduction of the highly toxic phosgene, British publications stressed the absolute necessity of doing as little exertion as possible when caught in a gas attack. See, General Staff, “Lessons from the German Gas Attack on 10-12 June 1916,” (Headquarters, 1916).


32Edmonds gives a more limited objective but it is clear from the writings of those who planned and fought the battle that the British hoped for a great success. See, Edmonds, Military Operations, France and Belgium, 1915, 1:74-80.

33Bidwell and Graham make this point in Firepower, 73 an observation also shared by Prior and Wilson, Command on the Western Front, 31.

34“Notes at Conference on 5 March 1915,” Haig Collection,
3155/171, NLS. Haig reiterated these objectives after the battle. A First Army memorandum reads:

It was proposed to undertake operations which, should the attack on the enemy's trenches succeed, offered a possibility of a definite advance with a view of breaking the enemy's line.

See, "Memorandum on the Attack on Neuve Chapelle by First Army," (n.d.), Haig Collection, 3155/171, NLS.

Prior and Wilson in their study of Rawlinson propose that the core of the British command control problems lay in the failure of Haig and IV Corps commander to agree on the battle's objectives. Haig envisaged Neuve Chapelle as a major push whereas Rawlinson, who drew up the plans for the operation, consistently tried to limit the attack to simply the seizure of the village. See Prior and Wilson, *Command on the Western Front*, 29-35.

Command control problems impeded the movement of both Rawlinson's IV Corps and Lt. Gen. Sir J. Willcocks' Indian Corps. They held up the advance for most of the day pending the capture of key strong points on their fronts, unaware that their troops had taken them in the initial push. See, Edmonds, *Military Operations, France and Belgium, 1915*, 1:102-3.

Ibid., 1:114.

Quoted in Prior and Wilson, *Command on the Western Front*, 25.


Ibid., 1:149-50.

Ibid., 1:150.

"Rawlinson to Clive Wigham," 25 March 1915, Rawlinson Collection, 5201-33-17, NAM.

Collection, 3155/171, NLS. Joffre reached similar conclusions based upon the experience of his own troops and that of the British. Writing to French regarding future coordinated attacks he listed the preliminary requirements as numerical superiority on a large front; possession of adequate materials; and large reserves of ammunition, both heavy and field. See Edmonds, *Military Operations, France and Belgium, 1915*, 1:154.


45"Rawlinson to Wigram," 25 March and 24 April, 1915, Rawlinson Collection, 5201-33-17, NAM.

46"Rawlinson to Kitchener," 1 April 1915, Rawlinson Collection, 5201-33-17, NAM.


48Ibid. , 2:4-5.

49In his diary, Haig outlined the attack’s objectives as:

1st. Breakthrough and then as soon as possible enlarge the gap 2nd. Extend defensive flank down from Fromelles to Fournes, and then start offensive movement . . . towards Beuvrin.

Haig also notes that the attack would be pressed day and night. See Haig, *The Haig Papers From the National Library of Scotland, May 1915*.


51Ibid. , 2:13-14.

52Ibid. , 2:17-37.


55 Haig, The Haig Papers From the National Library of Scotland, 11 May 1915.

56 “Butler to Corps HQ,” 10 May 1915, WO95/2, PRO.

57 “Rawlinson to Fitzgerald,” n. d., Rawlinson Collection, 5201-33-18, NAM. To Wigram, he wrote, “the moment that it ceased they were able to man their parapets with machine guns.” See, Rawlinson to Wigram, n. d., Rawlinson Collection, 5201-33-18, NAM.

58 “Rawlinson to Wigram,” n. d., Rawlinson Collection, 5201-33-18, NAM.

59 “Rawlinson Diary,” 14 May 1915, 1/1, CAC.

60 Edmonds, Military Operations. France and Belgium. 1915, 2:44.

61 “Western Front in the Great War,” Lecture Series at Camberley, 1920, Montgomery-Massingberd Collection, 114, LHCMA.


63 Ibid. , 2:51.

64 Bewsher, the History of the 51st Highland Division, 23.


66 Haig, The Haig Papers From the National Library of Scotland, 18 June 1915.

67 In the spring the British discussed the role of the New Armies with the intention of locating the decisive point for the coming summer. See, “Note on the Employment of the New Armies,” 5 April 1915, Rawlinson Collection, 5201-33-17, NAM.

68 Haig, The Haig Papers From the National Library of Scotland,
7, 21, 22 July, 1915. This is the first mention of the offensive use of gas by the British in Haig’s diary. The tone is matter of fact; gas had already become an accepted instrument of war.

69“Rawlinson to Fitzgerald,” n. d., Rawlinson Collection, 5201-33-18, NAM.


72“Joffre to French,” 5 August 1915, WO95/157, PRO.

73“Joffre to French,” 12 August 1915, WO95/157, PRO.

74The only exception appears to be Robertson who, while discussing plan for Loos with Haig, suggested that since Joffre was intending a breakthrough battle the British should also. Robertson’s tone suggests a political rather than an operational rationale and wanted the British to be in a good position to claim spoils if peace eventuated.


76“Report by Haig with Reference to GHQ,” 23 June 1915, Haig Collection, 3155/174, NLS; and Haig, The Haig Papers From the National Library of Scotland, 7 June 1915. Haig’s reference to the second line was actually to a line of trenches that the enemy had dug in front of Loos. The true second line lay further back in the enemy’s defenses.

77Haig, The Haig Papers From the National Library of Scotland, 5 June 1915

78Ibid. , 6 June 1915.

79Ibid. , 23 June 1915.
Ibid., 25 June 1915.

Prior and Wilson, *Command on the Western Front*, 103.


"HQ First Army to I and IV Corps," 13 August 1915, Haig Collection, 3155/174, NLS; "Butler to OC I and IV Corps," 13 August 1915, WO95/157, PRO; Haig, *The Haig Papers From the National Library of Scotland*, 13 August 1915; and "Proposal for Attack by IV Corps," 22 August 1915, WO95/711, PRO. Haig reiterated this policy on the next day by writing that any advance on Loos or Hulluch was dependent upon French success. See, "Memo by Haig," 14 August 1915, WO95/157, PRO.

"Maurice to Haig," 22 August 1915, WO95/157, PRO.

"First Army Conference," 6 September 1915, 2-3, 4-5, WO95/158, PRO.

"General Principles of the Attack," 6 September, Rawlinson Collection, 5201-33-67, NAM.

"First Army Conference," 6 September 1915, 2-3, WO95/158, PRO.


Foulkes, *Gas!,* 61.

Ibid., 42-44; "French to the War Office," 16 June 1915, WO32/5170, PRO. French's letter also dwelt upon a number of other issues relating to gas. It called for the establishment of special units, the future Special Brigade, to wage chemical warfare along with the creation of a depot near General Headquarters and the production of gas shells for the 2" mortar. French's principles were:
(a). It is desirable that the first attack should be in the nature of a surprise, and all preparations for it should therefore be made with utmost secrecy.

(b). The front of attack should be such as to ensure a considerable tactical success, and be suitable for the number of troops likely to be available. I consider this front to be about 5,000 yards, until additional divisions are sent out.

(c). The volume of gas should be sufficient to produce adequate results. For this purpose the duration of the discharge of gas, when made from cylinders, should be thirty minutes.

(d). The use of gas from cylinders should be supplemented as soon as arrangements can be made, by gasses of a more poisonous nature contained in bombs dropped from aircraft, and in shells thrown by guns and trench mortars.

92"Cubbitt to French," 24 June 1915, WO32/5170, PRO.

93"French to the War Office," 28 June 1915, WO32/5170, PRO.

94"French to Cubbitt," 5 July 1915, WO32/5170, PRO.


96"Rawlinson to Braithwaite," 28 June 1915, Rawlinson Collection, 5201-33-18, NAM.

97Haig, The Haig Papers From the National Library of Scotland, 5 August 1915.

98"Notes on Scheme by Gas Advisor," 5 August 1915, WO95/157, PRO.

99Haig, The Haig Papers From the National Library of Scotland.
21 August 1915.

100 Quoted in Prior and Wilson, Command on the Western Front, 105.

101 "Maurice to GOC First Army," 7 August 1915, WO95/157, PRO.

102 Haig, The Haig Papers From the National Library of Scotland, 13 August 1915; and "Butler to GOC 1st Corps and 4th Corps," 13 August 1915, WO95/157, PRO.

103 Haig, commenting on the need to preserve secrecy, wrote that, "surprise is always greatest in the first occasion of using some new instrument of war." See, Haig, The Haig Papers From the National Library of Scotland, 26 August 1915. See also, "French to War Office," 16 June 1915, and "French to War Office," 28 June 1915, WO32/5170, PRO; and "First Army Report," 23 August 1915, WO95/157, PRO.

104 "Advance HQ First Army," 23 August 1915, Haig Collection, 3155/174, NLS.

105 "First Army Report," 23 August 1915, WO95/157, PRO.

106 "Notes of Conference held at Advanced First Army Headquarters, Hinges" 24 August 1915, WO95/157, PRO.

107 "HQ First Army to Foulkes," 25 August 1915, Haig Collection, 3155/174, NLS.

108 "First Army Conference," 6 September 1915, Haig Collection, 3155/174, NLS.

109 Ibid.

110 Edmonds reprints the instructions in full. See, Edmonds, Military Operations, France and Belgium, 1915, 2:448.

111 Ibid., 450.

112 "First Army Instructions," 23 August 1915, WO95/157, PRO; "General Principles of the Attack," Rawlinson Collection, 5201-33-67, NAM; Haig, The Haig Papers From the National Library of Scotland,
24 August 1915. The First Army did not target these belts of wire because they lay in ground outside the area which the British could observe and because they were beyond the range of the 18 pounders and 4.5" howitzers who had responsibility for cutting the wire. The British also had insufficient numbers of heavy guns that could reach these positions.


114 "Advance HQ First Army," 23 August 1915, Haig Collection, 3155/174, NLS.

115 "First Army Conference," 6 September 1915, WO95/158, PRO.

116 "47th Division HQ to Brigade HQ," n. d., WO95/2698, PRO.

117 "Gough to HQ First Army," 27 August 1915, WO95/157, PRO.


119 Headlam, History of the Guards Division, 42-43.

120 Ewing, The History of the 9th (Scottish) Division, 21.

121 Erratic shipments of cylinders had begun to arrive in France in July. See Foulkes, Gas!, 60.

122 Ibid. , 61.


124 Edmonds, Military Operations France and Belgium, 1915, 2:160. See also, Foulkes, Gas!, 67.

125 Edmonds, Military Operations France and Belgium, 1915.
2:160-61. The 4 inch version of the Stokes mortar was specifically
designed for use by chemical rounds.

126“Haig to Robertson,” 16 September 1915, WO95/158, PRO.

127The Allies had coordinated their attacks for the same day but
since the French did not use gas they could schedule the hour of
their assault in advance. The time of the British attack was
dependent upon the vagaries of the wind and would be announced
only a few hours before the release of the gas. In the event, the
Allies did indeed attack nearly five hours apart.

128“Haig to G. H. Q.,” 13 September 1915, Haig Collection,
3155/174, NLS.

129Haig, The Haig Papers From the National Library of Scotland,
16 September 1915. The same day Butler asked I and IV Corps to
draw up plans for an attack without gas. See, “Butler to OC I and IV
Corps,” 16 September, 1915, WO95/158, PRO.

130“Rawlinson to HQ First Army,” 17 September 1915,
WO95/711, PRO. IV Corps had at its disposal only 4 - 9.2 inch and 8
- 8 inch howitzers which Rawlinson believed was inadequate to
pulverize the hostile trenches before advancing the infantry. See,
“Rawlinson Diary,” 17 and 19 September 1915, 1/3, CAC. He also
complained to HQ First Army about his need to ration his heavy
artillery shells. See, “Rawlinson to HQ First Army,” 4 September
1915, WO95/728, PRO.

131Haig, The Haig Papers From the National Library of Scotland,
17 September 1915.

132Ibid., 18 September 1915. Haig requested from French a
three day window, believing it improbable that not one of the days
would prove suitable. See, “Haig to G. H. Q.,” 18 September 1915,
Haig Collection, 3155/174, NLS.

133“I Corps Order No. 494(G)65,” 21 September 1915,
WO95/592, PRO; “Rawlinson Diary,” 20 September 1915, 1/3, CAC.

134“Memo from Montgomery to IV Corps Divisional Staff,” 21
September 1915, WO95/1911, PRO.
Rawlinson noted in his diary that:

... it has been decided that we must attack on the 25th gas or no gas but I have as yet received no instructions as to what form the attack is to take if the wind is unfavourable for gas. It will be a thousand pities if we cannot use the gas for I fear we shall not do much good without it.

See, “Rawlinson Diary,” 19 September 1915, 1/3, CAC.

“Memo from Montgomery to IV Corps Divisional Staff,” 21 September 1915, WO95/1911, PRO.


Haig, The Haig Papers From the National Library of Scotland, 26 August and 4 September 1915.

“Notes in Connection with the Employment of Gas in the Attack,” 22 September 1915, Haig Collection, 3155/176, NLS.


Butler also identified a possible tactical superiority that gas would establish for the British. Since the smoke helmet provided complete protection, the British troops should have an advantage in close fighting over German soldiers who were not similarly protected. See, “Notes in Connection with the Employment of Gas in the Attack,” 22 September 1915, Haig Collection, 3155/176, NLS.

“Plan of Operations,” 28 August 1915, WO95/157, PRO; and “15th Division Draft Instructions for Attack on 21st September,” WO95/1911, PRO.

144 Haig, *The Haig Papers From the National Library of Scotland*, 20 September 1915.

145 Robertson, then on French’s staff, cautioned that gas shell must not interfere with the production of high-explosive ammunition. See, “Robertson to WO,” 2 August 1915, MUN4/2340, PRO.


149 “First Army HQ to Corps HQ,” 3 September 1915, WO95/728, PRO; “Estimate of Ammunition - First Army,” Haig Collection, 3155/175, NLS.

150 “Butler to HQ Corps and HA Groups,” 10 September 1915, Rawiins Collection, 1162/3, RAI; “Report on Expended, Estimated Need and Allotted No. of Shells for 21-30 September 1915,” Montgomery-Massingberd Collection, 42, LHCMA; and “IV Corps, G. S. 164/3(D)” 10 September 1915, WO95/1911, PRO.

151 The message read, “A W or SW wind is anticipated for 25th September. Orders to attack with gas will hold. Zero hour will be
notified later during the night.” See, “First Army to I Corps,” 24 September 1915, WO95/592, PRO.

152Edmonds, Military Operations, France and Belgium, 1915, 2:168-71; Haig, The Haig Papers From the National Library of Scotland, 24 and 25 September 1915. Foulkes also summarizes the decision to open the cylinders in Gas!, 65, 68.

153The 15th Division’s War Diary summarized the weather at 5:50 AM as, “dull, light rain, wind very light apparently.” See, “15th Division War Diary Summary,” 25 September 1915, WO95/1911, PRO. For amount of gas released see, “Rawlinson to HQ First Army,” 5 October 1915, WO95/158, PRO, and “OC 187th Co. R. E. to GOC IVth Corps,” 1 October 1915, Montgomery-Massingberd Collection, 42, LHCMA.

154The gas bays on the extreme right and left flanks had only three cylinders while Foulkes had allocated between four and six to those in the Indian Corps. See Foulkes, Gas!, 64.

155“C. A. Ashley Diary,” 25 September 1915, Ashley Collection, IWM.

156They managed to open 2,263 along the main front and an additional 30 in the Indian Corps sector. See, “List of Special Brigade Operations,” WO142/266, PRO, Hereafter “SB Ops” WO142/266. The wind also affected the discharge rate. The commander of each cylinder bay, sometimes only a corporal, had the authority to cease the discharge if the wind was incorrect for the attack, and many did so. However, some local infantry officers insisted on maintaining the program, whatever the wind, and compelled the members of the Special Companies to continue, with predictable results. One gas officer was threatened with summary execution for his refusal to open the valves. See Foulkes, Gas!, 70-71 and Richter Chemical Soldiers, 59, 66-68.

157In only a few emplacements did the engineers succeed in emptying all of their cylinders. Their efforts were slowed by the necessity to transfer the discharge pipe from an empty cylinder to the next one, a process made all the more difficult by the enemy’s shell fire. See, Richter, Chemical Soldiers, 66-70.


The officer of the Special Companies in charge of the gas on the 6th Brigade's front refused to open his cylinders due to the unfavorable wind. The 2nd Division HQ, however, insisted on the discharge, resulting in the creation of a chlorine cloud of such density that even soldiers wearing their respirator helmets became casualties. See Edmonds, Military Operations France and Belgium, 1915, 2:254.

Ibid., 251-61.


Edmonds, Military Operations, France and Belgium, 1915, 2:267-71, 354-61, 369-72, 378-91; Haig, The Haig Papers From the National Library of Scotland, 4, 6, 7 October 1915; "SB Ops" WO142/266, PRO, and Foulkes, Gas!, 85-87. At a conference with Lieut.-Gen. R. C. B. Haking, CO XI Corps, and his divisional commanders, Haig explained that the objectives of the attack on the 13 October were limited, unlike the previous assaults when the goal was to break through the enemy's line. See, Haig, The Haig Papers From the National Library of Scotland, 6 October 1915.
166 C. E. D. Budworth, "Remarks Based on Recent IV Corps Operations," 6 October 1915, Montgomery-Massingberd Collection, 42, LHCMA.

167 See, General Staff, Artillery Notes: No. 4 - Artillery in Offensive Operations, 5. For shell gas principles see, General Staff, Instructions on the Use of Lethal and Lachrymatory Shell (n. p., 1918), 6.

168 C. E. D. Budworth, "Remarks Based on Recent IV Corps Operations," 6 October 1915, Montgomery-Massingberd Collection, 42, LHCMA; "Remarks based on Recent IV Corps Artillery Operations," 6 October 1915, Rawlinson Collection, 5201-33-67, NAM; and "IV Corps to Advanced HQ First Army," 9 October 1915, Montgomery-Massingberd Collection, 42, LHCMA.

169 "Lecture on the Battle of Loos," 27-28, Montgomery-Massingberd Collection, 45, LHCMA.

170 Ibid., 27-28.

171 "Report on the Use of Gas on 25 September, 1915," 5 October 1915, Barley Collection, IWM.

172 "O.C. 187 Company, R. E. to GOC IV Corps," Montgomery-Massingberd Collection, 42, LHCMA.

173 C. H. Foulkes, "Gas Warfare (Offensive) in the Field," 7, draft manuscript for History of the Royal Engineers, Volume X, Chapter XX, 1944, Foulkes Collection, 6-61, LHCMA.

174 "Report on Operations of the IV Corps," 22nd September to 7th October, 1915, WO95/711, PRO. The gas was also responsible for delaying the advance of the 1st Division because the cloud hung around No Man's Land and the soldiers had to advance through it. See, "Rawlinson Telephone Log," 25 September 1915, Montgomery-Massingberd Collection, 42, LHCMA.

175 "Rawlinson Diary," 26 September 1915, Rawlinson Collection, 1/3, CAC.

176 "Lecture Series on the Battle of Loos," 14 December 1915 - 5
June 1916, Montgomery-Massingberd Collection, 45, LHCMA.

177 "IV Corps to Advanced HQ First Army," 9 October 1915, Montgomery-Massingberd Collection, 42, LHCMA.

178 "47th Division at Loos," 9, WO95/2698, PRO. Ironically the 47th Division found only five cases of gassed Germans but suffered themselves several killed and 125 wounded. See, "CO 47th London Division to Advance HQ IV Corps," 2 October 1915, WO95/158, PRO.


180 "Foulkes Diary," 25 September 1915, Foulkes Collection, 2/16, LHCMA.

181 "CO 47th London Division to Advance HQ IV Corps," 2 October 1915, WO95/158, PRO.

182 "Notes on the Operations in the Neighborhood of Loos Between 25th September and 13th October 1915," 8, Rawlinson Collection, 5201-33-67, NAM.

183 "Lecture Series on the Battle of Loos," 14 December 1915 - 5 June 1916, Montgomery-Massingberd Collection, 45, LHCMA.

CHAPTER VI
EXPERIMENTATION

I consider it of first importance that an immediate supply of lethal gas shell should be sent.

- Sir Douglas Haig

Introduction

While gas had failed to bring about decisive victory at Loos, it was successful enough to suggest its potential as a useful adjunct in the attack. Despite the problems with blow back and the attitude that it violated the spirit of sportsmanship, gas would find a role in the British method of waging war. The officer corps had accepted it as a weapon that one used at all opportunities, and had created of specialized units charged with its employment, operational lessons had been incorporated into training materials and courses, and resources had been committed to satisfy the growing demand for necessary materials. However, relative to other weapon systems the importance of gas declined in 1916, as compared to 1915. At Loos, the chlorine cloud was the battle's critical element while at the Somme the various gases and their delivery systems represented a minor sub-theme to the supremacy of the gun. Throughout 1916, one must regard British participation in offensive chemical warfare
as a minor affair. Yet this state of affairs was not a result of a lack of enthusiasm for the weapon but rather a result of material shortages. As the war progressed and Britain expanded its chemical infrastructure, the value of gas and the army’s commitment to it greatly increased. While gas would never again challenge the other means of destroying the enemy for the prestige of being the most vital to the war effort, it would evolve into one of the more important auxiliaries.

Over the course of the year the War Office and the Ministry of Munitions laid the basis for a vast expansion that would compensate for the nation’s scandalous prewar neglect of its chemical industry. The results were dramatic. By 1917 the shortages would ease, by 1918 the position relative to the Germans would equalize, and by 1919, had the war lasted, Britain would have dominated the chemical battlefield. The year of the Somme also witnessed the creation of the Special Brigade and the acceptance of new dispersal systems, particularly for the Royal Artillery, which the British would employ in their quest for an advantage. The chemical struggle against Germany was a constant struggle. First there was the need to find the means to chemically dominate the enemy and, second the necessity to fit gas within the British perceptions of how they had to fight the war. Throughout 1916 the British would seek effectiveness and accommodation on both levels.
Organization

The Special Companies ended 1915 with a number of independent Red Star and Blue Star attacks. The objective of these discharges was to both gain experience and to use up the chlorine, which would soon be superseded by White Star, a mixture containing the far more deadly phosgene. In early January, 1916 the chemical troops withdrew to their winter quarters at Helfaut to train for next summer’s attempt to win the war and to absorb the new drafts as the companies expanded to a brigade-size organization.

During February, Foulkes’ command increased from four to twenty-one companies with a force of more than 5,000 officers and men. The War Office establishment provided four battalions of four companies each (A through Q but no I), a mortar battalion of four companies (one through four), and an independent company (Z company) which was originally responsible for flame thrower operations but after that weapon’s discontinuance it instead carried out gas discharges or experimental work. Foulkes changed his command’s structure as needed but the company designations remained constant till the war’s end. Also attached to the brigade was the Special Factory Section, a company size unit that took over a French phosgene plant at Coulogne near Calais. Sharing the output with their ally, they ran the factory non-stop, working three shifts around the clock every day until the war’s end. During 1916, except for a small plant in England, the Special Factory Section produced all the phosgene used by both the British and French. The final components of the Brigade were the gas advisers who served on the
army and corps level staffs. These officers were responsible for coordinating all Special Brigade operations on their fronts with the local units, and overseeing the command's anti-gas training. The leadership of the chemical warfare service also changed as Brig.-Gen. H. F. Thuillier, R. E., became Director of Gas Services, while the attack and defensive aspects of chemical warfare were split between two offices with Foulkes becoming Assistant Director - Offensive and Commanding Officer Special Brigade and Lieut.-Col. S. L. Cummins assuming the position of Assistant Director - Anti-Gas. Foulkes continued to direct Special Brigade operations and also served at General Headquarters as gas adviser to Haig.⁵

As the Special Brigade underwent its training, the primary difficulty lay in the inadequate provision of offensive materials. Throughout 1916 all gases would remain in acutely short supply and hamper the participation of both the gas engineers and the artillery in the wearing-down phase of battle. The weapon which suffered from the greatest shortages was the four inch Stokes Mortar which had a supply of smoke bombs left over from Loos but would not receive any further ordnance for more than a year after that battle. The 1915 issue were thirteen pound red phosphorus bombs which had performed poorly at Loos. They created an inadequate cloud, had a limited range with a maximum of 350 yards, and tended to fail to ignite upon impact. When they did explode, the bursting charge was excessive and blew the smoke sky-wards.⁶ Its replacement was the vastly improved twenty-five pound white phosphorus bomb, but it was not yet available. Except for the inferior red phosphorus
shells, Foulkes' four mortar companies would have little to do for the first three months of the Somme and even by the end of the year the availability of their ordnance remained irregular.7

This state of affairs regarding mortar ammunition was most unfortunate, as Stokes' invention would prove to be one of Britain's most effective inventions of the war. The four inch pattern, like the two and three inch high versions belonging to the infantry, enabled the user to a target specific position, such as a machine-gun nest or an observation post. For the chemical troops it also had the advantage of permitting a much more discreet attack than with a cylinder discharge, and was more reliable since it was less dependent upon the wind. Furthermore, a mortar shell contained a high percentage of gas relative to its weight when compared to other projectiles. Filled with phosgene the four inch Stokes shell contained 7.5 pounds of gas as opposed to 4.27 pounds in a 4.7-inch shell or the minuscule 1.32 pounds contained in a French 75 mm shell. Although its maximum range of 840 yards could not compete with that of the artillery, the mortar did have a high rate of fire, twenty rounds a minute, and could establish a dense, localized concentration of lethal gas with great rapidity.8

In December 1915, Lieut.-Col. Crossley reported to the Ministry of Munitions the BEF's needs regarding chemical ordnance for the Stokes Mortar. He called for the production of a four inch lachrymatory shell, but if not enough tearing substances were available he recommended the substitution of an asphyxiate filling. Foulkes suggested a two month deadline. He also requested white
phosphorus shells for use as smoke bombs, although he did abandon the idea of an abrasion round filled with corundum to jam the enemy’s machine guns. Crossley also noted the support by Butler for a thermite bomb and a shell filled with an inflammable liquid.\textsuperscript{9}

Foulkes’ expectations of rapid production were unquestionably too optimistic but repeated proddings from General Headquarters failed to produce any ordnance. In late January General Headquarters asked for 40,000 rounds, a lachrymatory agent known as SK to arrive by mid-April, and raised this figure to 200,000 a month later. In April General Headquarters modified their priorities and now requested 40,000 SK and 200,000 smoke bombs. On 16 May headquarters noted the lack of ammunition and reiterated the urgency of the appeal. On 23 August London received another requisition which for the first time included the demand for a lethal filling while requesting, per week, 6,000 lethal, 9,000 SK and 15,000 smoke bombs. Finally, on about 20 September, 3,000 SK bombs arrived and on the 24th they were put into use against Thiepval. The initial batch of white phosphorus smoke shells did not arrive until mid-October.\textsuperscript{10}

Thuillier went to London in late August to resolve an increasingly embarrassing situation, the virtual idleness of an entire battalion of specialized troops while the British Army waged the greatest battle in its history. At a conference at the War Office on the 30th the Trench Warfare Department informed him that the inability to produce smoke shells was due to shortages of phosphorus that no steps had yet been taken to increase the nation’s capacity to
produce the compound. Nor was Thuillier given any satisfaction on when the gas service might expect a regular supply. In mid-September the Trench Warfare Department told Thuillier that he could expect, at best, 5,000 rounds of phosphorus shell. This was one-third of what he had requested, and represented a rate of production that would meet General Headquarter’s request of the previous April fourteen months hence. The supply of SK was also alarmingly low. The Trench Warfare Department estimated that supplies of this gas would allow for the production of only 3,000 bombs per week, which was, again, a third of the initial request, although London had not thought it necessary to alert General Headquarters to the low stocks of SK prior to the Director of Gas Services’ inquiries. The Trench Warfare Department did suggest that it would be possible to increase the production of lethal ordnance for the Stokes Mortar, however no pattern for this variation had, as yet, passed inspection.\(^{11}\)

As an interim solution, Thuillier proposed rearming the mortar companies with the two-inch Stokes, for which gas bombs were available. This munition was already in use with some divisional trench mortar battalions and intelligence had credited them with success. The 24th Division had fired twenty rounds into Guillemont on 3 September and investigators subsequently ascertained that the enemy had suffered numerous casualties; they discovered some Germans in the process of donning their respirators when they were overwhelmed by the gas. The Special Brigade did take up the weapon and employed it, firing White Star bombs, on six occasions in
September and October 1916. However, their commitment to the smaller weapon was fleeting and the mortarmen continued to wait for their promised ammunition.\textsuperscript{12}

Supplies were more plentiful for cylinder discharges but Haig would still receive only a little over half of the gas materials he requested for the opening of the Somme. The Ministry of Munitions managed only 16,600 of the 35,000 White Star cylinders requested, and they shipped 6,300, less than a fourth, of the 26,600 pipe fittings required. To make up the shortage the Special Brigade still had approximately 10,000 Red Star cylinders as well as 2,100 Two Red Star containers in France.\textsuperscript{13} Despite chlorine being considerably less lethal than phosgene, as well as impermeable to German respirators, the British would have to continue to employ it in alarmingly large quantities. The battlefield consequences of the Ministry of Munitions inability to provide sufficient stocks of phosgene is, perhaps, best suggested by comparing the relative lethality of the principle war gases.
Table 6.0
Lethality of Principle War Gases\textsuperscript{14}

<table>
<thead>
<tr>
<th>Gas</th>
<th>Lethality Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine</td>
<td>7500</td>
</tr>
<tr>
<td>Mustard Gas</td>
<td>1500</td>
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<tr>
<td>Chlorpiprin</td>
<td>1000</td>
</tr>
<tr>
<td>Diphosgene</td>
<td>500</td>
</tr>
<tr>
<td>Phosgene</td>
<td>450</td>
</tr>
</tbody>
</table>

In 1916, therefore, the British had to maintain in their arsenal a weapon that was nearly seventeen times less deadly than the best available substance. To their credit, however, the Special Brigade did manage to make nearly ninety gas attacks, in addition to a large number of smoke discharges, over the months of the Somme\textsuperscript{15}.

The final major gas dispersal system available to the British before the Somme was the artillery. Shells had been the initial means to discharge gas, and the Germans had used them first against the British at Neuve Chapelle on 27 October 1915. Since 2nd Ypres its employment by the enemy, as well as the French, had increased greatly, and during the Verdun battle the combatants would make profligate use of the weapon. The British were once again behind the enemy in developing this weapon, but, along with the other players, they correctly anticipated a massive role for the artillery in chemical warfare. By the end of the war the average amount of gas shells as a factor of total shells was approximately 50 percent for Germany, 35 percent for France, 25 percent for Britain and 15 percent for the
United States, and the British and Americans planned further increases for 1919. However, for 1916 Haig set the objective at 10 percent and then only for three weapons, the 4.5-inch howitzer, and the 60 pounder and 4.7-inch guns. Even these modest objectives were not reached.\textsuperscript{16}

The usefulness of gas shell and its superiority, in several areas, over cylinder discharges was readily apparent. The employment of shells increased the opportunity to surprise the enemy, since the attacker delivered the gas directly to the objective with little warning. This increased the potential of harming or killing enemy troops before they could don their respirators, in contrast with the cloud method, where an observant defender might hear the release of the gas or see its approach. Artillery, although not free from constraints, had a much wider range of suitable wind conditions, and its use also avoided the onerous task of carrying forward and emplacing the heavy and awkward containers. Tactically, it allowed for more flexibility and selectivity, and its range permitted the gunners to fire upon distant targets, protect the infantry from enemy batteries, or help assaulting troops defend their objectives from hostile counter-attacks. For some missions gas shell would prove particularly useful, especially in counter-battery and counter-preparation, as well as harassment and isolation fire. Finally, artillery permitted the establishment of a prolonged gas attack, an approach frequently used by the British with the objective of killing or wearing down the morale of enemy by forcing them to wear their anti-gas equipment for lengthy periods of time. A long exposure to
poisonous fumes would render the enemy's respirators useless by exhausting their neutralizing chemicals, while being forced to breathe through a gas mask was an effective method of lowering morale. However, cloud gas did have certain advantages that the artillery could not duplicate, especially the dense concentration of lethal agents that the Special Brigade obtained.\textsuperscript{17}

In the future, the gunners would usurp the Special Brigade's position as Britain's principal wager of chemical warfare. During the Somme, however, the shortages of chemical munitions were severely felt by the Royal Artillery. Throughout 1916, the pressing need facing the Ministry of Munitions was to end the shortages of high explosives that had made conduct of the war so difficult the previous year. The allocation of resources for the production of chemicals for artillery shells and the building of specialized factories to fill these shells came as a poor second behind assuring a large supply of explosives. Gas would have to wait, and the gunners would have to make do with what chemical shell was available.

While the principle hindrance to the rapid production of chemical shell was the shortage of both the filling and the containers in which to put the limited amount of chemicals they did have, the situation was further exacerbated by the army itself. General Headquarters was unsure of exactly what they wanted and in what quantities, which led to a blizzard of requisitions and revisions. Initially Haig desired lachrymatory shells for the 4.7-inch and 60 pounder guns and the 4.5-inch howitzer, but his staff also made requests for designs for the 6-inch, 8-inch, 9.2-inch, and 12-inch
howitzers and the 6-inch gun, along with asking for changes in the nature of the fillings. Even Haig admitted that his needs were uncertain because the whole affair was still of an experimental nature. The Chemical Advisory Committee recorded its despair over the army's varied requests for chemical shell, cylinder gas and mortar bombs, and adopted a resolution at their 24 May 1916 meeting which noted testily:

The committee desires unanimously to record their opinion that, had the demands for chemicals now made known been put forward in the latter part of last year, those demands could have been, by this date, adequately met.¹⁸

The committee's claim is dubious, as the problem they faced was not only one of defining needs but also of creating a whole new class of delivery systems. The designs of the shells, and whether to use cast iron or steel were only two of a whole series of complex technological issues. Hence, the Ordnance Committee did not approve the specifications of a SK shell for the 60 pounder gun and the 4.5-inch howitzer until mid-February, a general purpose chemical shell for these calibers until a month later, and the 4.7-inch gun drawings only in April.¹⁹ The army's planners, therefore, never had a clear idea of how many chemical shells they would have available nor for what guns as they made their preparations for the Somme. Shell gas would be a part of the British arsenal but in what quantity remained uncertain.
The Ministry of Munitions placed its first order for a gas filled shell in October 1915 when it directed Woolwich to produce 10,000 cast iron lachrymatory shells for the 4.5-inch howitzer at a delivery rate of 500 per week, an order the arsenal did not complete until late April 1916. In mid-January General Headquarters requested that the Ministry of Munitions undertake to provide for a continuous supply of chemical shell for the 4.5-inch howitzer and 60 pounder gun at the rate of 10 percent of their total production and up to 5 percent for the 12-inch howitzer. Butler reiterated this position at the end of February, although Major-General John Du Cane noted that the only shell actually being manufactured, and at a rather torpid rate, was the 4.5-inch cast iron. However, in early March the War Office did prepare to place an order for 1,000 rounds a week for the 60 pounder, a figure it soon raised to 6,000. Organizational progress occurred on 10 March when the War Committee approved the construction of a factory for the filling of phosgene shells, a plant which would enter production in late summer, and it passed a resolution calling for the accumulation of as large a supply of gas shells as possible in France.\textsuperscript{20}

In April the demand clarified a bit as the army made a request for weekly shipments of 34,610 chemical shells, broken down to: 4.5-inch - 18,000, 60 pounder - 7,840, 4.7-inch - 930, and 6-inch howitzer - 7,840. The figures represented 10 percent of the supply of ordinary shell for these calibers, however the War Office delayed action on the 6-inch howitzer because its supply of high explosive
shell took priority and was not up to requirements. The Ministry of Munitions replied a few days later and estimated supply as:

- 4.5-inch cast iron - 10,000 completed by 1 May, 500 per week there after.
- 4.5-inch Steel - delivery to commence in May and working up to 10,000 per week by the second week in June with a considerable increase in July.
- 60 Pounder Steel - delivery to commence in May and build up to a rate of 1,000 a week by mid-June and increasing to 2,500 in July.
- 6-inch Howitzer and 4.7-inch gun - available in summer.

The report went on to caution that filled shells actually existed for only the 4.5-inch cast iron and that the others were still experimental and were subject to delay.

In early June General Headquarters produced its own estimate of what it would have on hand for the Somme. By 15 June General Headquarters expected stocks of 12,000 rounds for the 4.5-inch howitzer with possibly another 4,000 by the battle's beginning, and for the 4.7-inch gun and the 60 pounder gun they anticipated 2,000 shells by the end of the month. However, a different report from the same period revised the figures downward and noted that there would be only 7,330 4.5-inch SK shells with Fourth Army and a further 1,000 with Third Army. Of the other calibers there would be nothing. Haig's shortages forced him to turn to Joffre and ask for the
loan of up to twenty batteries of 75 mm guns equipped with as many gas shells as possible. The French came to Haig’s assistance and their batteries would fire considerably more chemical shell than the British on the 1st day of the Somme.23

Circumstances did improve as the summer passed into the fall but a report of 1 September showed a considerable gap still remained between supply and demand. The army now wanted 30,000 lethal rounds a week but could only count on 2,500 Jellite, 6,700 CBR and 11,000 PS, although its request for 5,000 SK was now being met. Mortar demand for lachrymatory shell stood at 9,000 but availability was 3,120 although a few days later this figure rose to 5,000, and the request for 6,000 lethal Stokes’ bombs remained unfulfilled as the shell’s design remained unapproved. The problem, however, except for SK, was no longer a shortage of chemicals but of shell in which to pour the chemicals, and of filling lines in which to assemble the ammunition. Britain’s expansion of its chemical infrastructure was starting to bear fruit, and though much remained to be done to close the gap with the Germans, the British had laid down the foundation for a massive expansion of the necessary industries.24

The Somme

The British Army based its plans for 1916 on the agreements reached by the Allies at the Chantilly Conference of 6 December 1915 and renewed at the Paris meeting of 27 March 1916. It called for the French, British, Italian and Russian armies to launch
simultaneous offensives, as soon as possible, with the objective of seeking a decisive action. Further, until the event reached its decisive point the Allies were to continue to build up their own resources while wearing down the enemy’s morale and using up its reserves. The German success against the Russians at Gorlice-Tarnow and the attritional battle with the French at Verdun ruined the Chantilly plan of coordinated offences, but the need to come to their coalition members aid only intensified the British desire to seek battle with Germany in France, the theater which the Chief of the Imperial General Staff, the general staff, and Haig, the new commander of the British Expeditionary Force, all agreed was the decisive one. From its conception, the senior officers envisioned the battle, which would become known as the Somme, as the culmination of a lengthy process in which the British Army would weaken the enemy, use up their reserves in a wearing down struggle leading up to the decisive moment and collapse of the German Army, just as the principles of the FSR dictated.

At a meeting with his army commanders on 8 January 1916 Haig explained the offensive’s objectives and the means by which he planned to achieve victory. He directed his subordinates to “work out schemes for (a) preliminary operations to wear out the enemy and exhaust his reserves and (b) for a decisive attack in the hopes of piercing the enemy’s lines of defence.” A few days later Haig’s offensive program for 1916 took a more structured form. He now broke his instructions into three parts, specifying that:
1. 'Winter sports' continued into the spring, i.e. capturing lengths of enemy trenches at favourable points.
2. Wearing out fight similar to [item one] one but on a larger scale at many points along the whole front. Will last about three weeks to draw in enemy reserves.
3. Decisive attacks at several points: object to breakthrough.\(^{27}\)

The first used the term 'winter sports' as a euphemism for small unit attacks, including raids by the infantry, surprise bombardments by the artillery, and discharges of gas by the engineers, with the intention not only of causing casualties but also of weakening the enemy's morale. Additionally, success would increase the morale of British troops resulting in an asymmetric advantage. In the second Haig reference was to brigade or divisional size operations whose primary purpose was to force the enemy to commit his reserves, which would then be unavailable when the British struck the decisive blow. These medium sized operations were to precede the principle attack by no more than two weeks. Haig's reference to the decisive blow at several points in his third section recognized the need for the Allies to coordinate their efforts and for all of them to participate in the final struggle. Haig also left open the option for the British to launch an attack on one sector, and if it did not achieve a breakthrough, to quickly switch the attack to another section of his front.\(^{28}\) At this point, Haig leaned towards an attack in Flanders under the direction of Plummer's Second Army. Only later in his
preparations, and at Joffre's suggestion, did his focus shift to the Somme and Rawlinson's Fourth Army. 29

Haig expected the final struggle to come in June-July and the army was to spend the intervening months in training and wearing down exercises. The armies were to stage raids in the period of February to the beginning of April, then from the second half of April the scale of the operations was to increase to divisional-size battles. 30 The army commanders responded quickly to their assignment and at the end of January, at another conference, they reported the commencement of these operations and their initial success. 31 Haig held strong opinions on the efficacy of raids. He saw them as an essential ingredient of the wearing down process and as a means to cultivate the offensive spirit, and hence morale, of his own men. 32

Joffre did not fully agree with Haig's intentions and instead wanted to launch the large scale preliminary attacks at an earlier date in the sequence. Haig, however, insisted on such attacks occurring no more than ten to fourteen days in advance of the decisive battle. He saw their primary task as being to force the enemy to commit his reserves, and to commence these battles too early would allow the enemy to stabilize the situation and then transfer units back into the reserves. Instead, Haig preferred to keep the focus on minor operations to advance the wearing down process. 33 He reiterated his position in his "Plans for Future Operations," a position paper which correlated the success of the summer's offensive with the strength and efficiency of the German
reserves. Again he pointed out the need for minor operations to wear down the Germans, and argued that they should increase in scope as the main offensive approached. He scheduled the divisional operations for no more than two weeks prior to the decisive battle and re-emphasised their importance in engaging the enemy’s reserves. However, by April Haig had lost his enthusiasm for the preparatory attacks and, in light of the German losses at Verdun, he no longer believed them necessary.34

Haig conferred with his army commanders in late May and identified the Somme sector as the likely location for the assault. In support of Fourth Army he asked the commanders of First, Second, and Third Armies to provide plans for misleading the enemy as to the site of the real attack. He suggested a program of:

(a) Preliminary preparations such as advancing our trenches and saps, construction of dummy assembly trenches, gun emplacements, etc.
(b) Wire cutting at intervals along the entire front with a view to inducing the enemy to man his defences and causing fatigue.
(c) Gas discharges, where possible, at selected places along the whole British front, accompanied by the discharge of smoke, with a view to causing the enemy to wear his gas helmets and inducing fatigue and causing causalities.
(d) Artillery barrages on important communications with a view to rendering reinforcements, relief and supply difficult.
(e) Bombardment of rest billets at night.
(f) Intermittent smoke discharges by day, accompanied by shrapnel fire on the enemy's front defences with a view to inflicting loss.

(g) Raids by night, of the strength of a company and upwards, on an extensive scale, into the enemy front system of defences. These to be prepared by intense artillery and trench mortar bombardments.35

Also distributed at the meeting was a paper on the Special Brigade and the use of gas and smoke. It outlined the composition of Foulkes' unit, its weapons, and its gases. The paper also included a ten year history of wind direction in France and Haig instructed the armies to take advantage of any winds from between west south west and south south west.36

This paper also identified one of the fundamental problems of Chemical Warfare, the difficulty of effectively attacking an enemy equipped with an adequate respirator. A technological solution, and one which the combatants pursued throughout the war, was to develop a vapor against which the enemy's mask afforded no barrier. However, in 1916 no such vapor existed and the only chemical that had any penetrating ability was PS and then only partially. The other solutions were tactical, either surprise the enemy's troops so that they took a few breaths of corrupted air before they realized their peril, and phosgene needed only that, or create either a dense concentration of gas or an exposure of such
duration that the poison overwhelmed the respirator’s protective capabilities.\footnote{37}

At the time of the report’s writing the British had lethal gases only for cylinder operations. It recommended that to disable the enemy before they put on their masks it was necessary to have a brief discharge from a great number of cylinders. To eliminate them by wearing out their respirators it was necessary to gradually open a series of cylinders so as to sustain the discharge for at least two hours. It continued that:

(a) For surprise effect, at least 4 cylinders simultaneously per bay, but it would probably suffice to discharge half the contents only then turn off.
(b) For wearing effect, one cylinder per bay every 15 minutes, combined with smoke - possibly one cylinder in every second bay would suffice.\footnote{38}

As for the type of gas, the report recommended White Star for surprise effect and either Red Star or Two Red Star for a lengthy flotation. Finally, to increase the chances of surprise, it established the policy of making cylinder discharges at night. These tactics became the basis of Special Brigade attacks, and the artillery would also adopt them.\footnote{39}

While it fell to Haig to outline the offence’s objectives, it was Rawlinson’s task to develop the plan. From the evidence the two generals did not share the same perceptions as to the nature of the
operation. While Haig wanted a breakthrough battle and Rawlinson preferred a ‘bite and hold’ assault, it is clear that their ultimate goals were the same, and they both envisioned the Somme as a decisive struggle. On 26 June Haig entered into his diary that he hoped to:

1) break enemy’s front
2) secure position about Bapaume and Givenchy
3) enlarge breach
4) advance on line Cambrai-Douai

Had the British achieved these ambitions their advance would have severed the enemy’s lines of communication and forced the Germans to abandon much of their conquests in Northern France and Western Belgium. Even Haig’s designation of Gough’s force as Reserve Army, not Fifth Army, showed his intention to use it as a breakthrough mass once Rawlinson had created a breach. As the battle progressed Haig maintained his optimism. He created a temporary Cavalry Corps to take advantage of the enemy’s rout and continued to believe that the resumption of open warfare was imminent. Even as the battle came to an end Haig could argue that the enemy were nearly out of men.

However the controversy that Edmonds discusses in the Official History has been exaggerated. While Rawlinson’s initial plan did merely call for the seizing of the enemy’s front line, and on the left parts of their second line, he nevertheless, sought a decisive battle. Instead of a rapid breakthrough, Fourth Army was to grab parts of
the German position and then bleed the enemy when they tried to recover their lost territory. Rawlinson explained his ideas in his paper on preparations for the battle. He wrote:

Our object rather seems to be to kill as many Germans as possible with the least loss to ourselves, and the best way to do this appears to me to be to seize points of tactical importance which will provide us with good observation and which we feel certain the Germans will counter-attack.\textsuperscript{43}

Rawlinson was reviving one of the observations he had made about the battles on 1915 but on a bigger scale.\textsuperscript{44} He wanted to rely upon the superiority of defensive technology and fortifications to destroy the German Army. In effect Rawlinson wanted to attempt what General Eric von Falkenhayn had failed to do to the French at Verdun. When the Germans had fought themselves into exhaustion and their morale had collapsed from the futility of their attacks, the time would have arrived for the British to resume the attack, smash through the enemy’s lines, release the cavalry and bring about the end of the war.

Haig, of course, had the final say in defining Fourth Army’s objectives. On 22 June Rawlinson issued a memorandum explaining that if the enemy’s resistance broke down sufficiently on the first day to permit the use of the cavalry their objective would be Bapaume, the principle railhead for the sector. A further notice, just days before the attack, recommended that if the enemy collapsed,
the nearest infantry unit should immediately press forward so that no time would be lost in expanding on the initial success. At a conference with his corps commanders, Rawlinson stressed the need for the assaulting troops to maintain a continuous forward movement and to press through right to their objectives. Lieut.-Gen. Launcelot Kiggell, Haig's chief-of-staff, was extremely confident of success and told Rawlinson that if the attack went well then the cavalry had to move quickly on to Bapaume. Haig's entreaties wore the Fourth Army commander down, and in his orders for 1 July Rawlinson noted that a large part of the enemy's reserves had already been drawn into the battle and it was essential to keep up the pressure to wear out the defense. He then entered in his diary, "I feel pretty confident of success . . . though only after heavy fighting." He continued that while he did not expect "the bosche to break he is prepared to take advantage of one."

Ironically, after the debacle of 1 July, British operations tended to resemble Rawlinson's idea of 'bite and hold' rather than Haig's. Subsequent attacks looked for opportunities to kill the enemy and to seize limited chunks of territory. However, with every advance, Haig remained hopeful that the enemy would break and his orders continued to remind his subordinates that they needed to be prepared to immediately switch to unlimited objectives if the Germans collapsed. At a meeting before the 14 July attack he advised Rawlinson to make sure his divisions were ready to push forward if the enemy's defenses broke down. Haig's hopes for a breakthrough were revived in September with the introduction of
tanks, and he again impressed upon his officers the need for bold action and the avoidance of unnecessary delay in moving forward. Finally, he always sought a role for the cavalry, who continued to prepare for their chance.\textsuperscript{50}

**Gas and the Somme**

For a week the British had subjected the Germans to a relentless barrage in preparation for the assault. At 6:25 AM on the morning of 1 July the program intensified and at 7:22 AM the gunners unleashed a hurricane bombardment as shells and mortar bombs rained down upon the enemy. At 7:30 AM the infantry rose and, under the burden of sixty-six pounds of equipment, began their slow, lumbering walk towards the enemy lines. The results are well known. German machine gunners emerged from their deep dug-outs, won the race to the parapet, and began to scythe through the British ranks while enemy guns concentrated their fire upon the exposed infantry caught in No Man’s Land. The day’s carnage would cost Britain nearly 60,000 men.\textsuperscript{51}

There were some small successes. On the far right the French Sixth Army, which attacked in support of the British, quickly and cheaply reached their day’s goals. The British XIII Corps, also on the southern flank, did manage to get as far as some tertiary objectives but the next corps in line, the XV, was less fortunate and only its 7th Division reached its intermediary objectives, while the 21st and 34th Divisions barely achieved their first objectives. Further to the north the situation worsened. The assaults of the III, X and VIII Corps
were largely repulsed with little or no gain, while the diversionary attack at Gommecourt by Third Army’s VII Corps also failed. Gough, who was at the Fourth Army Headquarters with a small staff to take advantage of any gap made in the enemy’s line waited, in vain for the chance to advance the cavalry of the General Headquarters Reserve.52

Rawlinson’s plan had depended upon the effectiveness of the artillery to physically crush, or at least morally destroy, the German defenders. The preliminary bombardment began on 24 June and continued with increasing ferocity up to the assault. Unfortunately for the attackers, the enemy’s deep dug-outs had provided a secure refuge which the artillery did not penetrate, a problem exacerbated by the high percentage of defective shells in the British ammunition and an inadequate number of heavy guns for an attack of such depth and breadth. The battle was far from over, however, and the British would renew their offensive the next day and make a series of fresh efforts into November. The catastrophe of the first day would not be repeated and the Somme settled into an attritional exchange with the combatants’ casualties, allowing for the exception of 1 July, virtually equal, so that the experience became equally horrific for the German and British soldiers.53

What role did gas play in the preparations for the battle and did British gas ideas respond to problems revealed in the tactical environment once the battle began? Additionally, what role did the battle play in shaping the future use of gas? As discussed earlier the supply situation doomed gas to a minor role in the battle, but it was
material shortages that stifled implementation, not a shortage of ideas. To the extent that gas was available the British used it to gain an asymmetric advantage over the enemy and thereby establish the essential condition for a decisive victory. Rawlinson saw gas as a means to help establish a superiority in morale and to assist the maneuver of the infantry on the battlefield.

Morale remained crucial to Rawlinson’s understanding of the nature of war. In his “Tactical Notes,” of May 1916, he stressed the continued importance of the intangible aspects of war and expressed the conviction that, “this war will be won by superior discipline and moral[e].”\textsuperscript{54} The same month General Headquarters issued a leaflet entitled “Training of Divisions for Offensive Action,” which also emphasised the critical nature of morale, soldierly spirit, and the determination to succeed, along with the principle that “decisive success in battle can be gained only by a vigorous offensive.”\textsuperscript{55} General Headquarters expected gas to contribute to this battle for morale. They believed that forcing the enemy to wear their masks would induce fatigue and thereby lower their efficiency. On 27 May Haig informed Rawlinson that he had instructed the other armies to implement a program which would exhaust the enemy’s morale. His orders included the extensive use of raids, the bombardment of rest billets, and the discharge of gas.\textsuperscript{56}

Rawlinson knew that there were two key problems, the solutions to which would determine the success of the battle. The first was the enemy soldiers who manned the trenches and strong points. Hidden underground in their deep bunkers beneath sturdy
layers of chalk, or in the basements of fortified villages, the enemy was invulnerable to all but a direct hit from a large caliber howitzer. Rawlinson understood the strength of these defenses, particularly the strongpoints, and how difficult it would be for the British gunners to subdue them. His “Tactical Notes” concede only two practical solutions, either screen the positions with smoke or neutralize the defenders by causing them to panic. The British would attempt both methods during the battle. The second threat was the enemy’s batteries which could bring devastating fire onto the assaulting troops or isolate the first wave from follow-up units by interdiciting the battle zone. If the British counter battery failed to suppress the enemy’s guns, the attackers would suffer heavily.

Rawlinson was initially reluctant to use chemical warfare at the Somme. In his operations plan of 3 April he wrote:

As regards gas, generally speaking, now that the enemy is provided with efficient masks, it appears to me that the disadvantages of using gas outweigh the advantages on account of its dependence on a suitable wind, its danger to our own troops, and the handicap to our men of wearing masks when assaulting.

Some of his subordinates also voiced their own concerns regarding the use of gas, particularly the potential for its release to alert the enemy to the commencement of the assault.
However, Rawlinson’s objection to gas rested upon his fear of a repetition of Loos rather than any scepticism towards the weapon. Prior to the writing of the Somme plan he had signalled an interest in the use of poisonous vapors. In March he queried his corps commanders on their requirements for chemical warfare and demanded an estimate of their gas and smoke needs. In April he followed up with another enquiry, this time asking for information on their needs for a one-hour discharge. Even in his original battle plan, although he rejected gas he also made allowances for its use. The plan suggested the use of cloud attacks on the defensive fronts and went so far as to recommend the releasing of small quantities of gas mixed with smoke in order to compel the enemy to put on their respirators and thus be at a disadvantage when faced by non-masked British troops. By mid-May he had provisionally scheduled two half-hour discharges, along with shrapnel barrages, along his entire front for the evening of X/Y day. General Headquarters also made it known that it expected not only Fourth Army but all the armies to make gas discharges. In May Haig told his army commanders that they would each have at their disposal 3,000 White Star and 2,000 Red Star or Two Red Star cylinders along with a battalion of troops from the Special Brigade. As well, he let them know that General Headquarters held a reserve of cylinders which he would release as needed.

By the end of May Rawlinson had gone from reluctance to enthusiasm. Despite his allocation of only 5,000 cylinders, he advanced a program that required 11,400 cylinders, the preparation
of 571 bays and two battalions from the Special Brigade. The attack along 14,000 yards of front would last two hours and he would authorize its launch at anytime up to and including Y day. The program ran:

- Z to Z + 4 minutes - Discharge 4 White Star cylinders per bay.
- Z + 4 to Z + 124 minutes - Discharge 1 Red Star or 1 Two Red Star every ten minutes per bay
- Z + 124 to Z + 128 minutes - Discharge 4 White Star cylinders per bay.

By 6 June the program had expanded to include a heavy shrapnel bombardment of the front line, to destroy any Germans who manned their defenses in expectation of an attack, along with the shelling of communication trenches and reserve billets. Additionally, the British infantry were to engage in rapid rifle and machine-gun fire to help preserve surprise by covering the noise of the gas during its initial release. Ten to fifteen minutes after the end of the discharge, the artillery was to unleash a heavy concentration of fire to catch the German relief and medical parties.

Rawlinson had outlined a plan that conformed to the principles of gas discharge which Haig had distributed to his commanders at their conference. He aimed to use a surprise release of a dense cloud of phosgene to kill the enemy before they had adjusted their masks and then follow up with a prolonged discharge to wear out the protective elements of the German soldiers’ respirators. Then, a final
release of concentrated White Star would finish off those Germans whose masks no longer afforded adequate protection. His intentions were clear. Rawlinson wanted to cause massive casualties along the entire front on which he intended to attack, and thereby force the Germans to replace the depleted units with their reserves. He also anticipated that the unexpected defeat would cause a sudden drop in the enemy’s morale. The British would use similar tactics in 1918 in their so-called “Beam Attacks.” Additionally, it is probable that Rawlinson was experimenting with a means to reach the enemy even while they were protected in their shelters from the British artillery, and that he hoped to devastate the enemy’s rear area installations such as headquarters or batteries. There is no hard evidence to support such a claim, but later developments in mid-July would suggest that the British had begun to apply gas for such a purpose.

The plan, if anything, was too ambitious and its grand scope would not long survive. One problem was the size of the attack. At 14,275 yards the convoluted front was far too long. A simultaneous discharge of gas required the unlikely event of a suitable wind blowing along the front’s entire length, and a wind that was acceptable along one sector might actually be quite dangerous to the British front line soldiers at another point. Additionally, Fourth Army’s plan simply called for too much gas. Haig would have had to leave the other armies with none which would violate his objective of inflicting casualties along the entire British zone in order to draw in German reserves as the principle attack approached.
As the Somme neared, Rawlinson remained uncertain as to how to schedule his gas. On 12 June he revised the cloud gas program and noted, “although the discharge will probably be of great value and inflict considerable casualties,” he found it necessary to leave it to the discretion of his corps commanders when to discharge and in what quantity. However he still recommended that they use up their more lethal White Star first, followed by Red Star and Two Red Star. Yet two days later Rawlinson took back the responsibility and told his subordinates that army headquarters would set zero hour for the discharge by 5 PM on the afternoon prior to the attack. The program for the preliminary bombardment authorized the release of gas on any night from U day on if the wind was favorable, with the exception of the final evening before the assault when he forbade any discharges. The prohibition was not only to prevent the gassing of British troops but also because a discharge tended to bring on an enemy retaliation against the point of flotation. On Y/Z night the trenches would be packed with assault troops, and to induce a barrage could result in severe casualties.

On the 27th Rawlinson again reversed course and scheduled the evening of U Day for a simultaneous discharge along his army’s front. He forbade corps-level releases until the mass cloud attack had taken place. His instructions also reminded his subordinates that the ultimate decision to open the cylinders remained with the Special Brigade officers and was dependent upon the wind. On the 24th the weather forecast was favorable and Rawlinson ordered the attack for 10 PM, U day. However, by evening, the wind was nearly
nil and the gas officers cancelled the discharge, except in front of 4th Division where the air speed was 3 MPH.\textsuperscript{69}

Once again the weather proved itself the critical element in cloud gas attacks. Although the wind had ruined Rawlinson’s plan for a synchronized release over the next several days, the Special Brigade launched a series of attacks all along the entire British Expeditionary Force front, opening over 10,000 cylinders. For a summary of the operations during the preliminary bombardment see Table 6.1.

Table 6.1\textsuperscript{70}

<table>
<thead>
<tr>
<th>Date</th>
<th>Army</th>
<th>Location</th>
<th>Ammunition</th>
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<td>4th</td>
<td>N of Beaumont Hamel</td>
<td>150 White Star</td>
</tr>
<tr>
<td>June 26th</td>
<td>4th</td>
<td>SE of Hébuterne</td>
<td>178 White Star</td>
</tr>
<tr>
<td>June 26th</td>
<td>4th</td>
<td>SW of B. Hamel</td>
<td>378 White Star</td>
</tr>
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<td>June 26th</td>
<td>4th</td>
<td>Becourt - Mametz Road</td>
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<td>436 White Star</td>
</tr>
<tr>
<td>June 26th</td>
<td>4th</td>
<td>E of Authuille</td>
<td>302 White Star</td>
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<td>4th</td>
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<td>66 White Star</td>
</tr>
<tr>
<td>June 26th</td>
<td>4th</td>
<td>W of Ovillers</td>
<td>163 White Star</td>
</tr>
<tr>
<td>June 27th</td>
<td>4th</td>
<td>N of Ovillers</td>
<td>152 White Star</td>
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Table 6.1 Cont.

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<th>Distance</th>
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<td>3rd</td>
<td>Beaurains</td>
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<tr>
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<td>3rd</td>
<td>E of Monchy</td>
<td>1,757 White S.</td>
</tr>
<tr>
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<td>4th</td>
<td>W of Serre</td>
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<tr>
<td>June 27th</td>
<td>4th</td>
<td>Angres &amp; Lievin</td>
<td>346 White Star</td>
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<td>1st</td>
<td>Hulluch Salient</td>
<td>1,055 White S.</td>
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<td>Blairville/Ficheux</td>
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</tr>
<tr>
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<td>3rd</td>
<td>NE Wulverghem</td>
<td>1,862 White S. and Red S.</td>
</tr>
<tr>
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<tr>
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<td>4th</td>
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<td>107 White Star</td>
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<td>2nd</td>
<td>Le Touquet</td>
<td>210 White Star</td>
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<tr>
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<td>Le Touquet</td>
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<td>2nd</td>
<td>Bellewarde</td>
<td>223 White Star</td>
</tr>
<tr>
<td>July 1st</td>
<td>2nd</td>
<td></td>
<td>119 White Star</td>
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After the commencement of the Somme, the chemical engineers continued to support the offensive with discharges on non-battle fronts, both to cause casualties and to reduce the enemy’s morale, in fulfilment of Haig’s orders for the other armies to hold the enemy to their sectors and to cause them losses.\textsuperscript{71} Due to local conditions, some targets became favorites of the Special Brigade, such as the Huliuch Salient on the First Army front. It received 1,037 White Star cylinders on 5 July, 927 more White Stars on 20 August, and another 2,537 White Stars and Red Stars on 5 October. The last date was a busy one for the chemists as they also released nearly 2,000 White Star cylinders at Nieuport in support of a French operation. Most operations, however, were much more modest and took the form of harassment or wasting assaults on small frontages. Foulkes’ companies would open an additional 26,262 cylinders by the battle’s end.\textsuperscript{72}

Foulkes’ mortarmen also played a role in the battle. Initially, due to the lack of gas ammunition, they had to limit their role to the creation of smoke screens. On 1 July, at 7:30 AM, as the British infantry began their assault, the Special Brigade mortars opened fire along the line targeting in particular the enemy’s fortified villages and strongpoints, such as Thiepval, Fricourt, Gommecourt, and Ovillers. Their objective was to obscure the advancing infantry from the machine guns hidden within these locations. Within minutes they had set off over 4,300 red phosphorus bombs. As the battle continued, the planners repeatedly called upon the Special Brigade to
provide smoke, such as for XIII Corps attacks against Guillemont on 16 and 21 August.\textsuperscript{73}

The mortar companies eventually did get gas bombs and began employing them in September. As a temporary expedient they employed the 2-inch Stokes mortar to fire phosgene into High Wood on 2 September and Guillemont the following day but it was not until 24 September when they fired their first 4-inch lachrymatory gas ammunition against Flers and Thiepval. Over the next two months they would shoot over 2,000 rounds of SK, 1,100 of which were used against Beaumont Hamel on 28 October. In the final days of the battle the Special Brigade received their first lethal gas bombs and dispatched 15 CG rounds into enemy positions south of Beaumont Hamel.\textsuperscript{74}

Smoke also acted as a ruse to compel the enemy to wear their masks and thus be at a disadvantage when the British infantry attacked. In May, Foulkes wrote of smoke that it had two purposes, to simulate gas and to cover the movement of infantry. Thus the Special Brigade released smoke and gas on the evening of 2 July to assist a raid by the 4th Australian Infantry Brigade, and General Headquarters ordered the Reserve Army to assist Rawlinson’s attack on 14 July with a release of gas and smoke.\textsuperscript{75}

Also entering routine issue at this time were gas grenades carried by the infantry to clear enemy dug-outs. Because, even the non-persistent gases tended to linger underground, it proved possible to quickly establish a dangerous concentration of gas that would rapidly kill a surprised defender or wear out the protective
chemicals in the German respirator and force the enemy to the surface. Gas grenades came in a variety of fillings including, Red Star, White Star, SK and PS and also a white phosphorus model called the P-Grenade. Experiments demonstrated that SK and PS were highly effective, and an unprotected observer could not remain in a contaminated dug-out for more than a few seconds fourteen hours after the gas’s release.76

On the first day of the Somme the Special Brigade’s Z Company took the opportunity to demonstrate their new flame throwers. They had installed the massive machines in a shallow mine shaft just in front of the enemy’s position near the Canoy-Montauban Road. At zero hour the engineers pushed the flame pipes through the thin roof of their hidden installation, fired the weapon and incinerated the target. They would subsequently use flame throwers against Guillemont on 3 September and High Wood on 8 September but it never became a efficient weapon and Foulkes soon discontinued its use. The weapons enormous frame and storage tanks meant that the engineers required days, if not weeks, of secretive and hazardous digging to install it near its target. Its short range of less than 100 yards also limited its flexibility because to fire at another target the engineers had to dig up the weapon and reinstall it elsewhere. In the future Foulkes would use Z Company for experimental work or as an ordinary gas discharge unit.77

After the Special Brigade, the Royal Artillery played the next most important role in the discharge of gas during the Somme. Early in 1916 gas officers undertook to disseminate policy regarding the
use of gas. They identified the objectives of a gas attack as two-fold: to incapacitate the enemy’s infantry and possibly his artillery in order to facilitate the advance, and to wear down the opposition through its effect on morale. Rawlinson built upon this and defined two principle missions for chemical shell at a Fourth Army conference in April. He believed that the critical missions for his guns were counter-battery and the neutralization of the enemy’s fortified villages. At this meeting he pointed out the value of lachrymatory shell for counter battery although he admitted not knowing how much would be available. He noted to his subordinates that “counter-battery work is becoming more and more important. For this gas shells will be useful, they last a long time, and if thick will stop a battery firing.” The British believed that gas was:

... the most powerful weapon for neutralization. With it we can, if not entirely deny the Bosche access to his guns, at least ruin his morale and force him to wear his gas masks, which will seriously impair his accuracy and rapidity of fire.

As a consequence Rawlinson authorized his gunners to use gas shells freely to suppress hostile batteries.

At the time the only agent the British had was the lachrymatory substance SK which was highly persistent. Although not lethal, its effect upon the eyes was most dramatic. It forced the enemy gunners to wear their masks and could even cut a battery off
from relief or resupply. Its persistence, however, did create a problem when it was used against strong points, as British troops could not then occupy the position. Rawlinson therefore warned that they could only use SK against villages which they planned to surround and not immediately possess. He also recommended its use against isolated strong points to induce the defenders to surrender.\textsuperscript{83}

The British also had the lethal gas shells provided by the French with the loaned 75mm guns. Haig assigned these to counter-battery, especially those using Special Shell No. 4 which required a high concentration to become effective and was therefore unsuitable for large targets. The French shell had the additional benefit for the advancing of infantry of being highly volatile, and the British believed it would be safe to traverse contaminated ground within thirty minutes of the last shell's arrival. Rawlinson's plan called for gas counter-battery bombardments to commence during the evening prior to the assault.\textsuperscript{84}

Rawlinson's tactics suggest a concern with the need for his infantry to safely maneuver on the battlefield if they were to obtain a breakthrough. If the artillery succeeded in obliterating the enemy's trench defenders, the next threats to his troops were the interdicting fire of machine guns from the fortified villages and the enemy's ability to isolate the advancing infantry with its artillery.\textsuperscript{85} SK had the potential to neutralize both of these obstacles, and if the attackers observed the prohibition of not occupying the contaminated ground, they might be able to maneuver around the strong points and penetrate deeply into the enemy's position.
After the battle began it was virtually impossible to gain any direct proof of the effectiveness of gas shells. Edmonds commented negatively in the Official History regarding the French shells which he believed “produced no noticeable effect.”\textsuperscript{86} However, there is considerable circumstantial evidence that shell gas made a powerful impression upon senior planners after the assaults on 1 and 14 July. Haig corresponded with the War Office on 17 July and demanded an immediate supply of lethal gas shell. He wrote:

The valuable effect has been most marked, both for counter battery work and for the attack on villages, and it seems probable that not only has the use of this shell considerably assisted the progress of the operations, but some attacks on villages have failed when a liberal use of this shell, if available, would probably have led to the attack being successful.\textsuperscript{87}

Haig followed up by dispatching Thuillier to London to hasten the provision of gas shells, a matter the Ministry of Munitions took up immediately.\textsuperscript{88} While Haig gave as evidence of the shells efficacy the effect the German lethal ammunition had upon British troops, his implications are still clear. He appealed to gas to solve one of the fundamental problems of the Great War, maneuver upon the battlefield. If the British were to break through the enemy’s defenses then it was essential that they find some method to neutralize the enemy’s strongpoints and villages.\textsuperscript{89} Haig’s appealing
for lethal shell, instead of demanding an increase in the
lachrymatory ammunition which his gunners already had, also
represented a realization that SK, while ideal for suppressing a
position, was highly persistent and would prevent the British from
following up a gas attack with an advance, whereas most lethal
agents rapidly dissipated.

Haig’s query was not an isolated rethinking of tactical
principles but rather an intensification of observations that the
British had made in preparation for the Somme. “Notes on Artillery,”
issued in mid-1916, established the idea that they had to, by any
means, induce the enemy to move away from the protection of their
dug-outs so that the British could kill them in the open. It
recommended striking at the enemy when they were predictably
exposed, such as during Stand To, or while firing salvoes of shrapnel
at crossroads, or enfilade fire on communication trenches. It also
suggested damaging the enemy’s parapet and then shelling with
shrapnel to catch the repair parties or for the troops to make
unusual sounds and actions, such as raising cardboard cut-outs, to
make the enemy think an attack was imminent and once they had
occupied their stations a artillery barrage would sweep them from
their defenses.90

Rawlinson, who had first suggested the use of gas against dug-
outs in 1915 in the aftermath of the failure of Aubers Ridge, had
hinted at a similar policy in his discussion on how to attack woods
and villages in his “Tactical Notes.” He feared that without panic in
the enemy ranks it would be extremely difficult to conquer the
fortified positions. The ability to cause otherwise stalwart men to panic, to lose their morale, was, of course, one of the first capabilities the British had attributed to gas. Rawlinson went on to explain that the artillery could neutralize a defended locale by a heavy bombardment of high explosive, smoke or gas shells. Furthermore, he suggested the establishment of a shrapnel barrage around the perimeter of the target so as to destroy any enemy who attempted to flee or reestablish themselves in an adjacent position. Rawlinson indicated the importance of these tactics. By neutralizing the target, the advancing infantry could turn the objective's flank or rear and thereby encourage its surrender. For example, Rawlinson ordered the XIV Corps to use their 4.5-inch howitzers to fire gas into Bouleaux wood in support of the successful attempt to capture Ginchy on 9 September. Germans within the woods protected the village's flank and would make an attack on Ginchy expensive. This policy also explains why XV Corps fired 9,000 rounds of PS into Flers on the nights of 13/14 and 14/15 September in preparation for their attack on the stronghold. Essentially, Rawlinson saw the suppression of the hostile troops defending in woods and villages as a prerequisite to opening up the battle field and restoring the infantry's ability to maneuver.91

In August General Headquarters issued a circular, "Notes on the Employment of Gas Shells," that emphasized the usefulness of gas in counter-battery work and in attacks on villages, woods and other enclosed positions. The report identified the four gas shells that were now becoming available and summarized their properties. It
explained that if the intention was to render a position uninhabitable for a long time then SK was the best choice. To obtain a quick effect immediately prior to an assault the proper gas was Jellite. Where the British desired a temporary neutralization followed somewhat later by an attack, PS was appropriate. Lastly, White Star was the most effective chemical for causing casualties. “Notes on the Employment of Gas Shells,” also noted that the German mask afforded good protection against all British gases with the possible exception of PS. Therefore, it suggested that bombardments should open with an extremely heavy concentration of gas shell. A companion document, “Gas Shell Bombardments,” made the point that a concentrated SK bombardment of a village would make all the dug-outs and cellars uninhabitable for at least twelve hours. Thus the gas would drive the defenders to the surface where the artillery could destroy them with shrapnel.92

The need to address fortified positions also became the driving force behind determining the types of fillings for gas shells. The day after Haig’s demand for chemical shells the Ministry of Munitions took up the question of whether or not to fill shells with Jellite, a lethal gas developed by the Royal Navy. By mid-July there were already over fifty tons of the substance in England with a production capacity of a further four tons a week. The result was a reordering of priorities with the lachrymatory substance SK being shifted from top to last priority with Jellite, Phosgene, and another substance PS - Chloropicrin - moving to the fore.93 Since Jellite was available, and because Haig wanted lethal shell, the Ministry of Munitions pressed
it into service. Its role in the war was a brief one as its battlefield performance proved inferior to other lethal compounds and it was soon discontinued.94

The production ratio that the British settled upon in late July for the three calibers then approved for chemical munitions was also determined by the need to overcome fortified positions. The British estimated that it was necessary to use between 5,000 and 8,000 shells, depending upon type, caliber and weather conditions, to suppress a defended local. However, the other part of the equation was time. How quickly could the British get the shells to the target to build up an effective concentration of gas? In a study, using the village of Guillemont as an example, they found that the gas-capable guns that the artillery could typically bring to bear were 36 - 4.5-inch howitzers, 16 - 60 pounders, and 4 - 4.7-inch guns. After factoring the different rates of fire the report concluded that the production ratio should be 6-4-1 for the 4.5-inch, 60 pounder, and 4.7-inch pieces. Haig subsequently submitted to London a request for 30,000 shells per week at the above ratios.95

On 23 July, at 12:27 AM, the Special Brigade presented its own method designed to obliterate the defenders of fortified locales, the Livens Projector. Capt. William H. Livens, an inventive engineer and commander of Z company, the unit responsible for the flame throwers, had rigged up an experimental version of what would evolve into the most feared chemical weapon of World War I. Livens' prototype was literally an old oil drum emplaced into the ground at a 45 degree angle and pointed at its target. He determined
range by varying the amount of propellant. His first bombs were homemade, three-gallon lubricating oil cans filled with a highly inflammable oil. While never a terribly refined device, the future model consisted of a smooth bore 9.5-inch steel tube with a closed bottom along with a base plate to prevent the recoil from sending the device further into the ground. The engineers dug the ensemble into the ground with only the muzzle exposed. They placed the firing charges at the bottom with the detonator wires running up the side and connecting to a detonator that could fire up to twenty projectors at once. The bomb was simply lowered into the muzzle until it rested upon the propellant at the base. The engineers could fire the weapon again as long as the blast did not shift the projector’s alignment in the ground.96

The basis of the claim for the weapon’s supremacy was its ability to deliver a large amount of gas onto a target with virtually no warning. Its bomb contained thirty pounds of pure phosgene, an enormous amount, especially when compared to artillery shells. The projector would quickly become the most devastating weapon possessed by the Special Brigade and it would rival and supplant cylinders as their most important operation. By the war’s end the Special Brigade would receive over 150,000 projectors, and would discharge more gas through this method than all the other Special Brigade methods combined. Furthermore, projectors were less labor intensive to install than cylinders, and a special company could ready 1,200 in a single night without the help of the infantry.97
The projector was an area weapon, but due to its large capacity it could still envelop the target in a dense cloud of phosgene. (See Table 6.2 for a firing pattern of a projector discharge.) Lieut.-Col. Arthur Crossley, who witnessed Livens’ work, was greatly impressed by the volume of gas that was simultaneously released in a hostile position. He wrote that “the instantaneous liberation ... of gas ... would be certain to find a number of the enemy engulfed in a high lethal concentration of gas without time to fix their masks before being overcome by it.” Even fitting a mask gave no guarantee of a soldier’s survival because the concentration of gas the Livens Projector obtained was so high that it could overwhelm the protective agents in the German respirator.
Table 6.2

Displacement of Livens Projector Bombs From Line of Sight\textsuperscript{99}

<table>
<thead>
<tr>
<th>LEFT OF LINE OF SIGHT</th>
<th>RIGHT OF LINE OF SIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>200-</td>
<td>100-</td>
</tr>
<tr>
<td>300</td>
<td>200</td>
</tr>
<tr>
<td>yds</td>
<td>yds</td>
</tr>
<tr>
<td>yds</td>
<td>yds</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

| 0-100                  | 100-                   |
| yds                   | 200                    |
| yds                   | 300                    |
| 400                   | in yds                 |
| 1,400                 | 1,300                  |
| 1,200                 | 1,100                  |
| 1,000                 |                         |
| 900                   |                         |
| 800                   |                         |
| 700                   |                         |

After the battle Foulkes established the weapon's tactical principles. He recommended its use against, "areas which are strongly held and which contain underground shelters designed to defy artillery bombardment.\textsuperscript{109} For best results he preferred a night discharge to help preserve surprise, and the ideal wind was dead calm so that the gas saturated the area. The British always used lethal gas with the projector, and while there was some risk to fire at the time of assault, they could safely discharge it the evening before.
Foulkes expected that this would weaken the defenders and leave them without sufficient time to bring up replacements or to relieve the garrison.\textsuperscript{101}

Livens repeated his experiments with incendiary bombs on 18 August and 3 September against High Wood but, also on the 3rd, the Special Brigade increased the lethality of their attack by firing their first phosgene bombs into the stronghold of Thiepval. The objectives of the discharges on 3 and 15 September were probably attempts to cause casualties in support of the army's breakthrough attempt at Flers. However the next barrage, at the end of September, was directly connected to the British seizure of Thiepval and the ridge it stood upon. At a conference on the 21st the Special Brigade received its orders to put gas into the village on the evening before the attack. They were also to have ready materials to employ against any outstanding strong points on the night after the attack.\textsuperscript{102} Thus if the infantry ran into any positions that they could not handle during the attack they were to let the Special Brigade asphyxiate these positions with gas. On the evening of 24 September the Special Brigade's mortar men dropped 517 rounds of SK onto the fortress, forcing the garrison to don their masks. The next evening twenty-four Livens bomb exploded onto the target, releasing phosgene onto defenders whose masks had already been depleted by exposure to the long-lasting SK the night before. The next day, at 12:35 in the afternoon, the British attacked and swept the Germans from the position. The second in command of the garrison, after his capture, said that it was
an extraordinary concentration of gas, the most he had ever encountered.\textsuperscript{103}

Foulkes repeated these tactics against Beaumont Hamel on 28th October in an independent attack while the Battle of Ancre Heights was underway. At noon, 1,126 SK Stokes Mortar bombs rained down on the ruins, followed that evening by 101 Livens bombs of phosgene. An additional thirty-four Livens, along with thirty two-inch White Star trench mortar bombs blanketed the nearby village of Serre. Again, Foulkes' intention was to first wear out the defenders' respirators and then kill them with phosgene. Beaumont Hamel received similar attention on 12 November but then on the 13th the British attacked and captured the village.\textsuperscript{104}

As gas shells become more common they gained additional missions. To further wear down the enemy's morale British gunners routinely fired harassment missions. These were sudden and brief bombardments of locations where personnel tended to congregate, such as trench junctions or positions where the enemy were making trench repairs. Much of this work was done at night, and therefore the British could not bring to bear observed fire from their batteries. However gas as an area weapon did not require the same degree of precision as high explosives or shrapnel to inflict casualties, and if wind conditions were acceptable the Royal Artillery would freely use chemical munitions at night. Gas also developed a role in counter-prep fire. The British realized that they could inflict serious losses or disorganize the enemy troops by shelling those locations in which they anticipated an enemy counter attack to develop or traverse.
Counter-prep built upon one of the lessons learned at Loos, where an enemy counter attack succeeded in sweeping the British from the summit of Hill 70, a position they would not regain till 1917. The British frequently fired such missions after the completion of one of their attacks in order to give the infantry a chance to consolidate their newly-won positions before having to face an enemy assault.\textsuperscript{105}

After the commencement of the Somme Haig continued his battle with the Ministry of Munitions for more gas shell, asking for 30,000 a week, divided among the 4.5-inch, 60 pounder and 4.7-inch in the ratio of 6 to 4 to 1. However, anxious to get his hands on anything, he added the provision that until supplies became regular they should fill any of these types whenever they were available and send them out as soon as possible. He also added that the fillings could be of the best substance which happened to be available. General Headquarters increased its demands the following month when they asked for 35,000 shells per week but this was broken down as 30,000 lethal and 5,000 SK, along with 6,000 lethal and 9,000 SK rounds for the Stokes Mortar and 3,000 cylinders. The memorandum again closed with a statement on the experimental nature of the request, but this time it explained that the figures were the minimum and that future revisions would be for increased amounts of chemical shell.\textsuperscript{106}

Despite these constant and detailed requisitions, the greatest handicap facing the British use of gas would remain the woefully inadequate supply. The French would initially supply 100,000 rounds for their 75s but the capacity of each shell was considerably
less than that of a British 4.5-inch shell. Furthermore, the provision of gas shell for the 4.5-inch howitzer fell short of even the minimal estimates, and no gas shell was available, at first, for the 4.7-inch and 60 pounder guns. Table 6.3 outlines the expenditure of British gas ammunition from the beginning of the battle through the end of October.

Table 6.3

Expenditure of British Gas Ammunition during the Somme

<table>
<thead>
<tr>
<th>Caliber</th>
<th>23 June-31</th>
<th>1 July-31</th>
<th>1-30</th>
<th>1-31</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June</td>
<td>August</td>
<td>September</td>
<td>October</td>
</tr>
<tr>
<td>4.5” SK</td>
<td>3,772</td>
<td>842</td>
<td>6,605</td>
<td>4,144</td>
</tr>
<tr>
<td>4.5” Lethal</td>
<td>nil</td>
<td>nil</td>
<td>25,706</td>
<td>3,898</td>
</tr>
<tr>
<td>4.7” SK</td>
<td>nil</td>
<td>2,818</td>
<td>2,049</td>
<td>60</td>
</tr>
<tr>
<td>4.7” Lethal</td>
<td>nil</td>
<td>nil</td>
<td>787</td>
<td>505</td>
</tr>
<tr>
<td>60 pdr SK</td>
<td>nil</td>
<td>1,484</td>
<td>2,104</td>
<td>1,744</td>
</tr>
<tr>
<td>60 pdr</td>
<td>nil</td>
<td>909</td>
<td>8,341</td>
<td>2,145</td>
</tr>
</tbody>
</table>

Lethal

Instructions issued by General Headquarters illustrate the extent of the British shortfall in chemical munitions. General Headquarters estimated the number of shells needed to bombard a village of 500,000 square yards so that the garrison was neutralized by the gas. The amount of shells required for a bombardment by 4.5-inch howitzers is outlined in Table 6.4.
Table 6.4^109
Number of Shells Required to Neutralize a Village

<table>
<thead>
<tr>
<th>Gas</th>
<th>Number of Shells</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lachrymatory SK</td>
<td>4,950</td>
<td>100</td>
</tr>
<tr>
<td>Lethal PS</td>
<td>6,200</td>
<td>125</td>
</tr>
<tr>
<td>Lethal White Star</td>
<td>7,425</td>
<td>150</td>
</tr>
<tr>
<td>Lethal Jellite</td>
<td>7,425</td>
<td>150</td>
</tr>
<tr>
<td>White Star in damp conditions</td>
<td>8,650</td>
<td>175</td>
</tr>
</tbody>
</table>

The report also expressed the figures in shells per thousand square yards per minute. This formula allowed the gunners to determine the ammunition requirements for any target based upon its size. Table 6.5 outlines this information.
Table 6.5

Shells Per 1,000 Yards Per Minute Required to Neutralize a Village

<table>
<thead>
<tr>
<th>Gas</th>
<th>Opening Concentration of 5 Minutes</th>
<th>Continuation Bombardment for Next 25 Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lachrymatory SK</td>
<td>.88</td>
<td>.22</td>
</tr>
<tr>
<td>Lethal PS</td>
<td>1.1</td>
<td>.27</td>
</tr>
<tr>
<td>Lethal White Star</td>
<td>1.32</td>
<td>.33</td>
</tr>
<tr>
<td>Lethal Jellite</td>
<td>1.32</td>
<td>.33</td>
</tr>
<tr>
<td>White Star in Damp</td>
<td>1.54</td>
<td>.38</td>
</tr>
</tbody>
</table>

Weather

The Effectiveness of Gas

The effectiveness of the British use of gas at the Somme is rather difficult to establish, and unless raiders gained the enemy’s lines it was practically impossible to collect any solid information on the results of the discharge. Frequently, the British had to base their assessments on indirect evidence. In some case the proof was impressionistic, such as the comments of Maj-Gen. H. Hudson, commanding officer 8th Division, who noted after a night-time discharge on his front that he was “inclined to think that the comparatively feeble retaliation directed against our lines was due to the casualties and confusion caused.” On another occasion it was the presence of six ambulances behind the enemy’s position the next morning, and the sound of motors from additional ambulances
during the night, that convinced the British that the enemy's casualties had been heavy.\textsuperscript{112} The British also had to rely upon prisoner interrogation such as the two soldiers of the 62 Bavarian Reserve Infantry Regiment who told their interrogators that their unit had sustained great losses in a recent gas attack, including 50 percent casualties in one battalion.\textsuperscript{113}

Proof was easier to collect when the British coordinated the discharge with a trench raid. On the evening of 27 June, O Company, Special Brigade, R. E. launched a massive gas flotation on the front of the 47th (London) Division. They released White Star from 1070 cylinders, approximately 30 tons of phosgene, over a two hour period with heavy concentrations of gas at the beginning and end of the discharge. Lieut.-Gen. Henry Wilson, IV Corps commander, concluded that the raid's success was due to the phosgene. He noted that:

(a) We crossed "No Man's Land" and entered the enemy's trenches without being met by either machine gun or rifle fire.
(b) The enemy's artillery was very slow in coming into action and were wild in their shooting when they did fire.\textsuperscript{114}

Wilson decided that he would try gas again when the wind permitted. Maj.-Gen. C. Barter, the Londoners commanding officer, believed that the enemy had to have suffered considerable casualties and loss of morale because, "it is difficult to suppose that our infantry could have penetrated into the German trenches with so
little opposition without its assistance." He also suggested that the ineffectiveness of the German gunners was due to the necessity for them to wear their respirators which hindered their performance.\(^{115}\)

C Company, Special Brigade, R. E., conducted another major attack on the 8th Division front on the evening of 5 October. They released nearly 80 tons of gas from over 2300 White Star and Red Star cylinders in three dense waves with smoke filling the intervals. The assault lasted two and one-half hours. Their intention was to both surprise the hostile troops and wear out the enemy's respirators. While the raiders failed to enter the enemy's lines, the indirect evidence suggested a major success. The weather conditions were perfect, the night dark, the retaliation weak, with the field batteries and trench mortars soon dying down, and the enemy quickly relieved the affected units.\(^{116}\)

In general, senior officers tended to be pleased with the results of Special Brigade operations and recommended their continuance when the meteorological conditions were good. Edmonds noted that Haig was comfortable enough with gas to urge its frequent use upon his army commanders, and General Headquarters believed that there was no better way to cause casualties and thus divert the enemy's reserves from the main battle. Cylinder operations, in particular, emitted a dense cloud of lethal vapor that penetrated deeply into the enemy's perimeter, killing not only front line troops but striking at headquarters, batteries and other rear echelon troops. Furthermore, cylinder discharges gave the British the means to strike at enemy
troops in reserve positions, thus denying these troops the restorative rest they needed to rebuild their morale.\footnote{117}

Rawlinson's conclusions from the discharges during the preliminary bombardment offer a case in point. Despite the problems with the wind he considered the results favorable. He credited gas for the sudden cessation of the enemy's trench mortars during III Corps' attack on 27 June, and his assessment of the discharges the following evening on X and XV Corps fronts was equally positive.\footnote{118} Foulkes, while admittedly a prejudiced observer, was voluble in his praise for the success of gas at the Somme. In his history he wrote that:

\... it is impossible to resist the conclusion that the German losses from gas were exceedingly heavy during the summer and autumn of 1916, especially in view of \... the heavy concentrations of gas liberated, the deadly nature of the gas employed, the silence of its emission \... and the frequency with which a complete surprise was effected.\footnote{119}

Of the various gas appliances tested during the Somme there was little doubt that the Livens Projector offered great promise. After the capture of Beaumont Hamel on 13 November, the British found over 300 Germans dead from gas poisoning, a discovery that might help explain their successful taking of the position. In investigating one of the shelters at Beaumont Hamel, the British came across a party of fifteen dead Germans whose final poses the
observers described as a "cinematographic series of photographs of German gas-mask drill . . . ."¹²⁰ Livens noted that it was possible to gauge how long it took for the gas to kill the Germans by the extent to which they had gotten their masks on. The three furthest from the entrance had positioned their masks, the fourth had his halfway on, the fifth had it on his face, the sixth had it out of his box, the seventh had the box open and the eighth had his hand on the box lid, while the remaining - closer to the entrance - had not found time to even think of their masks.¹²¹ The power of the Livens Projector suggests that Haig was correct in his demand of 17 July for lethal shell for use against the enemy’s fortified positions. The projector also received a positive welcome by the army commanders, who demanded as large a supply as possible of the weapon.

While the Special Brigade did not dominate the battle as it had done at Loos, its performance during the Somme assured its position as an important auxiliary in the struggle against Germany. The primary reason for this accomplishment is that the British succeeded in defining missions for the Special Brigade which corresponded with the methods they planned to employ to achieve decisive victory. The Somme proved that Foulkes’ unit had the capability to contribute to the gaining of an asymmetric advantage over the enemy. Gas, discharged from either cylinders, Livens Projectors, or Stokes Mortars, would continue to play a role in the wearing down process that would eventually lead to Britain’s superiority of morale over the Germany, while the projector and mortar would assist the
infantry in maneuvering across the battlefield and thereby aid the
British in their quest to restore mobility to warfare.

Shell gas too had established for itself missions within the fire
capabilities of the Royal Artillery. Counter-battery was an integral
objective of the gunners since the suppression of the enemy’s
batteries helped to ensure the survival of the infantry and the
sustainment of an assault. The addition of chemical shell gave the
gunners another dimension in their struggle with the enemy’s
artillery. They could now successfully bombard at night when
precision was impossible. Having helped the infantry obtain their
objectives, the use of counter-prep fire helped assure that the
attackers could consolidate and hold onto their gains. Gas shell also
gained an important role in harassment fire and helped fulfil the
British desire never to give the enemy a chance to recover their
morale. The wearing down process was a relentless struggle, and
compelling the enemy to wear their masks or working parties to
endure the sudden burst of chemical shells, exacerbated the tensions
and miseries of the war.

The failure of the Somme to achieve decisive victory
demonstrated that the wearing down process had not yet achieved
its goal. The German Army was still an effective fighting machine
whose morale, though damaged, remained intact. The war would
continue, and as more British factories and filling plants came into
service, the gas component of war would continue to expand. Haig,
Foulkes and the others in the chemical war would look to 1917 for
the opportunity to dominate and crush the enemy.
"Haig to War Office," 17 July 1916, AWM25/371/110, AWM.

Blue Star was a mixture of 80 percent chlorine and 20 percent sulphur chloride. The latter material is heavier than the chlorine and the British expected it to help keep the cloud close to the ground. The mixture, however, had the disadvantage of depositing a pool of liquefied gas in front of the parapet pipe and the British feared that its evaporation would injure their own soldiers. They subsequently discontinued its use. The Special Brigade discharged 305 cylinders of Blue Star on 9 January 1916 and a further 373 on the 19th. See, Foulkes, Gas!, 90, and "SB Ops," WO142/266, PRO.

White Star was a 1 to 1 blend of chlorine and phosgene. Phosgene has a high boiling point, 46° Fahr., and on summer nights or during the winter it lacked the vapor pressure necessary to escape its container. The British added chlorine, a more volatile agent, to help propel it from the cylinder. The Germans had already introduced phosgene in December 1915.

This expansion did eliminate one of the more obvious peculiarities of the Special Companies. The War Office authorized the rank of pioneer, equivalent to the infantry private, for the new drafts, while the existing pool of corporals became the NCOs of the reorganized unit. Among other things, this meant that guard duty, normally the responsibility of a private, would no longer be stood by a corporal, although the watchman's weapon remained the revolver, not the rifle. Richter provides a outline of the evolving organization of the Special Brigade. See, Richter, Chemical Soldiers, 235-36.


Foulkes, "Notes on Phosphorus Smoke Shells and Their Use with the 4" Stokes Mortar," n. d., Rawlinson's Fourth Army Records, Volume 6, IWM.

"Cubbitt to Ministry of Munitions," 22 September 1916, WO32/5175, PRO; and "Report by DGS on Availability of Stokes
Mortar Ammunition.” 29 March 1916, Rawlinson’s Fourth Army Records, Volume 6, IWM.

8British Army, Notes on the Employment of 4” Stokes Mortar Bombs, (n.p., 1917), 5-6. In 1917 improvements in the propellant increased the range to 1,100 yards. Prentiss said of the weapon that it combined, “the maximum mobility and chemical-projecting capacity of any weapon used in the war... and proved to be the most useful all-around chemical weapon used during the period of stabilized warfare.” Prentiss, Chemicals in War, 362. For figures on the gas content of British projectiles see, Ibid., 453.


11“Memorandum by Brigadier-General H. F. Thuillier, Director of Gas Services, G. H. Q., on situation regarding Bombs, 4” Stokes Mortar,” 20 October 1916, WO32/5175, PRO; and “Notes on the failure in supplies of ammunition for the 4” Stokes Mortar,” 17 September 1916, WO32/5175, PRO.

12“Notes on the failure in supplies of ammunition for the 4” Stokes Mortar,” 17 September 1916, WO32/5175, PRO; and “Notes on Gas Shells and T. B. Bs.,” n. d., Hartley Collection, 32, CAC. The Special Brigade’s use of the two-inch mortar was minimal, and during the six attacks they fired a total of 488 bombs. The low figures may also be another reflection of the on-going shortages of mortar ammunition. See, “SB Ops,” WO142/266, PRO.

133,000 of the Red Star cylinders had been returned from Egypt. They had been sent to the Near East for use at Gallipoli. Two Red Star was a mixture of 90 percent sulphurated hydrogen and 10 percent carbon disulphide, and its introduction was not a great success. Although quite lethal, the physical properties of the compound made it difficult to use as a battlefield gas. It needed to
be contained under such great pressure that it made a great noise when released and there was a risk that the escaping gas might burst the discharge pipe or knock the parapet pipe into the trench. Two Red Star also proved inflammable, and the odor of even minute leaks, was readily noticeable.

"The lower the figure the more deadly the gas. The figures represent the product of the concentration of parts per million and time in minutes required to cause death. These figures are based upon the research of Haber during the war and should be viewed in relative rather than exact terms. Other wartime or modern methods would result in different numbers, although the relationship between the compounds would not change. The British also attempted to ascertain a numerical comparison for the relative relationships that they intuitively perceived, however the British research aimed at determining the concentration of gas needed to merely incapacitate a soldier. This research was both an inexact science and a highly dangerous experiment, as the testing was done on human as well as animal subjects. See, Haber, _Poisonous Cloud_, 43-44 and Prentiss, _Chemicals in War_, 14.

For a list of the Special Brigade’s operations see, “SB Ops,” WO142/266, PRO.

Prentiss, _Chemicals in War_, 683.

"Notes on Gas Shells and T. B. Bs.,” n. d., Hartley Collection, 32, CAC, and _Instructions on the Use of Lethal and Lachrymatory Shell_.


History of the Ministry of Munitions, 10:35; “Memorandum on Chemical Shell,” 4 May 1916, MUN5/386/1650/10, PRO; “Butler to

21“Memorandum on the Requirements for Chemical Shell,” 1 April 1916, MUN4/2706, PRO.

22“Memorandum on Steps Taken by the Ministry of Munitions to Provide Chemical Shell,” 4 May 1916, MUN5/187/1360/1, PRO.

23“Probable Resources on 25th June,” 4 June 1916; “Estimate of Resources,” 4 June 1916; and “Haig to Joffre,” 3 June 1916, all in Haig’s War Diary, Haig Collection, 3155/106, NLS. The French 75s came equipped with Special Shell Number 4 (Vincennite), a mixture of fifty percent hydrocyanic acid and fifty percent trichloride, and Special Shell Number 5 (Collongite), a mixture of sixty percent phosgene and forty percent tin tetrachloride. Vincennite was one of the great failures of the gas war although the French refused to admit it and produced over four million rounds of the stuff. The compound, while theoretically deadly, was far too light for battlefield conditions and floated away before the French could establish a lethal concentration. See Prentiss, Chemicals in War, 444; “Notes on 4th Army Conference,” 27 June 1916, Rawlinson’s Fourth Army Records, Volume 6, IWM.

24“Bingham to DMRS,” 18 July 1016, MUN4/2709, PRO; “Notes on Conference Held on 4 September 1916 Regarding Supply of Chemical Shell and Bombs,” and “Supply of Chemical Shells and Bombs,” 1 September 1916, MUN5/197/1650/9, PRO; and “Minute of Discussion on Chemical Shell,” 18 July 1916, MUN4/2709, PRO.


26“Haig’s Great War Diary,” 8 January 1916, Haig Collection, 3155/97, NLS. Haig’s language mirrors the description of the concept of the phases of battle found in the FSR. See, General Staff, FSR, 113, and General Staff, Field Artillery Training, 246-52.

27“Haig’s Great War Diary,” 14 January 1916, Haig Collection, 3155/97, NLS.
28Ibid., and "Haig to Joffre," 1 February 1916, Haig Collection, 3155/104, NLS.

29"Haig's Great War Diary," 4 January 1916, Haig Collection, 3155/97, NLS.

30Ibid., 16 January 1916.

31Ibid., 29 January 1916.


33Haig to Joffre," 1 February 1916, Haig Collection, 3155/104, NLS.


35"Notes on Conference With Army Commanders," 27 May 1916, Haig Collection, 3155/106, NLS. On 12 June the army commanders received their orders to commence their subsidiary operations. See, "Kiggell to GOC Armies," 12 June 1916, Haig Collection, 3155/106, NLS.

36"Note on Special Brigade and Use of Gas and Smoke," and "Note on Wind," 27 May 1916, Haig Collection, 3155/106, NLS. For the wind charts see, Rawlinson's Fourth Army Records, Volume 1, IWM.

37"Note on Special Brigade and Use of Gas and Smoke," 27 May 1916, Haig Collection, 3155/106, NLS.

38Ibid.

39White Star (phosgene) needed only one or at most a few breaths to be lethal whereas Red Star (chlorine) and Two Red Star (sulphuretted hydrogen) were less dangerous and required many more inhalations before reaching a fatal concentration and were, therefore, unsuitable for a surprise attack since the enemy would have time to don their masks. Bays were cylinder emplacements cut into the trench parapet and spaced about twenty-five yards apart. See, Ibid.
“Haig’s Great War Diary,” 26 June 1916, Haig Collection, 3155/97, NLS.

“Haig’s Great War Diary,” 9 September 1916 and 2 November 1916, Haig Collection, 3155/97, NLS; and “Advanced GHQ to Rawlinson and Gough,” 31 August 1916, Haig Collection, 3155/107, NLS.

Haig made a number of strenuous objections to Rawlinson’s plan and required significant revisions. He noted his displeasure with his Fourth Army commander by writing into his diary that Rawlinson planned only to kill Germans. Haig wanted a plan that proposed reaching the open fields beyond the enemy’s defenses. See, “Haig’s Great War Diary,” 9 September 1916 and 2 November 1916, Haig Collection, 3155/97, NLS. For Rawlinson’s plan see, Military Operations France and Belgium, 1916 Appendices, Sir Douglas Haig’s Command to the 1st July: Battle of the Somme (London: Macmillan and Co., Limited, 1932), 64-71.

Furthermore, Rawlinson linked the depth of the penetration to the range of the British guns since the artillery was essential if his army was to sustain the advantage. See, “Battle of Somme Preparations,” n. d., Rawlinson’s Fourth Army Records, Volume 1, IWM.

For a discussion of this idea see, Prior and Wilson, Command on the Western Front, 144.

“Fourth Army Memorandum,” 22 June 1916 and 28 June 1916, Rawlinson’s Fourth Army Records, Volume 7, IWM.

Terraine, Douglas Haig, 204.

“Kiggell to GOC Armies,” 21 June 1916, Haig Collection, 3155/106, NLS.

“Fourth Army Operation Order No. 3,” 1 July 1916, cited in Prior and Wilson, Command on the Western Front, 184-84.

“Rawlinson Diary,” 30 June 1916, Part 1/5, CAC.
“Haig’s Great War Diary,” 5 July and 6 September 1916, Haig Collection, 3155/97, NLS. For the assault on 14 July the advance of the cavalry was contingent upon the infantry’s success in breaking through. See, “Instructions for the Action of Cavalry of the Fourth Army on Z Day,” 12 July 1916, Rawlinson’s Fourth Army Records, Volume 7, IWM.

The Official History lists the casualty figures as: officers, 993 dead, 1,337 wounded, 96 missing and 12 prisoner; and other ranks, 18,247 dead, 34,156 wounded, 2,056 missing, 573 prisoner. These reports do not include French losses. See, Edmonds, Military Operations, France and Belgium, 1916, 1:483.

For a brief outline of the day’s disappointments for the British see, Ibid, , 478-81.

Ibid., 299-307, 485-86. For the preliminary bombardment’s program see, Military Operations France and Belgium, 1916 Appendices, 148-49.

Ibid., 132.


“GHQ to Rawlinson,” 27 May 1916, Rawlinson’s Fourth Army Records, Volume 5, IWM.

On 6 July Maj.-Gen. Headlam, XV Corps, presented a report on the work of the artillery. He concluded that while the gunners had obliterated the enemy’s trenches, their deep dug-outs were only affected if their entrances happened to be blown in. The dug-outs were twenty to thirty feet below the surface. See, “Report by Maj.-Gen. Headlam on the Work of the Artillery of XV Corps,” 6 July 1916, Haig Collection, 3155/107, NLS.

Military Operations France and Belgium. 1916 Appendices, 70. See also, "Battle of Somme Preparations," Rawlinson's Fourth Army Records, Volume 1. IWM. For Prior and Wilson's analysis see their, Command on the Western Front, 145.

"GOC VIII Corps to Rawlinson," 10 April 1916, and "GOC 48th Division to Montgomery-Massingberd," 12 April 1916, Rawlinson Fourth Army Records, Volume 6, IWM.


The disposition of the rest of the Special Brigade was; Fourth Army - three mortar companies and one flame thrower company; Third Army - one mortar company and some personnel, as Fourth Army could spare, from the flame thrower company. See, "Conference of Army Commanders," 27 May 1916, Haig Collection, 3155/106, NLS. See also, "Resources, Appendix C," Rawlinson's Fourth Army Records, Volume 1, IWM.

The British designated the day of the start of the battle as Z day. They identified post commencement days Z+1, Z+2, etc., and pre-battle days used the reverse alphabet. Thus Y day was the day before the battle and X day was two days before the battle.

"Cylinder Requirements, 4th Army," 31 May 1916, Rawlinson's Fourth Army Records, Volume 5, IWM.


"Program of Preliminary Bombardment," 5 June 1916, Rawlinson's Fourth Army Records, Volume 7, IWM.

"Fourth Army Operation Order No. 2," 14 June 1916, Rawlinson's Fourth Army Records, Volume 7, IWM.

69 "Fourth Army Memorandum," 17 June 1916, Rawlinson’s Fourth Army Records, Volume 7, IWM; and "Summary of Operations," 24 June 1916, Rawlinson’s Fourth Army Records, Volume 1, IWM.

70 Data taken from, "SB Ops," WO142/266, PRO.


72 See, "SB Ops," WO142/266, PRO.

73 Ibid. Also see, "Notes on the Use of Smoke," 13 May 1916, Rawlinson’s Fourth Army Records, Volume 6, IWM.

74 "SB Ops," WO142/266, PRO.

75 Foulkes, "Notes on the Use of Smoke," 15 May 1916, Hartley Collection, Box 33, CAC; "Orders 4th Australian Infantry Brigade," 1 July 1916, Monash Collection, 3DRL2316, Item 22, AWM; "Notes on the Use of Smoke," 13 May 1916, Rawlinson’s Fourth Army Records, Volume 6, IWM; and "GHQ to 3rd Army, Reserve Army, & RFC," n. d., Rawlinson’s Fourth Army Records, Volume 1, IWM. Notes on the Use of Smoke described this principle as: "In case of a smoke cloud used offensively, to simulate gas, with a view to lowering the enemy’s moral and forcing him to use his gas mask." See General Staff, Notes on the Use of Smoke, (n. d.) 3.
76 "Clearing of Dug-outs by Chemical Grenades," 1916, WO142/98, PRO.

77 Ibid. See also, W. H. Livens, "The Development of the Livens Projector," n.d., WO188/143, PRO. The installation was indeed dangerous as the mine galleries were blown in several times by shell fire. See, Foulkes, Gas!, 111-12.

78 "Lecture Notes on the Offensive Use of Gas," n.d. (early 1916?), Gilliat Collection, IWM.

79 "Notes on Fourth Army Conference," 28 April 1916, Rawlinson's Fourth Army Records, Volume 6, IWM.

80 "Notes on Conference Held at Fourth Army Headquarters," 16 April 1916, Rawlinson's Fourth Army Records, Volume 6, IWM. Haig reiterated these policies in a letter to the Ministry of Munitions. See, "Haig to Ministry of Munitions," 16 May 1916, MUN4/2709, PRO.


83 Ibid. Rawlinson repeated these suggestions at conferences on 28 April and 17 May. See, "Notes on Conference," 28 April 1916 and "Notes on Conference," 17 May 1916, Rawlinson's Fourth Army Records, Volume 1, IWM.


85 Commenting on the problem the GOC XIV Corps noted that the difficult problem facing the British in an attack was sustaining the forward momentum once the enemy put an interdiction barrage onto No Man's Land. See, "Tactical Memoranda Circulated By GOC XIV Corps," 3 August 1916, in Military Operations, France and Belgium.
86Edmonds’ indictment is perhaps directed solely at the French and not gas shells in general. He also wrote of 1 July that, “gas shelling and the creeping barrage, the factors on which later successes grew to be so dependent, were to all intents and purposes lacking . . . .” See, Edmonds, Military Operations France and Belgium, 1916, 1:261.


88“Haig’s Great War Diary,” 17 July 1916, Haig Collection, 3155/97, NLS.

89“Haig to War Office,” 17 July 1916, MUN4/2709, PRO.

90“Notes on Artillery,” n. d. but mid-1916, Monash Collection, 3DRL2316, Item 22, AWM.

91Edmonds, Military Operations, France and Belgium, 1916, 2:298; “Tactical Notes,” May 1916, in Military Operations, France and Belgium, 1916, Appendices, 137-38; and “Artillery Instructions,” 7 September 1916, Rawlinson’s Fourth Army Records, Volume 7, IWM. For Rawlinson’s comments regarding Aubers Ridge see, “Rawlinson to Fitzgerald,” n. d., Rawlinson Collection, 5201-33-18, NAM.

92“Notes on the Employment of Gas Shells,” 23 August 1916 and, “Gas Shell Bombardments,” 23 August 1916, WO 158/436, PRO. Within this environment it is not surprising that the initial role for the tank was also to help the infantry advance past the enemy’s fortified strongpoints. See, “Preliminary Notes on Tactical Employment of Tanks,” August 1916, in Military Operations, France and Belgium, 1916, Maps and Appendices, 44. Lieut.-Col. E. D. Swinton described the tank as:

. . . a machine designed for the express purpose of assisting attacking infantry by crossing the defences, breaking through obstacles, and of disposing of the machine guns. It is primarily a machine-gun destroyer which can be employed as an auxiliary to an infantry attack.

93The potential of Chloropicrin had been known for some time but it only became available during the summer 1916. It had both lachrymatory and lung injuring capabilities, but as its effect upon the respiratory system was more pronounced, the British classified it as a lethal agent. It could be made at the same factory that produced SK but its production cut into the output of the other agent. See, Prentiss, Chemicals in War, 140.

94“Haig to War Office,” 31 July 1916, AWM45/31/16, AWM; “Bingham to DMRS,” 18 July 1916, MUN4/2709, PRO; and “Minute of Discussion on Chemical Shell,” 18 July 1916, MUN4/2709, PRO.

95“Memorandum on Gas Shells,” 31 July 1916, Haig Collection, 3155/107, NLS; and “Haig to WO,” 31 July 1916, MUN4/2706, PRO.

96“SB Ops,” WO142/266, PRO.


99Data take from “Report on Projector Targets,” 20 August 1918, Campbell-Smith Collection, 6101-06/S. l. g., REM. Summary:

Shortest Range: 725 yards
Longest Range: 1525 yards
Greatest Concentration: 1100-1200 yards
Greatest Deflections: 425 yards at 1150 yards
Shots within 100 yards of target: 34
Shots within 200 yards of target: 96

In this shoot D Company, Special Brigade, RE fired 195 shots of which they found 151 and another 8 were duds. The numbers on the chart represent the number of bombs they found at that range and how far the bombs were displaced from the line of fire.

100 C. H. Foulkes, “Employment of Projectors,” 26 March 1917, WO188/143, PRO, [emphasis in original].

101 Ibid.

102 “Attack on Thiepval, Conclusions of Conference,” 21 September 1916, Maxse Collection, 65/53/7, IWM.


105 “Artillery in Defence,” n. d., AWM224/Mss4, AWM; “Artillery Instructions, No. 30,” 22 September 1916, Maxse Collection, 65/53/7, IWM; and “Handwritten Notes on Preparation for the Somme,” n. d., Rawlinson Collection, 5201-33-70, NAM. For a discussion on the difficulty of holding a newly won position see, “Memorandum of Trench to Trench Attack by a Battalion Commander in the Fifth Army,” 31 October 1916, Montgomery-Massingberd Collection, 48, LHCMA.


107 Rawlinson to GHQ,” 17 June 1916, Rawlinson’s Fourth Army Records, Volume 5, IWM.

108 By comparison, over the same period, the British shot vastly
greater quantities of high explosives and shrapnel. For example during the period 23 June to 31 June the British gunners expended nearly 2 million rounds for the 4.5-inch howitzer, 110,000 for the 4.7-inch gun and nearly 600,000 for the 60 pounder gun. Data collected from: “Ammunition Expenditure - 23 June 1916 to 31 August 1916,” Rawlinson’s Fourth Army Records, Volume 2, IWM; and “Ammunition Expenditure - 23 June to 1 October 1916, and “Summary of Special Ammunition other than Shown in Daily Summaries - Expenditures during October,” Rawlinson’s Fourth Army Records, Volume 4, IWM. While expenditure is not the same as availability, it does reflect British capabilities. It is also possible to demonstrate the narrowness of the British supply by comparing the amount on hand with the amount expended. On 10 September the British had in France, including the line of communication, stocks of gas shell for the 4.5-inch howitzer - 30,590; 60 pounder - 11,758; and 4.7 inch gun - 4,710. They were therefore clearly firing gas shell as quickly as it arrived. See, “Ammunition Available in Total Rounds at 12 Noon 1st September 1916,” Haig Collection, 3155/108, NLS.


110Ibid. Figures are for a 4.5-inch howitzer shell. The program assumes an initial surprise concentration followed by a sustained bombardment of 25 minutes. This program represents the state of the art during the Somme. By the following year the continuation phase of the program would be much longer. These figures also assume suitable weather conditions.


112“OC No 4A Battalion, Special Brigade, R. E. to HQ 1st Army,” 12 September 1916, WO158/270, PRO.

113“Effects of Special Brigade Operations, Summary of Evidence,” WO142/266, PRO.

114“Henry Wilson to HQ 1st Army,” 2 July 1916, WO158/270, PRO.

116“OC No. 4A Battalion, Special Brigade, R. E. to HQ 1st Army,” 4 October 1916, WO158/270, PRO.


118“Effectiveness Reports - Fourth Army War Diary,” 26 & 27 June 1916, Rawlinson’s Fourth Army Records, Volume 1, IWM.

119Foulkes, Gas!, 157.

120Livens, “The Development of the Liven’s Projector,” WO188/143, PRO.

121Ibid.
CHAPTER VII

INSTITUTIONALIZATION

Regard your masks as sacred,
for gas causes as many casualties as artillery.
- German Anti-Gas Lecture

Introduction

The 1917 campaign began on a positive note for the Western Allies. Britain’s newly constructed munitions factories were turning out materials in abundance and, along with purchases from neutrals, such as the United States, the Entente would have a resource superiority on the Western Front. The coming year would also confirm the growing British edge in many new war technologies, including the tank, indirect predicted fire, and gas. Morally, Haig believed that the Battles of the Somme and Verdun had exposed a sense of fatigue in German soldiers’ commitment to the war, which with further pounding would widen and lead to a collapse of the German Army. The withdrawal of the enemy, in late February to mid-March, to the prepared positions of the Hindenburg Line seemed to confirm that the battles of 1916 had indeed left the enemy weakened. The year would not end on such an optimistic note; the collapse of Russia threatened to redress Germany’s numerical inferiority on the Western Front, the French Army mutinied after the
botched offensive along the Aisne, Italy suffered heavily in its futile efforts on the Isonzo, and the British campaign of Passchendaele became associated with drowning mud and a distant staff. Even with these failures, however, 1917 proved to be the turning point in the war. Germany's gamble on unrestricted submarine warfare failed to starve Britain into submission and predictably forced the world's greatest industrial power into the enemy's camp. The entry of the United States assured eventual victory for the Allies, however the vital question remained: how to achieve decisive victory.²

The British in 1917 would make great strides in institutionalizing the technologies and tactics that would bring victory the following year. By the campaign season of 1917 most infantry platoons had a Lewis gun, which, combined with bombers, rifle grenades, and rifles, gave the unit formidable firepower and maneuverability. Of equal importance was the spreading of attack principles outlined in training manuals such as, Instructions for the Training of Platoons for Offensive Action, Assault Training, and Instructions for the Training of Divisions for Offensive Action.³ In the air the Royal Flying Corps began the year outclassed by the enemy's machines, and at the Battle of Arras the flyers paid a heavy price for technological inferiority, but they also displayed superb skill in aerial photography and artillery observation. The tank continued to undergo improvements and increase in numbers, but its effect remained relatively minor, except for their success at Cambrai in November. It was in the artillery that the most dramatic advances occurred. As Griffith notes in Battle Tactics of the Western
Front, "by 1917 techniques had . . . been refined whereby the fire could be very precisely predicted merely from the map or an air photograph, without an observer at all." Due to the combination of map surveyors, aerial observers and photographers, sound rangers, flash spotters, and meteorologists, along with the knowledge derived from detailed analysis of gun and shell characteristics, British gunners gained the ability to fire indirectly with a high degree of precision. Predicted fire was a critical area of gunnery skill in which the British gained an advantage over the Germans, a lead which they held to the end of the war.

Contributing to this success was another important artillery innovation which came about from the recognition of the vital importance of counter-battery fire to the success of the infantry. By 1917 the British had created corps level counter-battery offices under the command of a Counter-Battery Staff Officer charged with the location and destruction or neutralization of the enemy's guns. Attached to a typical office was an Royal Flying Corps squadron and a balloon company to make aerial reconnaissance and direct fire, an observation group of field survey engineers for flash spotting and mapping, and a sound-ranging group for the location of active enemy batteries. The counter-battery office also included intelligence officers to sift through the information collected from the above groups, along with data reported by the infantry and knowledge gained from the interrogation of prisoners and captured documents. After Messines, Brigadier-General G. Humphreys, BGRA IX Corps, maintained that:
... the success of our counter-battery fire was largely due to
the fact that control rested in the hands of one expert [the
Counter-Battery Staff Officer] and his staff, who were free to
devote their whole time, energy, brains to the one end of
defeating enemy guns.6

The combined efforts of these elements succeeded in giving the
counter-battery commander a fairly accurate picture of the enemy's
artillery and the effects of British counter-battery efforts. Gas
featured heavily in the operations of this office and chemical shell
became the preferred method of neutralizing the German artillery,
especially at night when observed shoots were impossible.7

While gas had played a comparatively minor role in 1916 due
to its limited availability, by the end of 1917 it would become
ubiquitous, and the frequency of its use and importance would
correspondingly increase. Its dependence upon meteorological
conditions still acted as a brake upon its employment but
improvements in weaponry and theory helped broaden its
application and lessen the influence of weather. Increased supply,
enhanced technology, and formalized ideas would lead to the
institutionalization of gas within the British way of making war. As
gas became more widespread, the suffering it caused was intensified,
particularly after the introduction of mustard gas by the Germans in
July. The protection provided by a respirator was insufficient
against this new gas, as the caustic chemical acted directly upon the
skin. There was no escaping from gas on the Western Front as it became a component of all British operations. 8

The Campaigns of 1917

The Chantilly Conference of 16 November 1916 laid the basis for Anglo-Franco operations in the following year. Allied commanders determined to seek a decision with a series of offensives in the Western, Russian and Italian theaters, so timed as to make it impossible for the Germans to shift reserves between fronts. France was to be the decisive sector but all the fronts would contribute to the weakening of the enemy. Haig and Joffre agreed to a combined offensive, straddling the old Somme battlefield with the French to the south and the British to the north. However, Joffre’s replacement with General Robert Nivelle in December led to a revision of the British role. Nivelle, one of the heroes of Verdun, intended to win the war with a massive blow from the entire resources of his army that would drive the Germans from the country. Whereas the Allies had intended to destroy their opponent’s will through a series of hard blows leading to the rupture of the German line, Nivelle proposed to crush the enemy’s main body in a single pitched battle. He envisioned the offensives as a two stage process. First the French Army would breakthrough the German line, and then his reserve, the “Mass of Maneuver,” would advance into the open and destroy the enemy’s armies. The Allies tentatively scheduled the battle for mid-March, but, after various delays, the British would attack on 9 April and the French seven days later. To maximize his resources
Nivelle asked for and received the British agreement to take over more of the French line so as to free up additional divisions for the attack. The role of the British was now subsidiary with attacks along side of the River Scarpe, near Arras, aimed at the reduction of the Bapaume Salient and possibly an advance on the rail centers of Cambrai and Douai. Victory depended upon Nivelle's thrust, and if it failed the British efforts would be meaningless.²

Haig outlined the plan to his army commanders in a letter on 2 January 1917. He explained that the British would undertake operations with Gough's Fifth Army in the Ancre Valley, General E. H. H. Allenby's Third Army opposite Arras, and General H. S. Horne's First Army against Vimy Ridge. While the British attacks held the promise of snipping off the Bapaume Salient, their principle function was to draw in German reserves so that the enemy would have fewer divisions to react to Nivelle's blow. Haig, while committed to supporting Nivelle, remained unconvinced that French attacks would destroy the German Army. Accordingly, at the London Convention of 16 January 1917, he extracted a promise that if the Anglo-Franco attacks did not lead to rapid victory then the British could shut down their operations and redirect their efforts further north to Flanders, the area in which Haig preferred to seek the decisive battle. Throughout the winter the British worked on plans for a massive breakthrough offensive from the Ypres Salient, coordinated with secondary operations around Nieuport along with a five division landing by the Royal Navy on the Belgian coast.¹⁰
The German withdrawal to the Hindenburg Line caught the British by surprise and necessitated changes in Haig's plans. The retirement vacated the Bapaume Salient and thereby obviated the need for Fifth Army's attack. Instead, Haig ordered Gough to follow the retreating Germans in an attempt to cutoff those withdrawing from the salient. Although the British fought a number of sharp engagements, the German rear guard succeeded in delaying the British pursuit until their main body had gained the sanctuary of the Hindenburg Line. Haig then instructed Gough to assist Third Army by attacking the German defenses at Bullecourt. If successful, this would have put Fifth Army within interdiction range of the main route over which Third Army planned to move, thereby preventing the enemy from moving up reserves which would have impeded Allenby's advance. Originally scheduled in conjunction with Third Army's attack on 9 April, delays in getting guns forward and clearing enemy wire postponed Gough's contribution to the 11th. Thus Haig's support of Nivelle, though modified, would still involve three of his five armies.\textsuperscript{11}

Allenby's attack at Arras remained the principle thrust of the BEF's April battles. Originally scheduled for 8 April, but postponed twenty-four hours to the 9th, the offensive had as its objective:

To strike the enemy on the Arras-Vimy front in the greatest possible strength with a view of penetrating his defences, outflanking the Hindenburg Line from the North, and operating in the direction of Cambrai.\textsuperscript{12}
The breaching of the enemy's defenses and the threat towards a critical logistical center would force the Germans to divert reserves towards the British thrust, thereby achieving the operation's principal mission, the aiding of Nivelle.

The Third Army would attack on a three corps front. From right to left the VII Corps would assault with four divisions while the VI and XVII Corps would each use a three divisional frontage with a fourth in reserve. Allenby would also have two cavalry division along with the attached 17th division of the Cavalry Corps and, in army reserve, the three division XVIII Corps for exploitation of any success. Third Army would have at its disposal sixteen infantry and two cavalry divisions. The infantry assault would have powerful support, including over 1,100 field guns and nearly 600 heavy pieces. The bombardment to clear the wire and weaken the enemy would last two weeks although the gunners would do the bulk of their work during the last four days, but the twenty-four hour delay gave the gunners an extra day. The army also had the support of a brigade of forty tanks, ten squadrons of the Royal Flying Corps, and the Special Brigade. The gas component of the battle was substantial. The artillery set as its objective the suppression of as many enemy batteries as possible at the battle's commencement. Accordingly, the 4.5-inch howitzers and 60 pounder guns would bombard enemy positions with gas from 7:30 PM on the evening preceding the attack to an hour after zero. The Special Brigade would contribute two
discharges, one on the 4th and another on the 6th to weaken the enemy’s defenses. ¹³

On the morning of 9 April soldiers of Third Army went over the top and advanced toward the Germans. The assault began brilliantly with the British occupying most of the enemy’s first line within forty-five minutes and over-running the second line two hours later. They would also capture 5,600 prisoners. However, the German third line remained and the British attack slowed. By nightfall most of it remained in enemy hands. Despite the failure to break through, the attack showed the effect of the changes the British had made in their tactics and the technological improvements, particularly in artillery, that were responsible for the increased firepower and accuracy of the guns. Gas, too, had also served its purpose, and many German batteries were unable to respond to the British advance. However, once Third Army failed to reach the open, the battle took on a familiar air. Increasing resistance and smaller gains followed the initial fast movement, until finally the advance ceased. Allenby renewed the attack the next day but with diminishing chances of success. Arriving German reinforcements spelled the doom of the offensive and Haig ordered it shut down on the 14th. While the first phase was over, Haig, determined to fulfil his commitment of support to the French, required Third Army to make a series of further efforts throughout April to the end of May. The consequences of this support would be high. It cost Third Army nearly 90,000 casualties. ¹⁴
Coordinated with the start of Arras was the storming of Vimy Ridge by the Canadians of Horne’s First Army. Vimy was a formidable obstacle whose heights dominated the surrounding plain. Unlike at Arras, the British had conceived this attack strictly in terms of a limited action. Once the ridge was in British hands the attack would stop. The four Canadian divisions had lots of support fielding over 750 field guns and nearly 400 heavy pieces for what was essentially a corps-level attack. The Special Brigade had arranged to carry out a preliminary projector attack and its mortarmen would support the infantry with a smoke barrage. The artillery also planned to employ gas, and the gunners arranged a counter-battery bombardment for zero hour to neutralize the enemy’s artillery. Tanks were also available but, as there were only eight and the ground was rough, planners did not attach much hope to their presence.

At 5:30 AM the British artillery opened fire and engulfed Vimy in a storm of steel while tunnellers exploded two mines under the ridge. Simultaneously the Canadians began their advance and they made it across No Man’s Land with few casualties. The attackers quickly overwhelmed the enemy’s front line and by 7:00 AM they had reached their intermediate objectives. The attack now paused for consolidation but just before 10 AM the artillery redoubled its efforts and the Canadians resumed their advance. By the end of the day the entire ridge was in their possession except for the summit of Hill 145, which they took the next day, and some other small objectives which fell by the 14th. At the battle’s end the Canadians
gazed from the summit over enemy territory across the plain of Douai to the east, and the suburbs and slag heaps of Lens and the old battle field of Loos to the north. The view dominated the enemy trenches below and left their approach routes exposed to British interdiction. So complete had been the Canadians' accomplishment that the Germans declined to launch a counter-attack and accepted their defeat.

Fifth Army began their attack at Bullecourt on 11 April. Gough had drawn up the plan hastily, since the army had until recently been fully involved in the advance to the Hindenburg Line. Consequently, the operation lacked the same degree of detail as had the attacks at Arras and Vimy, and there was insufficient time to reduce the enemy's strong defenses. The attack was a complete failure and there was little chance of the infantry being able to penetrate the Hindenburg Line. The price was nearly 11,000 soldiers.

On 16 April, after the British battles had come to an end, Nivelle launched his war-ending offensive along the Aisne. The results were a catastrophe. Anticipating the blow, the Germans had positioned counter-attack divisions behind their lines. As the French soldiers advanced into the German positions they came under increasing pressure and were forced back, many to their starting points. Having planned a gain of six miles, the French could barely manage 600 yards and at a cost of nearly 100,000 men. Nivelle had guaranteed not only victory but the end of the war. Instead, his attack led to the mutiny of the French Army and the virtual collapse
of France’s offensive capability until the war’s final campaigns. In the aftermath, the government would sack Nivelle and place France’s fortune in the hands of Foch.

With the near collapse of the French Army, future offensive operations on the Western Front devolved virtually exclusively onto the British. Foch would not resume significant operations until the war’s final months and America’s first offensive was still a year away. Haig thus turned to his own ideas of how to win the war. Flanders had long held his interest as an area for a decisive victory. In January he had rejected a plan drawn up by Plummer as being too passive and demanded one “based upon rapid action and . . . the breaking through of the enemy’s defences on a wide front without any delay.” He wanted a plan that aimed at the decisive defeat of the enemy and the freeing of the Belgian coast. Not only did a breakout from the Ypres Salient have the potential to clear the coast, thereby ending one of Germany’s U-Boat threats, but the capture of the Belgian rail net, upon which the enemy’s logistics depended, would force his opponent from much of Northern France.

Haig hoped that the offensive, which became known as the Battle of Passchendaele, would bring about the collapse of the enemy. Estimates of the enemy’s manpower, drawn up in the summer, and taking into account the situation in Russia, suggested that Germany had reached the nadir of their personnel resources. The report announced that:
Germany is now within four to six months of the total exhaustion of her available man-power, if fighting continues at the present intensity.

At the end of this time, it can be definitely asserted, she will be unable to maintain the strength of her field units . . . .

The report also concluded that worsening economic conditions in the enemy’s homeland had brought about a decline in industrial production, with a corresponding effect upon the German Army’s resources. Furthermore, both the morale of the enemy’s civilian and military sectors had fallen, leaving no doubt as to British ascendancy in that sphere. The report concluded that “given a continuance of circumstances as they stand at present and given a continuation of the effort of the Allies, then Germany may well be forced to conclude a peace on our terms before the end of the year.” Haig reiterated these points to the War Council on 17 June to justify his plan, protest the diversion of resources to other fronts, and reassure the reluctant government of David Lloyd George that the offensive was necessary and had a good chance of success. Not to attack, Haig suggested, would allow the enemy to recover and result in the loss of any advantage gained from the wearing-down process. Haig anticipated that if the British kept up the pressure, continued the exhaustion of the enemy, and inflicted a major defeat upon their opponent, the German’s subsequent collapse would end the war.

Haig assigned the task to Gough and Fifth Army. Although Ypres had since 1915 been the preserve of Plummer’s Second Army,
the insertion of Gough into the arena reinforced the conclusion that Haig was seeking a quick, decisive victory. Plummer’s plans had stressed a series of infantry battles that would eventually break the enemy’s defenses. Haig did not want a prolonged struggle, and so in late April he substituted Gough, a dashing cavalryman with a reputation for rapid decisions. He expected Gough to break through the enemy’s defenses within a matter of days and destroy the German Army in the subsequent pursuit. Ironically, Haig would become dissatisfied with Gough’s rate of progress during the battle and reinstall Plummer into the salient, so that both Second and Fifth Armies would fight the second half of the battle.²¹

However, before the break-out from the salient could commence, it was necessary to seize the Messines - Wytschaete Ridge to create a defensive flank and to deny the enemy observation of the British preparations for Passchendaele, which they could easily see from its heights. Undertaken by Plummer’s Second Army, the Battle of Messines was one of Britain’s most successful and cheapest victories. Preparations for the ridges capture dated to September 1915 when the engineers put forth the idea of tunnelling mines under the position. Although digging did not begin in earnest until 1916, eventually twenty-four tunnels, some more than 2,000 feet long, stretched from the British lines to under the enemy position. The British announced the battle’s commencement on 7 June 1916 when they detonated twenty-one of the explosive packed chambers, ripping the top off the ridge and devastating the defenders, although only nineteen of the chambers blew up.²²
Although the destructive and stunning effects of the explosives helped assure an easy victory the mines were only one element of force that the British brought to the battle. Even without the mines, the British had gathered an enormous amount of firepower. The artillery had 1,560 field guns and over 750 heavy calibres while the Royal Flying Corps provided over 300 machines for observation and photographic services. The airmen photographed the enemy’s battery areas every other day, thereby greatly assisting the location of German guns and the assessment of the British counter-battery effort. The gunners began their preliminary work on 21 May and intensified their effort at the end of month. The battle also featured important roles for the gas services. Throughout the build-up the artillery used chemical shells as harassment, attrition, and counter-battery, and at zero hour they unleashed a special gas bombardment on enemy gun positions so as to prevent their challenge of the advancing British infantry. The Special Brigade made contributions to the wearing out battle, including the projection of oil drums onto enemy positions, although poor weather conditions cancelled much of their plans.23

At 3:10 AM on 7 June the British detonated the mines, immediately followed by the roar of the artillery. The explosion took the Germans completely by surprise as the British had maintained the secrecy of the scale of their digging. Twelve divisions of infantry rose and advanced on the ridge, now obscured by dust and falling debris. The gunners firing gas and high-explosives in their counter-battery missions succeeded in neutralizing the enemy’s artillery and
the infantry crossed No Man’s Land with little interference. The attackers found the garrison largely dead, wounded, or stunned, and the British, Australians and New Zealanders quickly captured the enemy’s first line. Resistance did increase and casualties mounted, but by 9:00 AM the ridge was in British hands and the infantry began the process of consolidation in anticipation of enemy counter-attacks.

With Messines conquered the British began planning in earnest for a breakout from Ypres and the decisive battle. On 30 June Haig gave Gough his objectives as first the occupation of the Passchendaele Ridge closing the exits from the salient and second the sea. His ambitions were far too great, however, as the enemy defenses were extremely strong and their depth exceeded the effective range of the British artillery. Gough responded with a plan which, while it did not call for a break through on the first day, still anticipated rapid success. The attackers would aim to penetrate about 3,500 yards into the enemy line in the initial surge, and then after a pause of a few days, would bring forward their guns so that they could reach the enemy’s final organized positions. Gough had considered a less controlled advance on the first day, but with the infantry gaining as much territory as possible to take advantage of the enemy’s confusion in the attack’s opening hours. However on the eve of the battle he issued instructions that the infantry were to halt on predesignated stop lines, so that the organization for the second round could proceed in a more systematic fashion. When Fifth Army resumed the attack they were to smash through the last of the
enemy’s defenses and push into the open beyond, first towards the rail hub or Roulers and then towards the coast. This grand sweep would trap the enemy troops in Belgium and isolate much of the enemy’s troops in Northern France from their source of supply.\textsuperscript{24}

The artillery preparation for the battle began on 16 July and Fifth Army had at its disposal 1,422 field guns and 752 medium and heavy pieces. Second Army on its right would further augment the artillery resources. The gunners were packed in to the salient and were under observation from enemy positions on the ridges; they would suffer heavily, especially after the arrival of mustard gas. The counter-battery barrage reached its climax over the final three days and nights, with gas shells employed on as many targets as possible to neutralize the enemy gunners as the infantry moved into their jump-off positions. On the final night, from midnight to zero hour at 3:50 AM, the artillery sent gas shells against all known enemy batteries that they could reach. Additionally, the 4.5-inch howitzers, over the final six nights of the preparation, sent gas shells into enemy strong points in woods and along the banks of the Steenbeck to weaken their garrisons. German artillery power remained great but the British succeeded in suppressing their rival’s guns during two critical maneuvers. The infantry reached their assembly positions without serious loss and the enemy’s defensive barrage was ineffective as the attackers crossed No Man’s Land.\textsuperscript{25}

The Special Brigade began their contribution to the preliminary bombardment on the 15th with a series of early morning wasting strikes against enemy positions all along Fifth Army’s front. Foulkes’
troops dispatched 2,696 projector drums and 3,622 gas-filled mortar bombs. They continued their bombardment the next night and on all subsequent opportunities when the weather was favorable. In total they would fire over 5,100 projector drums and 10,500 mortar bombs. At zero hour they switched from gas, and hit enemy strong points with thermite and boiling oil. Edmonds was impressed enough by these efforts to note in the official history that their actions lowered the fighting resistance of the enemy.26

At 3:50 AM on 31 July nine divisions of infantry rose, went over the top, and headed towards the enemy. Slightly to the rear, two cavalry divisions waited for their opportunity. Initially the British made good progress and the attackers quickly captured the German outpost and observation lines, but as they entered the enemy's strong points the assault slowed and casualties began to mount. The enemy's artillery would also prove themselves not fully tamed as their barrages, particularly against the center, savaged the attackers. German resistance and counter-attacks would halt the offensive with the British less than half-way to their objectives. The losses were high, with Fifth Army sustaining 27,000 casualties for the first four days of the battle. The enemy had also suffered heavily, as the British had mauled nine German divisions and taken over 6,000 prisoners.

Worse, however, was the rain which began as a drizzle but by evening had become a sustained downpour that lasted three days. The war had shattered the region's system of dikes and canals which normally drained the ground and, with nowhere to go, the water
collected and converted the torn and shattered terrain into a waste of mud. The wounded, who had taken shelter in shell holes, slowly sank as pools of water collected and the mud drew them down to a slow, suffocating death. If the Somme was pre-eminent first in the nation’s collective memory for the tragedy of its first day, then Passchendaele was a close second with the nightmare of its consuming earth.

The rain also altered the operational plan. In a sea of mud Fifth Army could not quickly prepare their next blow, and instead of a pause of only a few days, the next attack would not go off until 10 August, allowing the enemy plenty of time to repair their defenses and move up reinforcements. Instead of a swift breakthrough, the campaign would become a series of sharp, limited engagements, with pauses in between, as the British fought themselves up the high ground. At each stage gas attacks, by both Special Brigade and the Royal Artillery, assisted in the preliminary bombardments and the assault. Haig, however, never gave up hope of eventually reaching the coast, and the British adopted a wearing down attitude towards the battle.

By October Haig sensed that the enemy were nearing the end of their resources and at conference with Gough and Plummer on the 2nd he questioned their preparations should the opportunity for exploitation arise. Haig wanted the reserve brigades of the attacking divisions for the Broodseinde assault of 4 October, along with corps cavalry units, tanks, and mobile batteries, to be ready to advance on the initiative of local commanders. Gough and Plummer
both agreed that there were signs that the enemy were approaching the breaking point and that their armies had to be ready for a rapid advance, but they also thought that the Germans required two more defeats.\textsuperscript{27} On the 6th the Fifth Army ordered that "in case of a complete breakdown of the enemy's opposition, corps will be prepared to make a further advance . . . ."\textsuperscript{28} and Haig noted in his diary a discussion on the concentration of rolling stock and lorries for the rapid sending forward of reserves.\textsuperscript{29} The collapse of the enemy never eventuated even though the battle cost the British nearly 240,000 men.\textsuperscript{30} Though pushed back the Germans bent but did not collapse, and with the Canadian seizure of the Passchendaele Ridge, Haig brought the offensive to an end on 10 November. Victory would wait until next year.

**The Supply of Gas**

During 1917, an increased supply of chemical ordnance guaranteed a more visible and integral role for gas than had existed during the Somme. While gas munitions were rarely available in the quantities desired by the army, ammunition for the Special Brigade and the Royal Artillery would become more regular and plentiful over the course of the year, allowing for a gradual intensification of gas operations. Objectives once thought an impossibility, such as the neutralization of every known enemy battery, would become a reality. Table 7.0 outlines the status of supply as it stood at the end of 1916 and highlights the continuing discrepancies between request and receipt for shell gas.
Table 7.0

Demand and Supply of Chemical Shell as of 31 December 1916

<table>
<thead>
<tr>
<th></th>
<th>4.5 inch lethal</th>
<th>4.5 inch lach.</th>
<th>4.7 inch lethal</th>
<th>4.7 inch lach.</th>
<th>60 pdr. lethal</th>
<th>60 pdr. lach.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly</td>
<td>18,450</td>
<td>3,000</td>
<td>2,300</td>
<td>nil</td>
<td>9,250</td>
<td>2,000</td>
</tr>
<tr>
<td>Demand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>3,890</td>
<td>1,985</td>
<td>1,695</td>
<td>285</td>
<td>276</td>
<td>1,594</td>
</tr>
<tr>
<td>Receipt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Now</td>
<td>18,450</td>
<td>3,000</td>
<td>nil</td>
<td>nil</td>
<td>11,550</td>
<td>2,000</td>
</tr>
<tr>
<td>Required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The widest gaps were for lethal shell, a reflection of the continuing shortage of production capacity for phosgene.¹²

A report drawn up in late February further reinforces the image of Ministry of Munitions’ inability to meet General Headquarters requests. It showed that for the two month period of January-February 1917 General Headquarters desired 90,000 4.5-inch lethal shell, had been given a probable output estimate of 72,000, and had actually received 27,608. The figures for the 60 pounder lethal shell were 52,000 requested, 34,000 promised, and 11,946 received. Production thus continued to fall short of both requirements and guarantees. Despite the discrepancy, Haig raised his demands for the period of January-March to 165,000 and
100,000 lethal shell for the 4.5-inch howitzer and the 60 pounder gun respectively. Production of lachrymatory shell was much closer to demand, and a mid-March report showed that the Ministry of Munitions exceeded GHQ's request for 3,000 rounds per week by 75 percent for the 4.5-inch howitzer, although they provided less than half of the requested 2,000 60 pounder shells per week.33

The arrival of mustard gas in June and the approval of a chemical round for the 6-inch howitzer complicated the British demand for gas shell. Table 7.1 outlines a revised General Headquarters program for a weekly supply of chemical shells.

Table 7.134

<table>
<thead>
<tr>
<th>Caliber</th>
<th>Lachrymator</th>
<th>Lethal</th>
<th>Mustard Gas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weekly</td>
<td></td>
<td></td>
<td>Weekly</td>
</tr>
<tr>
<td>a) 6-inch</td>
<td>10,000</td>
<td>4,000</td>
<td>36,000</td>
<td>50,000</td>
</tr>
<tr>
<td>howitzer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) 4.5-inch</td>
<td>7,500</td>
<td>7,500</td>
<td>15,000</td>
<td>30,000</td>
</tr>
<tr>
<td>howitzer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) 18-pounder</td>
<td>nil</td>
<td>nil</td>
<td>50,000</td>
<td>50,000</td>
</tr>
</tbody>
</table>

The demand for mustard gas, code name HS, underlines the scale of the impression the substance had made on General Headquarters. Furthermore, its inclusion, and at such high rates of production,
suggested that this agenda was a long-range goal, an observation reinforced by the fact that the Ministry of Munitions did not yet have a factory in which to make the chemical nor even a clear understanding of the necessary processes. Table 7.1 also demonstrates the army's preference for the 6-inch howitzer now that an approved pattern existed for the shell. The report did not include production targets for the 60 pounder gun since the British planned to largely replace it, especially for counter-battery, with the 6-inch howitzer. The addition of the 18 pounder also represents a desire to further diversify the capabilities of the British gas arsenal, even though a chemical shell was not yet available for this caliber. The field artillery would not fire an 18 pounder gas shell for more than a year.

The greatest logistical failure of Britain's chemical effort during the war was the great delay in the arrival of mustard gas shells. The British made its production a top priority and at a conference on gas policy Butler reflected that, "he attached great importance to H. S. or any other gas which can be proved to be an equally good or better incapacitator; he considered it to be the most effective gas used up to the present."^35

At the same conference, the British agreed that to expedite construction of a third of the mustard gas factory, to start production quickly, with the rest built at a lower priority.^36 However fourteen months would pass before the gunners would have any shells to fire. The production of the substance required a complex chemical process, and although the British assigned a number of teams to
work simultaneously on the task, the secret of its mass manufacture proved difficult to solve. Scientific egos also entered into the picture, as competing researchers sought to advance their own solutions. One went so far as to appeal to Churchill to promote his process over that of his rivals. But the principle cause of the delay was the state of Britain’s prewar chemical industry. The British simply lacked the personnel, unlike the Germans, who had experience with these substances in industrial settings. The British would retaliate with some mustard gas in 1917, such as the five projector drums they dropped near Armentieres on 1 August, but they used materials, in minuscule amounts, that they had either captured from the Germans or extracted from dud enemy shells.

The introduction of Blue Cross, the other German chemical innovation of 1917, had no effect on the British gas mixture as the substance proved to be a failure, one of the great gas fiascos of the war. Blue Cross was an arsenic based compound which acted as a powerful sternutator on the respiratory system. As an inert powder it had the ability to pass through the current pattern of British respirators, and if the Germans had designed a proper delivery system the gas would have had a devastating effect. Once inhaled, the irritation to the nose and throat, along with the possibility of nausea, forced the wearer to remove his mask, thereby exposing the victim to lethal agents which the Germans included in their gas bombardments. However the substance was only effective if it was dispersed as a particulate cloud in the atmosphere. The Germans believed that the explosive force of the shell’s detonation would be
sufficient to pulverize the agent to the required fineness. Their error was to inadequately test the device, for on the battlefield the explosion failed to reduce the chemical to the size necessary to achieve airborne status and instead dispersed it in chunks that collected harmlessly on the ground. The Germans fired millions of Blue Cross rounds and wasted enormous chemical resources on a weapon that proved to have negligible effects. The British, who were also at work on an arsenic-based weapon, did not make the same mistake and did develop a dispersal system that properly suspended the chemical in a cloud. It was not ready until 1919, however.\textsuperscript{39}

The British quickly deduced that in its present form Blue Cross posed no threat. Capt. A. C. Jessup, RE, that the German method of dispersing Blue Cross negated the chemical's sternutator properties, and that the only harmful consequence was a secondary symptom of modest depression from which victims soon recovered within six to twelve hours. "Even in more prolonged cases," he went on, "the man can never be considered as a serious casualty for any length of time."\textsuperscript{40} After the war, C. G. Douglas, who had been the army's chief gas pathologist, reached the same assessment.\textsuperscript{41}

While General Headquarters did not get all they wanted, the army's stockpiles progressively increased over the year. At Vimy, First Army had an inventory of 40,000 gas shells and Third Army had 60,000 for Arras. Two months later, for the larger Battle of Messines, Second Army had on hand 120,000 gas rounds. By the end of the month Fifth Army had accumulated 154,000 rounds for use in the preliminary bombardment at Passchendaele and had
expectations of receiving a further 34,000 a week. While supply had
never caught up with demand, the Ministry of Munitions had
certainly made progress in meeting the army’s needs.42

Shortfalls also existed for the Special Brigade. Foulkes had
wanted 22,000 rounds per week for the Stokes Mortar, but for the
three weeks ending 17 February he would get a total of 11,630,
barely one-sixth of his request. Shipments for the Livens projector
also failed to meet requisitions. Foulkes demanded 10,000 copies of
the device but received only 5,800 and of the drums only 2,300 of
the ordered 20,000. Another 6,000 devices came by mid-March and
the Ministry of Munitions promised a regular supply of 5,000 Livens
bombs a week. However, on 20 March the Army Council saw fit to
appeal to the Ministry of Munitions to provide as many Livens
projectiles as possible as they expected a great opportunity for their
use prior to the April offences, while Lieut.-Gen. William Furse, the
Master General of the Ordnance, wrote to complain that the Special
Brigade was not getting the chemical munitions it needed.43

General Headquarters reiterated the importance it placed upon
chemical munitions in late February when it raised the percentage of
gas shell to 12 percent of total supply of ammunition for the 4.5-inch
howitzer and 60 pounder gun from the previous year’s
establishment of 10 percent. In April the ratio was further
increased to 12.5 percent and Haig authorized the filling of chemical
shell at the expense of both high explosives and shrapnel. General
Headquarters also weighed the priority between the Special
Brigade’s needs for Stokes Mortar ammunition and the requirements
of the artillery. In mid-March Haig decided that if there was not enough gas for both organizations then his preference was to be for shells over mortar bombs. By advancing gas shell ahead of high explosives and shrapnel, Haig signalled the value he placed upon these munitions.44 However, despite the increased urgency, output by the Ministry of Munitions still lagged behind demand. By May they only reached 7 percent of the total for the 60 pounder gun. In response, the Director of Ordnance Services requested the acceleration of the supply so that this ammunition would reach its established level of 12.5 percent as quickly as possible.45

The shortages of materials had real operational implications, and on occasion the British had to curtail or cancel a discharge.46 Yet to blame solely the Ministry of Munitions for its inability to meet General Headquarters demands would be unfair, especially since this organization had to overcome Britain's tremendous prewar inferiority in chemical industries. Furthermore, General Headquarters did not help matters by their frequent increases in demand and changes in the composition of the fillings. For example in March 17 Haig eliminated the long-standing order for the lachrymatory agent SK as a shell material and instead wanted half of the 4.5-inch and 60 pounder rounds to contain PS while the remainder could be any lethal substance such as phosgene. PS was the code for chloropicrin, a compound with lethal and lachrymatory properties, which would become one of the mainstays of the British gas effort. It had gained in importance because the German mask was not entirely proof against it and upon penetration PS had the
effect of inducing vomiting. This forced the wearer to remove the mask and thereby become even more exposed to the lethal vapors. It became a standard tactic to combine PS with more deadly compounds during bombardments of enemy positions.\textsuperscript{47}

In July Haig modified the order for the howitzer to 25 percent lethal and 75 percent PS while the 60 pounder would revert to 75 percent SK.\textsuperscript{48} Later in the year General Headquarters abandoned PS for the 4.5-inch howitzer and substituted either PG or NC, both of which contained chloropicrin but also contained other elements.\textsuperscript{49} For the 60 pounder the army also replaced PS with PG and NC but only to the proportion of 25 percent with the remainder to be 50 percent lethal and 25 percent KSK, a purer version of SK. In these shifts, General Headquarters was reacting to a tactical opportunity, seeking a mixture that would maximize the vomit effect of chloropicrin and increase an attack’s casualty potential. The Ministry of Munitions did seek more predictability in the army demands but Furse replied in March that a better forecast of requirements was impossible, a situation which did improve by summer.\textsuperscript{50}

The Special Brigade contributed its own confusion to the production situation by also reducing its requirement for SK, once in high demand, to zero. In April Haig changed the allocation for Stokes Mortar bombs to 75 percent lethal and 25 percent lachrymatory, and he requested if possible that the lachrymatory agent should be PS not SK. By mid-May General Headquarters determined that they no longer had a need for any SK mortar bombs and asked the Ministry of Munitions to cease their production.\textsuperscript{51} In July the Special Brigade
had 96,000 rounds of SK bombs in France and Foulkes suggested the return of 80,000 to England for the reuse of the contents.52

The combination of its chemical properties and the capabilities of the delivery systems contributed to SK’s fall from favor. It was among the most persistent agents used during the war, which complicated its use near friendly troops, a problem that the short range of the chemical mortar exacerbated. However, its fall from grace was temporary, and as counter-battery increased in importance the British discovered that its persistency properties were ideal for the long-term incapacitation of the enemy’s guns. Before the year was out there was a renewed call for its production, and its successor the more powerful KSK, and it would remain an essential ingredient in the Britain’s gas arsenal until its replacement by mustard gas almost at the war’s end.53

SK’s trial had another source, it was simply a victim of the changing nature of chemical warfare. British chemists fully participated in the struggle to gain an advantage over the enemy, and they were constantly developing better agents. The army was quite anxious to escalate the chemical war and it naturally wanted to switch to the latest and most effective substances. However, the consequences of this inventive genius for the Ministry of Munitions was quite daunting. While samples produced in labs for field testing purposes were not difficult to generate, the ministry faced a much harder task when called upon to make new materials on the scale necessary for battlefield use. The Ministry of Munitions had to shut down no longer needed production lines for reconfiguration, or they
had to build entirely new plants for the manufacture of the latest gases. The Ministry of Munitions faced continual difficulties with modernization, and its plants were usually obsolete before they became operational. The pulsating environment driving the search for improved materials and the production battle to keep up with an ever-changing program serves to dispel the myth of stalemate that is the popular image of warfare on the Western Front. The struggle for supremacy in chemical warfare demonstrates just how dynamic the war was in France.

The Special Brigade in 1917

The lessons derived from the use of gas in 1916 helped to establish the methods by which the British would wage chemical warfare for the rest of the war. Foulkes defined for the Special Brigade two broad principles by which to guide the Special Companies, and he disseminated his ideas through a lecture tour of British Headquarters during 1917. He divided the combat environment into two sections, the assaulting front and the non-attacking front. On the assaulting front Foulkes believed that:

The discharge from cylinders or projectiles is made so soon before zero that the enemy cannot, under the circumstances, replace his casualties. Resistance is thereby weakened and advantage is taken of resultant confusion.⁵⁴
General Headquarters also accepted Foulkes' interpretation, and its planners concluded that "a discharge at . . . night preceding a general assault is likely to reduce very considerably the resistance to the assault." On the non-attacking front, Foulkes identified the objective of gas bombardments as the elimination of the enemy's potential reserves.

Foulkes distinctions helped fit Special Brigade operations within the overall principles outlined in the FSRs and Haig's concept of the phases of battle. Once the British Army had determined on battle, it was necessary to weaken the enemy and gain fire superiority so that the infantry could successfully close with their opponent at the decisive moment. Foulkes sought ways for his engineers to contribute to this struggle by the discharge of poisonous vapors to kill, confuse, impair the efficiency of, or morally weaken the enemy. Furthermore, the Special Brigade could also strike at targets that were immune to destructive fire by the artillery, namely the defenders of strong points who were securely ensconced in their deep dug-outs. British policy stressed that gas was more effective than artillery in destroying these kinds of defenses. Finally, the Special Brigade would, through the use of ruses or attacks on defensive flanks, create diversions to assist the main attack. Through these actions gas would restore a degree of mobility to the battlefield and the Special Brigade would aid the infantry across No Man's Land and into the enemy's defenses.

On the non-attacking front, the Special Brigade would contribute to the overall wearing down of the enemy through a
deliberate program of deadly discharges. The successful gassing of an enemy unit would lower its morale and also eat away at the extent of the German reserves. When not supporting an attack by the infantry, gas became an attritional weapon, a pure auxiliary to the wearing down process. Gas need not result in casualties for it to be effective. The British believed that simply forcing the enemy to wear masks resulted in a lowering of their morale. Gas, along with other wasting activities on passive fronts, such as infantry raids or artillery harassment fire, would wear away the enemy’s morale, pushing the German Army closer to the point when it would collapse under the pressure of a decisive battle. The largest discharge of 1917 occurred on a non-attacking front when the Special Brigade released 102 tons of gas between Givenchy and Hulluch on the night of 4-5 October.

By the beginning of 1917 Foulkes had identified a number of missions that the Special Brigade was capable of performing and which contributed to the overall goal of gaining superiority over the enemy in order to be ready for the decisive battle. Attritional missions, both on attacking and non-attacking fronts, were the most common and had the objective of causing casualties. Foulkes believed that the Special Brigade was the most efficient wearing down unit in the British arsenal. After the war he calculated that the Special Brigade caused one enemy casualty for every cylinder, for every five drums, and for every ten mortar bombs discharged. Harassment missions were similar to attritional missions but instead of trying to kill or injure the enemy they hoped to increase the
victim's misery and thereby lower their efficiency and morale. Counter-preparation missions, on an attacking front, were also vital in order to give the infantry time to consolidate before facing counter-attack. Finally, the Special Brigade utilized ruses and discharges on defensive flanks to confuse the enemy and protect the infantry in the carrying out of their duties. The British rarely fired gas in a defensive mode, a form of chemical warfare in which the Germans specialized.

Foulkes also identified three ways to counteract the use of respirators by the enemy, namely surprise, exhaustion of the enemy’s mask, and penetration of the enemy’s mask. Surprise required the Special Brigade to envelop their target in a gas cloud before the enemy had a chance to put on their respirator. Projectile weapons, the Livens drum, Stokes bomb, and artillery shell, which arrived with little warning, were highly effective means of obtaining this sort of success. Under the right conditions, a cylinder discharge might also catch the enemy unawares. If the British had secretly installed the appliances, covered the sound of the discharge with rifle or artillery, and attacked at night, the high concentration of gas obtained by a cylinder floatation could be devastating.59

Even after the enemy had put on their masks they were not safe from British gas. Foulkes pointed out that the German respirator’s life expectancy was shorter than that of the British type and that after an exposure of several hours, through saturation, they would become useless, thus rendering the soldier vulnerable. Foulkes also planned to take advantage of several design weaknesses
in the enemy's issue in order to inflict casualties. General Headquarters increased the demand for PS since it had some ability to penetrate the German mask, and British chemists constantly sought other agents with similar properties, such as stannic chloride, known as KJ. Since the air intake valve on the German mask was fairly small, gas officers believed it was possible to overload the protective agents. If the wearer took a breath in a cloud of extremely concentrated gas some of the toxic elements would escape reaction with the mask's active ingredients and pass into the victim's lungs. Finally, Foulkes had reliable intelligence that a significant percentage of the enemy's masks were defective.

In April 1916 the enemy had lost 1,600 men as a result of blowback from a lethal cloud they themselves had released. In the report, of which the British had captured a copy, the investigators revealed that 35 percent of the masks in the area were unreliable. A wider search of the entire Western Front disclosed that 11.5 percent of un-issued masks were not gas-proof. Foulkes hoped that the enemy would be slow to fix these deficiencies, and there is evidence that he was correct. A projector attack at 2:00 AM on 21 July on Fifth Army's front in preparation for Passchendaele resulted in numerous enemy casualties. The doctor at the regimental dressing station revealed, in a captured document, that many of the injured complained that the gas went right through their masks. Upon investigation he found that the masks were too large for the men and that the loose fit had caused the casualties. In conclusion he recommended that the army give resting units facilities for testing
masks, apparently something that the enemy’s anti-gas organization had failed to provide. Foulkes’ intentions were dangerous for the enemy, in regard to both their survival and their morale. If gas could penetrate the German mask, then the soldiers would lose faith in its protective value and feel that they were powerless against the deadly chemicals. Such a development had great appeal to the British because not only did it suggest moral superiority but if German soldiers believed that their masks were worthless, gas discipline would break down and create a self-fulfilling cycle leading to more enemy casualties.61

Using these methods the Special Brigade frequently drew blood. A captured document dated 8 July 1917 from the 111th Division warned, “our losses have been serious up to now, as the enemy has succeeded in a majority of cases, in surprising us, and masks have often [been] put on too late.”62 Another document disclosed that “[we] cannot hope to prevent gas casualties owing to the surprise effected and the heavy concentrations of gas obtained.”63 Surprise was the most effective way to kill or injure the enemy, but if the chemical engineers could establish a sufficient concentration than even protected soldiers would fall victim.

Foulkes had three principle means at his disposal to strike at the enemy: cylinders, projectors and mortars. “Z” Special Company would manage another flame thrower attack in October 1917 but it would be that weapon’s final appearance. During the year, the chemical engineers would release 2,031 tons of gas. Table 7.2
illustrates how the Special Brigade allocated the gas between the three delivery systems.

Table 7.264

Weight of Gas Discharged By the Special Brigade

<table>
<thead>
<tr>
<th>System</th>
<th>Weight of Gas in Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livens Projectors</td>
<td>1,307</td>
</tr>
<tr>
<td>Stokes Mortars</td>
<td>370</td>
</tr>
<tr>
<td>Cylinders</td>
<td>354</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,031</strong></td>
</tr>
</tbody>
</table>

Throughout the year the British Army would debate the relative efficiency of the three dispersal systems, and most officers preferred projectile weapons. The Livens Projector would gain the favor of most leaders and it would eclipse cylinders as the primary means of discharging gas. Foulkes, however, preferred cylinders and therefore they would continue to play a role, if at a reduced rate.

Foulkes' support for the cylinder derived from its ability to deliver the largest volume of gas to the enemy, on the broadest front, and therefore had the greatest potential for causing the enemy severe casualties. Projectors and mortars were limited area weapons which, while useful for causing casualties, could not destroy the effectiveness of a whole unit. Cylinders had the potential to force the enemy to withdraw entire organizations from the line for
prolonged periods of rebuilding or the reestablishment of morale. Cloud gas, however, continued to have a number of insurmountable drawbacks. Its dependency upon the wind made it incapable of coordination with any of the other arms, and the risk of blowback, the self-infliction of casualties, remained a prime concern. But the biggest problem for cylinders was the extraordinary degree of preparation and labor that they required for installation and discharge. The Special Brigade had to rely upon work parties, seconded from the infantry, to carry in the appliances, pipes, valves and other materials, and then it was the infantry that had to share their positions with the gas, and assume the risk of a leak or detection by the enemy, while the chemical engineers waited for a suitable wind. It was the infantry that also bore the brunt of the enemy's retaliation as the Germans aimed their guns upon the point of discharge, the trenches. Infantry officers, therefore, tended to prefer projectors for which they did not provide any assistance in carrying the materials, preparing the site, or the risk, since the Special Brigade installed the devices in a retired, camouflaged position.

In his lectures Foulkes reiterated the value of cloud gas as a killing device and requested greater infantry support for his operations. To the Fifth Army staff he noted that "[the] present exclusive use of projectors is reducing the ability of the Special Brigade very much." He explained that the Special Brigade installed projectors without any infantry help and therefore his engineers could launch fewer attacks. He concluded that the main problem was
the provision of labor, and he hoped commanders would make better utilization of the potential of gas by being more willing to provide work details.  Foulkes revealed his long-term plans for chemical warfare and his ability as an empire builder when he said, in his conclusion, that, as a result of more discharges, "gas would be looked upon not so much as one of the minor accessories in the preparation for offensive operations but as one of the major weapons in trench warfare." To the Second Army he again spoke of the need for more support from the infantry for cylinder discharges. He explained that the cloud gas method was, "by far the most effective for inflicting casualties, and by far the most profitable to employ." At the end of his lecture he suggested that:

It is one of the ironies of fate, now that there is for the first time anything like a general demand for gas in the armies, that the demand should be for projectiles - which are less effective than cylinders . . . .

Foulkes was fighting a losing battle, particularly since the demands upon the infantry's labor were already enormous. Even when moved out of the trenches for rest, British battalions engaged in all sorts of training and work details. His claims to the superiority of cloud gas are also a little suspect. Cylinder discharges did cause casualties, and in large numbers, but it was the projector that apparently struck the greatest terror in the enemy's ranks. From the perspective of
wearing down Foulkes should have more firmly embraced Livens’ invention.

To overcome opposition, Foulkes endeavored to make cylinder discharges more deadly and easier to launch. He arranged an issue of 500 small White Star cylinders, each weighing fifty pounds, to be carried by a single man in a sling. “C” Special Company carried them forward on the night of 17 April and discharged them the same evening without bothering to dig emplacements and without infantry assistance. However, even with reduced weight it still proved an exhausting operation as each engineer had to make two trips with a cylinder, and then assemble the pipes and discharge hoses. Foulkes would occasionally use this method but only for minor operations. On another instance the Special Brigade employed Yellow Star, a mixture of 70 percent chloropicrin and 30 percent chlorine. They opened 700 cylinders on the night of 6 November and the resulting cloud carried across to the enemy’s trenches on a three mph wind. Captured enemy documents revealed that the chloropicrin penetrated the German soldiers’ masks and caused heavy casualties in the 453rd and 10th Bavarian Regiments. Foulkes also sought to utilize terrain to increase the efficiency of gas. In May, in support of the upcoming Messines battle, he suggested flooding the Lys valley with a massive flotation of gas. Foulkes believed that pushed by the wind and held together by the shoulders of the valley, the gas would not disperse and a dense cloud of deadly gas would penetrate into the enemy’s rear, bringing devastating damage to the enemy’s artillery, headquarters and support installations. Foulkes planned to
release 3,700 White Star on about 21 May, 2,000 Green Star and 3,000 White Star on about 5 June and a grand finale of 4,500 White Star on the eve of the attack. However this never took place. Foulkes would continue the debate into 1918 and would continue to experiment with other methods of cylinder attacks.\textsuperscript{69}

Projectors became the mainstay of Special Brigade operations in 1917, and the chemical engineers fired nearly 100,000 drums during the year. Foulkes identified the most suitable targets as areas which the enemy held strongly and which contained underground shelters that were immune to artillery bombardment. The Special Brigade would principally fire gas from their projectors, but on occasion they discharged drums filled with flammable oil or high explosives. When filled with gas, the drum contained thirty pounds of phosgene, the equivalent in capacity of a 8-inch howitzer gas shell although the drum weighed only sixty pounds compared to the shell’s weight of more than 205 pounds.\textsuperscript{70} Easily camouflaged, the projector was an ideal weapon of surprise, and if the enemy did not see the muzzle flash the drums arrived without any warning. Even if the German sentries were alert they still had only a few seconds to raise the alarm before the gas plunged onto their position.\textsuperscript{71} Captured enemy documents repeatedly stressed the devastating nature of the weapon and the difficulty in protecting the men from its threat. A memorandum of 4 June 1917 from the German Fourth Army headquarters referred to it as a “dangerous weapon with a high degree of effectiveness,” while another enemy report conceded that it was impossible to prevent gas casualties from the projector.\textsuperscript{72}
The final branch of the Special Brigade’s triad was the Stokes Mortar. Unlike in 1916, this weapon now had an adequate supply of munitions along with a wide selection of chemical fillings. The mortar companies could choose from PS, SK, and CG, the code for phosgene, as well as smoke and thermite bombs. The PS rounds were soon replaced by PG and NC. Each gas bomb contained about seven pounds of chemicals and was the equivalent of a 6-inch howitzer gas shell, although the shell weighed about 100 pounds compared to the bombs’ twenty-five.73 So plentiful had ammunition become that Foulkes could write:

The most lavish expenditure of ammunition should be aimed at, and, if possible, every round allotted to the armies should be fired before the assault takes place as abundant fresh supplies are now being made available.74

In 1916 the Special Brigade used its mortars intermittently and only to fire smoke. In 1917 they would launch over 90,000 gas bombs along with nearly 11,000 thermite rounds.75 Foulkes welcomed the opportunity to finally be able to employ this weapon in the role that had been envisioned, both to help the infantry on the battlefield and to wear down the enemy.

The variety of bombs increased the mortarmen’s ability to trick the enemy and inflict casualties. Foulkes, in Gas!, provides an example of an operation conducted by No. 1 Special Company on 1 December near Monchy-le-Preux. He wrote:
Forty-four mortars were engaged, and they opened with a half-minute bombardment with thermite, which brought the Germans hurrying out of their dug-outs to man the parapet in anticipation of the infantry raid which they thought to be imminent. Then came one and a half minutes rapid fire with CG bombs, followed by twelve minutes with PS and NC for penetrative effect, with a final one and a half minutes with CG. The whole attack lasted for a quarter of an hour, during which 2300 rounds of ammunition were fired. 76

This method became a frequently used tactic from mid-July 1917 onwards. 77

The Special Brigade’s projectiles had certain advantages over the cylinder. Both the mortar and the projector could quickly, if not instantly, establish a deadly concentration of gas on top of the target, and the rapidity of the arrival of the gas made the attainment of surprise highly likely. While not unaffected by wind direction and velocity they worked best in a dead calm when the wind would not blow the gas away from its victims. They also required less labor and were harder for the enemy to find, therefore making retaliation more difficult and rendering them more acceptable to the infantry. 78

The Battle of Messines can serve as a case study to illustrate how the Special Brigade applied Foulkes’ principles on an attacking front. The preliminary bombardment began on 21 May and the chemical engineers made their first discharge during the night of the
24th/25th. At 10:35 PM No. 2 Special Company opened fire with a barrage of 1,000 PS and 992 SK Stokes Mortar bombs on enemy trenches on the River Lys North-East of Houplines. The report on the operation outlined the objectives of the attack. The mortarmen used PS to inflict casualties and SK to force the enemy to wear their respirators for a prolonged period and thereby interfere with their repair of the damage that the British artillery bombardment had caused. Masked soldiers found it difficult, if not impossible, to undertake any labor since the device impeded the flow of oxygen, a problem more pronounced in German models since they had a smaller intake aperture than the Small Box Respirator. At 1:35 AM the next morning the Special Brigade fired 100 rounds of thermite onto the enemy position with the expectation of causing confusion within the ranks of soldiers who had already suffered the fatigue of having to wear their masks for three hours, thereby producing displacement of respirators and adding to the enemy’s casualties. The British were unable to ascertain the results of this attack but the conditions for a mortar discharge had been ideal.79

The Special Brigade had begun their contribution to the wearing down process and they would continue until these activities the battle’s commencement. On the evening of the 25th, L Special Company sent 179 drums of CG into the enemy’s support lines in Bois Blancs. Their objective was not only to cause casualties within an area containing numerous dug-outs, but also to disorganize the enemy’s ranks so as to assist a fighting patrol of infantry who were out on a raid. After a pause of four days the Special Brigade
resumed activity with a series of attacks on the II ANZAC Corps front. Early in the morning, forty-five rounds of thermite exploded over enemy positions around St. Yves. That evening the Special Brigade sent 644 drums of phosgene, along with 720 PS, fifty SK and fifty thermite Stokes Mortar rounds into enemy positions around Houplines. On the 30th the Special Brigade sent fifty SK bombs into Le Touquet, twenty-two projector drums against Trois Tilleuls Farm, and 250 PS and fifty thermit bombs on enemy positions east of Armentieres. Early in the morning on 1 June, No. 2 Special Company assisted a party of raiding Australians with a barge of SK and smoke some distance on either flank of their target so as to mask their movements and interfere with interdicting fire by forcing the enemy to wear their masks. The next morning the same company fired over 500 PS and SK bombs into several enemy trenches with the intention of inflicting casualties.

While most of the preceding operations were relatively minor affairs, the Special Brigade launched a large and quite novel gambit, just after mid-night on the morning of 4 June, operation "boiling oil." O and K Special Companies fired into the woods of Grand Bois and Wytschaete nearly 1,200 projector oil-drums with the intention of setting the trees and brush afire. In a scene that must have called to mind the burning pitch used during a medieval siege, the woods burst into flame and burnt for about twenty minutes. A prisoner of the 33rd Fusilier Regiment stated that the attack caused a mass panic throughout the position as soldiers stampeded to escape the fire. To increase the confusion and cause more casualties, the
mortarmen added 173 rounds of PS to the conflagration. Simultaneously with the operation against the woods, No. 2 Special Company mortared 120 thermite bombs into enemy positions near Wytschaete, with the intention of affecting the morale of the enemy and causing casualties. The results of the oil bombardment were sufficiently encouraging that the Special Brigade would repeat the method twenty-three more times in 1917 and continue the practice in 1918.82

On the day of the battle, the Special Brigade undertook a series of operations at zero hour to help the infantry get across No Man's Land. No. 3 Special Company sent 267 rounds of thermite into enemy positions near Wytschaete to cause casualties among the enemy as they manned their defenses. An inspection by the engineers that evening demonstrated that the bombs had found their target and that the enemy's trenches contained fragments of thermite bombs. Additionally, the bombs had set one dug-out on fire, and they found the remains of several Germans who had suffered burns. Another section of No. 3 Special Company fired 182 rounds of thermite into a different enemy trench in order to facilitate the advance of the 69th Infantry Brigade. Elsewhere, the same company used thermite to cause casualties and smoke to protect the advance of the 47th Division infantry from enemy machine-gun fire. Finally, this company undertook a counter-preparation bombardment of Clonmel Copse with 295 SK, 188 CG, and 190 PS bombs to prevent the enemy from massing troops in the site for a counter-attack. In this discharge the British used gas since
they did not intend to occupy the position. The No. 2 Special Company also participated in the day's activity, attempting to establish a smoke barrage for the 3rd Australian Division, on the right flank of the attack, and disorganizing the enemy with SK gas so as to impede their interference with the ANZAC advance. They had to discontinue their smoke discharge, however, when the wind became unfavorable, and they were unable to fire any lachrymatory gas.  

The largest planned floatation of the battle also fell victim to the weather. Foulkes had intended to discharge 300 tons of gas up the Lys River valley at zero hour to protect the flank of the attack. Intelligence had correctly reported that the enemy had positioned two counter-attack divisions in the valley. Foulkes had hoped to sweep the entire river bottom with gas, neutralizing the enemy's troops and batteries which could have maneuvered or fired against the flank of the advancing troops. However, on the day of the attack the wind was such that it would have blown the cloud onto ground that the attackers would have traversed, so the discharge was aborted. Not only had the wind once again prevented the use of gas but it had also wasted the labor of four Special Companies who had installed, and would later remove unused, nearly 10,000 cylinders and projectors.

Foulkes had allocated nearly one-half of his command to the Messines battle. The rest of his companies were by no means idle, contributing to the wearing down process by discharging gas on non-attacking fronts with the intention of inflicting casualties and fraying
the enemy’s morale. On First Army’s front, the Special Brigade fired 687 projector drums of lethal gas along with 475 Stokes mortar bombs filled with PS into St. Laurent at 12:30 AM on 25 May. The combination of PS, i.e. chloropicrin, with phosgenc might have accounted for the heavy losses the enemy suffered as the affected regiment reported over 300 casualties. A smaller attack of 570 projectors at midnight on 31 May near Avion on the 4th Canadian Division front also netted a satisfying number of victims. From prisoner interrogations the British estimated they had caused 400 casualties of which 130 were fatalities, including one platoon which lost twenty-five men. On the Third Army front on the night of 3 June the Special Brigade began its program with 189 PS mortar bombs into Havrincourt at 12:30 AM. An hour later 180 phosgene filled projector drums landed within the village, and at 2:10 AM nearly 200 more landed on enemy positions near Bullecourt. This was in addition to the nearly 1,000 projector drums and 750 PS mortar bombs the Special Brigade had sent into Havrincourt in the early hours of 29 May. In addition to their support of Second Army’s attack, from the beginning of the bombardment of Messines until the seizure of the ridge, the Special Brigade would conduct twenty-one operations on other army fronts. 86

Over the course of 1917 the Special Brigade conducted 540 operations. Therefore only a few more examples must suffice to illustrate the success of the Special Brigade in fulfilling their mission. During the lead up to Passchendaele Gough arranged for extensive discharges to wear down the enemy in preparation for the attack.
On 15 July chemical engineers from seven Special Companies released gas on enemy positions that lay in the path of the advance by the II, XIV, XVIII, and XIX Corps. Their targets were German strongpoints, trenches, concentrations of dug-outs and other positions which contained large numbers of enemy troops and which might impede the progress of the attack. They employed a total of 2,696 Livens drums and 3,619 mortar bombs, and virtually all of the gas they employed was lethal. On the evening of 20-21 July they repeated the attack, although with somewhat less weight, discharging 1,512 Livens drums and 2,723 mortar bombs.\textsuperscript{87} The gas that exploded over the 90th Fusilier Regiment on the 15th struck at a particularly vulnerable time as the unit was in the middle of a relief. A captured order of 18 July from that unit noted that the gas attack caused considerable casualties and, it warned, “at the slightest indication of gas, masks are to be put on immediately.”\textsuperscript{88} Translated orders of the German 226 Reserve Regiment from the day after the attack also sternly reminded the unit of the need for strict gas discipline. This unit required a draft of 500 men to bring it back up to strength.\textsuperscript{89} A captured NCO in the 392 Regiment from the strongpoint of Below Farm reported that there were at least forty gas casualties in his company, a figure that an enlisted man from the same outfit confirmed.\textsuperscript{90} After the subsequent discharge of the 21st, a report by the medical officer of this regiment revealed that he treated at least sixty-two casualties; others probably never made it to his aid post.\textsuperscript{91}
The Special Brigade had even more success in causing casualties in discharge against the fortified village of Bullecourt just prior to the commencement of that battle on 10 April. The gas troops dropped 296 Livens drums and 340 PS-filled mortar bombs directly onto the enemy’s position. The gas had a devastating effect upon the garrison, the men of the German 120th Regiment. A prisoner report estimated casualties to be at least 100 dead and nearly 200 wounded. One company had its establishment reduced to twenty-five soldiers, and the gas was so concentrated that some men died almost instantaneously. Shortly after the attack the British intercepted a German telephone conversation which described the gassing as a catastrophe and posed the question, "how could such an incident take place."\(^9^2\) Not surprisingly, Foulkes reports that the Germans withdrew the unit before its relief was due.\(^9^3\)

The Special Brigade achieved a similar effect with a projector attack near Lens on a non-attacking front belonging to First Army. Nearly 1,200 Livens drums unleashed a cloud of phosgene in the early hours of 26 July. A captured letter described the effect:

Then all at one the gas projectors were discharged, and everyone swallowed gas. When we were relieved later our company was 24 men strong. . . . On account of our heavy losses our battalion went straight from the front line to rest.\(^9^4\)

Even on quiet sectors the Special Brigade could quickly inflict casualties on the enemy. The German 84th Regiment during the
period 20 September to 16 October suffered twenty-eight deaths. Of these twenty-one were due to a 596 projector discharge onto Havrincourt on the night of 5 October.\textsuperscript{95}

Foulkes also continued in 1917 a practice that he had begun during the Somme with the aim or irreparably reducing the morale of select units. He availed himself of intelligence reports at General Headquarters on the disposition of enemy units and would have his Brigade follow certain outfits, repeatedly gassing them as they operated in the British zone. The 1st Bavarian Reserve Regiment was hit fifteen times, the 1st Guards Reserve Regiment twelve times and the 156th Regiment ten times.\textsuperscript{96} Sometimes the Special Brigade would gas a German unit that was due to transfer to a battle front so that the enemy arrived with their morale already tested. This was the intention behind L Company’s gassing of the 16th Bavarian Division which was about to move to the salient during the Passchendaele campaign.\textsuperscript{97} Foulkes also tried to gas enemy units that had recently arrived from the east to take advantage of their lack of experience with the more intensive gas conditions in France. This practice resulted in a memorandum by the German general staff which called for units new to the English zone to receive instructions in the procedures necessary to survive the British gas attacks.\textsuperscript{96}

The Royal Artillery in 1917

The Royal Artillery represented the second major means of conducting chemical warfare and, like the Special Brigade, the gunners developed principles by which to guide their gas operations.
Although the gases were often the same ones used by the Royal Engineers, the different delivery systems necessitated a slightly different operational philosophy. The primary distinction between the two branches was that the Special Brigade placed their major emphasis upon causing the death of the victim, although they also defined success in terms of causing casualties or lowering morale, while the artillery sought neutralization of the target with causing casualties a secondary condition. Haig identified the effect he wanted from his projectiles at a conference with the Ministry of Munitions in May 1917. He classified his weapons as:

- Artillery Projectiles: Principally neutralizing effect, with a small proportion of killing effect.
- 4-inch Stokes Mortar Projectiles: Principally killing effect, with a small proportion of neutralizing effect.
- Livens Drum: Killing effect only.99

The conference did not consider cylinders, but since they only came with a lethal filling there is little doubt that the British perceived their role as principally to produce “killing effect.”

The necessity for thus distinguishing between roles was due to the nature of the delivery systems, and the British conceded that a “killing effect” was difficult to obtain with shell gas. The manual on the use of shell gas recognized two means to obtain a permanent effect. They were:
a) To take the enemy by surprise by bursting shells so close to him that he is overtaken by the vapour before he has time to put on his mask.

b) To keep up a bombardment for so long a period, either that the resistant capacity of the German respirator is exhausted, or that the physical exhaustion of the wearer consequent on wearing it so long forces him to discard it and so expose himself to the gas.¹⁰⁰

The artillery had only a few seconds in which to cause casualties by the first method since, after the initial burst of shells, the enemy would naturally seek the protection of their masks. The second means of causing casualties was also difficult, since artillery shells held a small volume of gas when compared to Livens drums and Stokes bombs, and it was extremely difficult, and costly in shells, to establish a concentration of such density that the gas could overwhelm or penetrate the enemy’s respirators. Since it was expensive, if not impossible, to create a cloud of the necessary density, British gunners had only two practical choices by which to disable the enemy. They could employ sudden and short bursts of lethal shells to cause casualties or slow prolonged bombardments with lachrymatory agents to neutralize the opposing forces. Both methods achieved success, but since the FSR defined artillery’s primary responsibility as assistance to the infantry, neutralization, especially of enemy batteries, provided the greatest help to advancing troops.
The gunners also outlined the methodology necessary to meet these goals. While actual programs would vary according to local conditions, the British did develop a typical neutralization program. The bombardment opened with a burst of seventy lethal shells followed by lachrymatory gas at a rate of 150 rounds an hour, interspersed with occasional bursts of lethal shell to catch those defenders whose masks might have failed. The shelling could last hours to force the enemy to remain masked, assuring their inability to properly man their pieces. If the objective was the killing of Germans than the attackers used a modified firing schedule. A number of batteries would fire concentrated salvoes of lethal shells for two minutes, after which they would switch to a different target. The gas consumed for either mission did not exceed several hundred rounds, which was far less than the up to 8,000 shells that policy had called for in 1916. The dramatic downward revision was derived from two key observations. First, once the enemy had their masks on additional lethal substances would be useless and hence wasted. Second, it was virtually impossible for the artillery to build up concentrations of gas that could overwhelm the German respirator or penetrate down into their opponent’s underground strongholds. Only the Special Brigade possessed weapons in the Livens Projector and Stokes Mortar which were capable of reaching the enemy within their refuges. In order to kill, the artillery had to surprise the enemy on the surface and strike before they had donned their masks. The persistency of lachrymatory agents, such as SK or KSK,
also meant that the British needed only a few shells to so contaminant an area as to force the enemy into their respirators.

The manual Instructions on the Use of Lethal and Lachrymatory Shell outlined the operational specifications of gas munitions. Weather remained of paramount concern, and the best condition was dead calm. Shell gas was useless if the wind speed exceeded seven MPH for lethal gas and twelve MPH for lachrymatory agents. Both types were ineffective in freezing temperatures as the liquefied substances would not evaporate in extreme cold. The best targets were in valleys, woods and other places that impeded the wind or positions that contained trenches, dug-outs, cellars, and covered gun pits into which the gas could sink. It was virtually impossible to build up a sufficient concentration of gas on open ground. Finally, the artillery had to fire gas shells in large numbers, as isolated rounds were ineffective. For ranging purposes the manual recommended the use of a different type of shell in order to preserve the element of surprise.101

The gunners defined three phases of battle during which they could contribute to victory: during the preliminary bombardment, during the infantry assault, and during the time of consolidation after a successful attack. In the period leading up to the offensive the artillery would use lachrymatory shell to neutralize enemy batteries, interdict roads, tracks and junctions, and subject strongpoints to prolonged bombardments to tire the defenders. Second Army described the desired effect as, “his [the enemy’s] front system must be cut off and starved. All means of supply and
reinforcement must be reduced and his morale lowered by every possible means.\textsuperscript{102} A post-battle lecture reiterated this point as the speaker explained:

Maintenance of harassment fire through the night on roads and approaches is of the greatest importance and guns should not be redeployed to other purposes. The danger is not the enemy's infantry in the front line but rather the weight of troops moving up from the rear.\textsuperscript{103}

During the same period British batteries would fire brief barrages of lethal gas in order to cause casualties to small well-defined targets such as enemy battery emplacements, headquarters, and strongpoints.\textsuperscript{104} Both methods had a similar objective. The British used lachrymatory gas to harass their opponent and lower enemy efficiency and will to resist, while the lethal agents would thin the enemy's ranks. If the casualties were widespread enough it would render enemy units unfit for duty and force the German command to commit their reserves prior to the offensive.\textsuperscript{105}

Once the infantry assault began, the guns not involved in the barrage would concentrate on counter-battery. They would employ bursts of lethal gas followed by lachrymatory substances to compel the enemy gunners to wear their masks, to hamper their actions, and ultimately to prevent the Germans from manning their pieces and hindering the British advance. After the British had secured their objectives, the artillery support would revert to the role they had
played during the preliminary bombardment, with the additional objective that they would also attempt to impede enemy reinforcements by firing upon likely approach routes and assembly points to forestall a counter-attack. As had been first noted during the Nivelle Offensive, the Germans continued to hold in close reserve, just out of range of hostile guns, division-size bodies of troops for the purpose of launching an immediate and organized counter-attack. Training instructions noted that attacking troops must assume they would have to face a counter-attack, and that all plans should include provisions for the defeat of this threat. Counter-preparation fire would not only cause casualties within the ranks of the enemy massing for a counter-attack but would also buy time for the infantry to consolidate and prepare for the defense of their newly-won positions. Gas was an ideal weapon with which to disorganize enemy concentrations of troops or prevent their advance over vulnerable terrain. A report on Fifth Army operations during Passchendaele concluded that with good wind conditions a gas barrage beyond the final infantry objective, “will have considerable effect hampering hostile counter-attacks.”

While the gunners employed gas shell for a number of mission, including harassment, counter-preparation, and attrition, it was in counter-battery that chemical munitions achieved their most important function. British policy defined counter-battery as a fundamental operation of the artillery and its success was essential for the attainment of fire superiority and the survival of the
attacking infantry. The training manual *Artillery Notes* explained the importance of counter-battery in battle thus:

> Unless the enemy's batteries are discovered and destroyed, not only may his barrage fire render the capture of an objective difficult and costly, but his subsequent bombardments may make its retention impossible.¹⁰⁹

It was therefore vital that at the moment the infantry left their trenches the artillery open fire "on every hostile battery, known or suspected, of a sufficient intensity to prevent the service of the guns."¹¹⁰ By 1917, largely due to their technical innovations, British gunners had achieved such a degree of competency in neutralization that they would attempt to silence every German gun at the start of each battle.

Even though the Royal Artillery had obtained a high degree of accuracy, the elimination of an enemy gun by destructive shooting was still a slow and difficult task. Gas obviated the need for such precision since, as an area weapon, it only needed to land slightly upwind of the target so that the gas could drift over the enemy position. It therefore had a significantly greater allowance for aiming error than high explosive or shrapnel shells. Additionally, it could be effective at night when the target was invisible and the Royal Flying Corps was unable to correct fire. Subjected to observed shooting during the day and gas attacks at night the enemy would thus have no respite.
It was not even necessary to destroy the enemy guns for the infantry to achieve their missions. The neutralization of hostile batteries was sufficient. The British defined neutralization as the “firing at batteries with the object of preventing the detachments from serving their guns, or, alternatively causing the standard of their fire to be so lowered as to render their fire erratic and ineffective.”¹¹ The report continued, “gas shell . . . have probably the best neutralizing effect, especially on batteries sited in valleys and wood; the mere fact of the detachments having to wear gas masks renders the efficient service of the guns difficult.”¹² The Artillery Notes series propagated the primacy of gas in achieving neutralization throughout the Royal Artillery. It noted that:

Gas shell are particularly valuable in counter-battery work for neutralizing hostile batteries immediately prior to and during an attack, and should be employed in large quantities for this purpose. Recent experience has shown that this procedure has been attended with very excellent results, some hostile batteries so neutralized having subsequently remained silent for two or three days.¹³

Artillery Notes also recommended an exhaustion method to render enemy gunners unfit to man their pieces. It suggested that employing gas shell night after night against certain targets would force the enemy gunners to wear their masks all night and “gradually produce physical exhaustion from want of sleep.” Such
methods would also keep the target isolated, making feeding, resupply, and relief difficult.\textsuperscript{14}

A post-Passchendaele assessment suggested a growing preference for neutralization fire rather than destructive shoots as the means to gain an ascendancy over the enemy guns. It concluded, “a battery cannot be destroyed in a real sense of the word. It can be put out of action for a varying length of time which, however, will rarely exceed a week.”\textsuperscript{15} The Canadians shared this opinion in their own review of Passchendaele and determined that “the object of all counter-battery work is the reduction of enemy fire at critical points.”\textsuperscript{16} Elsewhere they noted that “gas shell provided the most valuable means of obtaining that reduction of hostile artillery fire at critical periods.”\textsuperscript{17} The enemy’s industrial resources enabled them to make up any material losses. It might be a better use of munitions to merely neutralize the enemy at the time and for the period desired. Gas counter-battery, however, could not be limited to the moment of attack since this would alert the enemy to the immediacy of the assault. While it would remain an ongoing process, featuring both high explosives and chemical agents, gas had achieved a vital place in helping the infantry to negotiate No Man’s Land.

The capabilities of the guns limited the scope of gas neutralization however. The British admitted that the short range of the 4.5-inch howitzer restricted the number of targets that it could reach, and there were not enough of the longer-range 60 pounder to effectively strike at distant targets. For this reason the provision of gas shells for the 6-inch howitzer became increasingly important,
since they were numerous and had a reach similar to that of the 60-pounder. The British would eventually acquire even longer gas range when shells entered service for the 8-inch and 9.2-inch howitzers, but these did not become available until nearly the war's conclusion.118

As the summer approached, the need for effective counter-battery fire became even more paramount. Enemy plans, captured before Messines, indicated that the Germans intended to rely upon an artillery defense. Intelligence reported that the Germans hoped to catch the infantry in an annihilating barrage as they left the trenches. Furthermore, any troops that did get into German lines would be cut off from reinforcement by a curtain of fire and subsequently destroyed. To counter this threat, General Headquarters intensified their emphasis upon efficient counter-battery. Second Army arranged for each of its attacking corps to carry out two demonstration barrages to simulate an assault. Plummer also ordered a army wide demonstration for 3 June. The objective of these actions was to trick the enemy into thinking that the attack had begun and thus unleashing their counter-barrage program. Having forced their opponent to disclose their firing plan and the location of their batteries, the British would use this information to improve their counter-battery agenda.119 The enemy showed that the British fears were not groundless. During Messines an enemy gas barrage caught the 3rd Australian Division as it moved up to its assembly area. The Germans caused over 1,000 casualties and effectively eliminated two battalions from the offensive. The
risk would be even greater for the Flanders campaign since the British had to pack the salient with troops and because the enemy could barrage the attackers from three sides.\textsuperscript{120}

The counter-battery solution the British decided upon was the concentration shoot, which they introduced at Messines and developed further during Passchendaele. The mission required every howitzer within range of the target to fire upon it with the intention of making the position unfit for further occupation. The goal was to damage gun pits, ammunition pits, headquarters, and surrounding terrain so badly that the continued utilization of the site, and its resupply, would be a great labor.\textsuperscript{121} This mission differed from a destructive counter-battery shoot in a significant way. In a destructive bombardment the battery fired at a slow, methodical pace and attempted to destroy the enemy’s gun by physically hitting it with a high explosive shell. Affecting the rate of fire was the need for the gunners to coordinate with an aerial observer to correct aim. A concentration shoot differed by its reliance upon the simultaneous arrival of a mass of shells to devastate the target and immediately stop the enemy piece from firing. It did not require the assistance of the Royal Flying Corps nor was it necessary to destroy the enemy’s artillery. Instead, its true objective was the immediate cessation of the enemy’s firing, even if only for a few critical minutes, during certain crucial phases of the battle, such as when the infantry crossed No Man’s Land. British gunners would also fire gas shells with this mission since the surprise effect of a multitude of shells would increase the chance of
causing casualties. Concentration shoots tended to be brief, frequently only two minutes of gas or high explosives before the guns switched to their next target.

As with the Special Brigade, the artillery campaign during the Battle of Messines can also serve as a case study for the gunners’ use of gas. The battle’s planners outlined the essential conditions necessary for the attack in a questionnaire regarding preparations. They wrote:

We must impose our will on the enemy. The upper hand must be gained by vigorous and controlled counter-battery work, by frequent raids of all descriptions, by accurate well placed harassment fire and by the destruction of OP, SPs, and L of Cs.122

The authors then listed a series of questions regarding the means to achieve these goals and concluded with the query, “what use are you making of your smoke and gas shell?”123 The implication was that not only did headquarters believe gas had a role in assuring victory, it also expected subordinate commands to actively employ gas.

Second Army planners conceived of a number of applications for gas before, during, and after the assault. During the preliminary bombardment the gunners kept hostile batteries, sections of cleared wire, trench positions, roads and tracks under the influence of lachrymatory gas in order to reduce the enemy’s morale and efficiency and deter them from repairing defensive positions
damaged or destroyed by British fire. They also employed bursts of lethal shell, on limited objectives, to cause casualties. During the assault the artillery focused upon counter-battery work with a concentrated salvo of lethal shell from a number of batteries followed by SK. Even if the gas found few or no victims, wearing a mask was tiring and greatly reduced a man’s ability to work his guns. After the infantry had reached their objectives the artillery again changed its priorities and resumed firing upon the enemy’s rear and communications to prevent a counter-attack. The gunners also used lethal shells to cause casualties among the enemy’s disorganized retreating troops, whose gas discipline was adversely affected by defeat and who were therefore more vulnerable to a chemical attack.¹²⁴ Whenever possible the artillery included shrapnel shells in the bombardment to force the defenders to take cover in shell holes or trench bottoms, the very areas into which the gas would sink and achieve its most deadly concentrations. At other times they fired shrapnel onto the perimeter of a gas attack to catch German soldiers who attempted to flee the poisonous environment. After the battle German prisoners admitted that they dreaded the combination of gas and shrapnel because it made it virtually impossible to find a safe refuge.¹²⁵

All three corps that participated in the attack employed gas against a variety of targets on the three nights preceding the battle and it is possible to summarize briefly their work. X Corps conducted the broadest range of gas attacks by using chemical shells to undertake four mission objectives. They were:
a) To disturb and cause casualties - intense bursts of lethal at intervals throughout the night.
b) Firing at gaps in wire with SK to prevent repair.
c) Counter-battery work.
d) Lethal shells were used with smoke shells on Y day with the object of making the enemy put on masks when the smoke barrage was put up during the attack.\textsuperscript{126}

The corps also selected twelve enemy batteries for neutralization at zero hour. The IX Corps target mix included as many support positions and headquarters as possible, and they conducted a special gas bombardment of the village of Wytschaete on 3 June. On the nights of W/X and X/Y IX Corps gunners employed lachrymatory shell for exhaustion purposes against the enemy batteries, then on Y/Z night they switched to lethal ordnance to eliminate the enemy whose masks no longer provided adequate protection. The II ANZAC Corps also directed its gas against enemy strong points and trench systems with the intention of causing casualties, preventing sleep and reducing morale, while their counter-battery program commenced on the 3rd and continued up to the battle's start. Each of these programs involved concentrated bursts of lethal shell generally lasting no more than three minutes, followed by at least an hour of lachrymatory shell.\textsuperscript{127}

The attritional missions involved a combination of gas and shrapnel and a considerable numbers of shells. IX Corps, for their
special bombardment of Wytschaete on 3 June, employed ninety-six of their own heavy howitzers and fifty-seven from II ANZAC Corps. The calibres ranged from 6-inch all the way up to 15-inch, and for thirty minutes they rained shells down onto the strongholds within the village. Additionally, three batteries of 60 pounder guns swept the exits of the village. At zero plus two hours the 4.5-inch howitzer batteries of the 16th, 19th, and 36th Divisions opened fire with a concentrated bombardment of gas shells. Nine hundred lethal rounds landed in the first minutes followed by 600 lachrymatory shells at a steady rate of fire. The British hoped the lethal gas would catch German work parties in the process of repairing the damage sustained during the high explosive bombardment. The British counted on the psychological effect of having survived the early round of shelling and the difficulty of having to engage in heavy labor to result in a lowering of gas discipline that might result in the harvesting of a rich crop of casualties. The purpose of the follow-up saturation with lachrymatory shell was to hinder the enemy’s repairs by contaminating the environment and forcing the work crews to wear masks while working until the long-lasting SK disappeared.¹²⁸

The Australians conducted an attritional bombardment of their own during Y/Z night on the eve of the battle. Against the strongpoint of Potterie Farm they allocated 750 4.5-inch gas shells and doused a concentration of enemy dug-outs with 3,400 4.5-inch gas shells. The gunners also bombarded the approaches with shrapnel fired from 18 pounder and 60 pounder guns.¹²⁹ Against the
village of Warneton they planned to use over 2,700 60 pounder chemical rounds, along with shrapnel bursts on the perimeter. However the artillery cancelled the operations and the gunners used the gas shell for counter-battery.\textsuperscript{130} II ANZAC Corps also conducted an exhaustion barrage against Messines. Divisional and Corps guns interposed brief three-minute bombardments of lethal shell with lengthy steady barrages of SK or Ps. The total program lasted from 11:00 PM on the 3rd to 2:47 AM on the 4th and involved over 6,000 lethal and nearly 1,900 lachrymatory gas shells. The program orders provided options in case of problems with the wind. If the wind exceeded seven MPH the gunners would replace the lethal component with high explosives. Winds greater than twelve MPH would have resulted in the cancellation of the action. Fortunately for the British, the wind proved compliant and the artillery fired the entire scheme. Similar programs were undertaken on the nights of W/X and X/Y.\textsuperscript{131}

Gas also played an important role in wearing down the enemy through harassment fire. The British noticed that the traffic behind enemy lines was immense and realized that gas shell could profitably serve to dislocate these movements. The British employed gas to make it harder for the enemy to repair the damage caused by destructive bombardments.\textsuperscript{132} From U Day onwards the harassing of roads, approaches, and communication became continuous. The artillery commander for II ANZAC Corps called for harassment fire twenty-four hours a day.\textsuperscript{133} If the artillery succeeded in preventing the carrying forward of rations and ammunition or the removal of
casualties and the advancement of replacements, the fighting efficiency of the enemy would suffer. Haig described the objective in simpler terms, "starve the enemy." While the British fired harassment missions each evening it is difficult to ascertain which ones included gas because the gunners did not differentiate between types of ordnance in their reports. It is probable that they used gas more frequently than records indicate. The War Diary of the IX Corps showed gas harassment bombardments on the nights of 31 May, 2 June, 4 June. The New Zealand Division used gas against enemy communications on 2 June. X Corps employed a lethal and lachrymatory program on 4 and 6 June, and the Australians began a five day program of shelling the enemy's rear areas on 31 May.

The British made limited use of counter-preparatory fire, a mission that would see greater use later in the year. If ANZAC Corps did choose to target gas the night before the battle on enemy positions south of the River Douve on the battle's right flank. The Australians believed that the SK would prevent the enemy from counter-attacking from that direction for twenty-four hours. This was the same flank where Foulkes planned to pour gas on the Lys Valley to create a defensive chemical flank to protect the attackers.

While the other missions were important, the success of counter-battery fire was absolutely crucial, the mission which Second Army headquarters identified as the one "on which so much depends." Even with the explosion of the mines, had the German guns brought their fire to bear, the advance of the British infantry
would have become, at minimum, a bloody affair. Originally, Plummer did not want any gas counter-battery work before Z Day, and he restricted the use of chemical shell on days U to Z to the reducing of the enemy. Instead, he wanted gas counter-battery to commence at zero hour, when the British would attempt to neutralize all the German batteries. Furthermore, the artillery plan reminded the gunners that even on the day of the battle they had to use care with gas since some of the enemy batteries lay within the zone which the infantry intended to occupy by zero plus twelve hours. However, on 31 May Plummer changed his mind and authorized the use of gas for this mission from 2 June on. The demonstrations of 3 and 5 June had revealed the location of over 200 German battery positions, all of which would receive an intensive neutralization bombardment at zero hour. Second Army would subject the enemy guns to a twenty-four hour trial, with high explosives during daylight and gas at night.

Plummer had several reasons for revising his instructions. Exposure to gas over many nights would deny the Germans a rest from the counter-battery efforts of the British. More importantly, it would keep the Germans awake and force them to do their nighttime maintenance tasks with their masks on, thereby making this work even more laborious and increasing the exhaustion of the enemy gunners. The British perceived these actions to be necessary if they were to foil the German plan to employ defensive artillery barrages to defeat the attack. The change in policy also provided the British with two additional benefits. First, it would be
more difficult for the enemy to withdraw their pieces in the face of advancing infantry if the British enveloped their position in a cloud of gas. Second, the use of gas on all the preceding nights would not tip the enemy that the attack was about to commence as it might have done if zero hour was the first occasion for chemical counter-battery.

IX Corps was particularly active in its counter-battery work, allocating nearly 5,000 60 pounder chemical rounds and over 9,500 4.5-inch howitzer gas shells to the task. They commenced their work on the evening of U Day and fired missions each night. At zero hour the Second Army unleashed a special gas bombardment aimed at neutralizing the enemy’s batteries for those dangerous minutes while the infantry assaulted. This was the climactic moment of the battle, and, as the FSR outlined, the failure to suppress the German artillery could result in a repulse of the attack. The artillery instructions for II ANZAC Corps explained that every howitzer that the gunners could spare from barrage duties was to take up counter-battery work. The Counter-Battery Staff Officer had determined targets after two feint barrages which had revealed the enemy’s defensive bombardment arrangements. The shelling took the form of neutralizing fire of sufficient intensity to inhibit or stop the enemy from working their weapons. The Australians actually committed only 1,000 gas rounds to this task, far less than IX Corps, and this might suggest a reliance upon the Special Brigade to neutralize German batteries in the Lys valley. The British captured few gunners during the battle, but the overall impression was that they had succeeded in neutralizing
the enemy’s guns, and Edmonds deemed the gas shell as “very effective with a minimum of expenditure.” The German reaction to the infantry advance was slight, and the British gunners had to respond to only a few enemy artillery firing calls.

The policies employed at Messines became the standard practice of the Royal Artillery, and a few additional examples drawn from Passchendaele will help to highlight the value the gunners placed on gas in achieving their missions. Counter-Battery in Flanders was even more critical due to the fact that the position favored the enemy. On the six nights preceding the battle, divisional howitzers and corps heavy artillery groups engaged enemy batteries with gas shells, except on the evening of 26/27 July when the wind was too great. On the final night the gunners enjoyed excellent conditions, as the wind varied between dead calm and three mph. In addition, during the last four hours before the assault, the gunners undertook a front-wide counter-battery program in order to neutralize the enemy artillerymen at zero hour. The gunners received instructions requiring them to pay particular attention to hostile batteries that the enemy planned to use in their defensive barrage. These enemy guns were the ones that posed the greatest threat to the advancing infantry. The XVIII Corps engaged thirty hostile positions on their front while II Corps bombarded thirty-three locations. In the XIV, sector each of its howitzer batteries engaged one of the enemy’s, while the gunners of XIX Corps took on thirty-seven enemy positions.
Fifth Army also undertook a series of harassment and attrition gas attacks on the enemy. On the nights of 20/21 and 23/24, XIV Corps bombarded Arbi Wood with gas shell, along with a shrapnel barrage around its perimeter. On the evening of 22/23 the corps selected the four bridges over the Steenbeek River as the focus of a three hour gas shelling. The bridges were choke points over which enemy traffic had to cross, thus providing good harassment possibilities. During the entire preliminary bombardment period, Fifth Army would dispatch over 83,000 4.5-inch and 60 pounder gas rounds.\textsuperscript{150}

The British continued to focus upon counter-battery at each stage of the Flanders campaign, and they preceded each phase with an attempt to neutralize the enemy’s guns. In September a staff memorandum noted, “it is essential that sufficient gas shells are kept for neutralizing batteries for about four hours previous to zero hour.”\textsuperscript{151} Second Army’s subsequent orders for the battle of Menin Road mandated the neutralization of hostile batteries, with gas shells, for four hours immediately preceding zero hour. The orders allowed the subsitution of high explosive for chemical shells if the weather was unsuitable for gas.\textsuperscript{152} The order also required a second neutralizing bombardment three days prior to the attack, in conjunction with a practice barrage, in order to confuse the enemy as to the time of commencement of the battle.\textsuperscript{153} Gas policy also suggested that hostile batteries near roads were particularly good targets since the bombardment would gain the additional benefit of harassing enemy traffic.\textsuperscript{154} XVIII Corps reported good results for
these efforts with only a few of the enemy batteries active by the
day after the battle.\textsuperscript{155}

When the British attacked at Menin Road on 20 September, the
artillery had subjected the enemy gunners to gas bombardments on
the three preceding evenings, in addition to the zero hour
neutralization. The artillery also fired counter-preparation missions
against the most likely avenues of approach for the enemy’s counter-
attack divisions. A post battle report by Fifth Army concluded that
with good wind conditions a gas barrage beyond the final infantry
objective “will have considerable effect in hampering hostile
counter-attacks.”\textsuperscript{156} Prior to the battle Gough had requested that his
corps commanders consider the “formation of a gas shell barrage for
two hours after the objective had been taken.”\textsuperscript{157} The program they
developed required the establishment of gas barrages at 8:15 AM,
9:15 AM, 1:30 PM and 4:00 PM. In total the gunners used in
counter-preparation 5,650 4.5-inch howitzer and 2,400 60 pounder
chemical shells. They carried out a similar program for the attack on
Polygon Woods on the 26th.\textsuperscript{158} Rawlins, in his history of the artillery,
stated his belief that the gunners had great success in breaking up
enemy troop concentrations on these occasions. To further confuse
the enemy the British had left certain avenues free of gas during the
preliminary bombardment assuming the enemy would use these
routes to bring forward their divisions. These were then the subject
of gas barrages once the battle was underway.\textsuperscript{159} Captured
documents also suggested that these gas barriers handicapped
German counter-attack preparations. For example, a German order
noted that since Houthulst Forest was heavily gassed during an enemy attack, it was an obstacle to counter-attack divisions and was to be avoided.\textsuperscript{160}

In an assessment of 30 October, after the Canadian assault on Passchendaele Ridge on the 26th, the army concluded that the four hour gas bombardment was effective, and the corps commanders agreed that it had silenced much of the enemy’s fire. One example cited was the fact that only three of twelve batteries neutralized with gas were able to fire by the next day.\textsuperscript{161} As the battle ground down the Counter-Battery Staff Officer of the Canadian Corps issued orders that “whenever weather permits, selected batteries will be subject of gas bombardment at night.”\textsuperscript{162} For their penultimate attack on 6 November the Canadians expanded the gas program from four hours to ten, a reflection of both an increasing availability of shell and an increased commitment to chemical munitions.\textsuperscript{163}

**The Infantry in 1917**

While the infantry was a distant third as a user of chemical weapons, there were some advances in its weapons and tactics, especially for clearing dug-outs. The British had found the high explosive version of the Miles grenade ineffective in clearing out underground strongholds and instead resorted to gas with much greater success.\textsuperscript{164} Originally equipped with the white phosphorus P-grenade the infantry now had, in addition, grenades filled with phosgene and KSK and, by the end of the year, KJ became available. The latter was particularly effective since the German mask offered
little protection from its contents, stannic chloride. The phosgene bomb gave underground defenders only a few seconds to get their masks on or receive a fatal dose of the gas, while KSK left the position uninhabitable for at least twelve hours. In the confined space of the shelter the gas did not disperse as it did on the surface, and even the normally volatile phosgene remained deadly for hours. Furthermore, the gas remained highly concentrated and therefore was more readily able to exhaust the mask’s protective ingredients or even overwhelm its ability to neutralize the poison. KJ was neither lethal nor persistent but since it went through the German mask the severe irritant effect upon its victim’s nose and throat soon forced the defenders to the surface. In any case the nature of underground chemical warfare resulted in a rapid decline in the life expectancy of a respirator. The Australian journalist C. E. W. Bean observed the effect of a KSK grenade on a dug-out. As soon as the bomb exploded the German inhabitants rushed out with their hands up even though they already had their masks on. Due to the potency of these gases General Headquarters included in orders issued in preparation for an attack instructions that the troops were not to enter dug-outs until they had been cleared of gas, because even if the surface had become free of chemical dangers underground installations were likely to remain highly toxic.

By 1917 the British had assigned a portion of their assaulting troops to the duty of mopping up captured ground while the main part of the attacking wave continued on to the objective. Troops assigned to this duty and raiders, who had only a few minutes in
which to wreak as much havoc as possible, made great use of gas grenades. For example, the 11th Division issued 1,600 KJ grenades to its troops for their attack on 18 August at Passchendaele.\textsuperscript{167} Their responsibility was to ferret out Germans who remained behind in their deep dug-outs. These German posed a threat because they could emerge later and take British soldiers in the rear and impede the progress of follow-up waves, thereby isolating and preventing consolidation by the initial assault force, or assist in an enemy counter-attack.\textsuperscript{168}

\textbf{The Effect of Gas in 1917}

At first glance 1917 appears to have been a disaster for the Allies. Russia had collapsed into revolution, the French Army had mutinied, and the British battles were costly and inconclusive. Decisive victory had eluded Haig at Passchendaele and instead both servicemen and civilians were left with the memory of a horrible, tragic campaign conducted by a remote and uncaring staff. While the British did not achieve their goal, however, 1917 did secure important, if not critical accomplishments. By the year's end the British Army had successfully incorporated a host of new technologies into their principles of war, which would help to bring victory in 1918. Passchendaele had also been an unpleasant experience for the Germans, which, along with growing discontent amongst their civilian population, signalled the beginning of British ascendancy in morale superiority. Gas, in particular, was an area in which, despite their lack of mustard gas, the British were slowly
gaining the ability to dominate the enemy. The year did not bring victory, but with hindsight, it is clear that it brought the basis for asymmetry.

British gas tactics proved highly effective in helping the army achieve its necessary prerequisites for victory of moral superiority and the ability to maneuver on the battlefield. The reaction of the German officer corps to gas attacks suggest the degree to which the British were making progress in these areas. A captured German document on the Battle of Arras, from the beginning of the year, credited the British with considerable success in suppressing their batteries. It observed that gas greatly affected the fighting resistance of the men, and and gas injuries to horses impeded the flow of ammunition to the guns. It then suggested the substitution of horses with mechanical transport. The report concluded, “our artillery appears to have suffered heavily from hostile counter-battery work . . . . Material was badly damaged, and artillery activity seems to have been paralysed by the effect of the gas.”

The Livens Projector caused the greatest concern to the enemy, who seemed powerless to prevent it from causing casualties and lowering morale. A German study of the device conceded that:

The most thorough precautions must be taken against this mortar owing to . . . it high degree of effectiveness . . . . [T]he British possess a very effective means of throwing large quantities of highly poisonous gases, dangerously concentrated,
onto our positions. . . . The most careful watch must be kept
day and night in order to avoid casualties through surprise.\textsuperscript{170}

The projector was indeed a formidable weapon and the Germans
estimated that it caused about 100-200 gas casualties per shoot and
that 10 percent were fatalities. The British artillery also gained the
enemy’s recognition with the concession that dense clouds of gas
forced German gunners to cease fire.\textsuperscript{171}

The risk and prevalence of gas forced the German command to
go to great and demoralizing lengths to protect its troops. In July the
Germans recommended that soldiers carry around their neck a three
layer drum, without the mask. If a burst of fire occurred they were
to immediately put the drum into their mouths while they retrieved
the respirator from its canister. The idea was to save a precious few
seconds in gaining protection.\textsuperscript{172} A German intelligence summary
from the same period contained the reminder that when hostile
artillery was active in the vicinity the troops should put on their
masks even if there is no evidence of gas present.\textsuperscript{173} The German
fear of their enemy’s gas effectiveness gained the British an added
benefit, the enemy donned their masks and suffered the debilitating
effects of restricted breathing unnecessarily, thus effecting their
morale.

After the war Foulkes would conclude that:

\... it was evident that the German troops feared gas above all
else, that it was a constant subject of discussion amongst them
and that their losses from it had a profound effect both moral and material which seriously reduced their fitness for battle.\textsuperscript{174} 1917 had passed without decision, and the British command though disappointed, continued to believe and pursue the decisive battle. The next year would bring them victory.

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\textsuperscript{1}Remarks of a German prisoner quoted in "Monthly Return of Evidence of Effect of Our Gas on the Enemy, September, 1917," AWM27/314/29, AWM.


\textsuperscript{3}See, General Staff, Assault Training (London: Harrison & Sons, 1917); Great Britain, War Office, Instructions for the Training of Platoons for Offensive Action; and General Staff, Instructions for the Training of Divisions for Offensive Action.

\textsuperscript{4}Griffith, Battle Tactics of the Western Front, 137.

\textsuperscript{5}Martin Farndale, History of the Royal Regiment of Artillery (Woolwich: The Royal Artillery Institution, 1986), 187.

\textsuperscript{6}Ibid.

\textsuperscript{7}Griffith, Battle Tactics of the Western Front, 137-38, 151-52. See also, "Notes on Counter-Battery Work," Uniacke Collection, Folder VIII, RAI.

\textsuperscript{8}S. W. H. Rawlins, "A History of the Development of the British Artillery in France, 1914-1918," Rawlins Collection, i162/1, RAI.

\textsuperscript{9}Ibid., v-vi, 51; and James Edmonds, Military Operations, France and Belgium, 1917, vol. 2, 7th June - 10th November.


12Military Operations, France and Belgium, 1917, Appendices, 72.

13Falls, Military Operations, France and Belgium, 1917, 1:79-87. See also, “Report on the Effects Produced by Gas Shells on the Night of April 8th/9th on the Third Army Front,” 19 April 1917, Hartley Collection, 33, CAC.

14Falls, Military Operations, France and Belgium, 1917, 1:558.

15Ibid


17“Note on the Strategical Situation With Special Reference to the Present Condition of German Resources and Probable German Operations,” 11 June 1917, Haig Collection, 3155/114, NLS.

18British Intelligence reported reductions in the establishment of German battalions, notices to conserve guns since wastage exceeded replacement, shortages of copper for telephone wires, and the lowering of the ration for the troops. See, “Notes on German Resources,” 10 July 1917, Haig Collection, 3155/115, NLS.
19"Note on the Strategical Situation With Special Reference to the Present Condition of German Resources and Probable German Operations," 11 June 1917, Haig Collection, 3155/114, NLS.

20"The Present Situation and Future Plans," 1 May 1917, and "Haig to CIGS," 16 May 1917, Haig Collection, 3155/113, NLS; and "Haig to CIGS," 17 June 1917, Haig Collection, 3155/114, NLS. Such was the angst in London regarding the offensive that Haig did not receive approval for the attack until 25 July, well after the start of the preliminary bombardment. See, Edmonds, Military Operations, France and Belgium, 1917, 2:103-6.


22For details of the mines see, Ibid. , 52-53.

23Ibid. , 35-49.

24Edmonds, Military Operations, France and Belgium, 1917, 2:131, 440-42, 445-46; and "Kiggell to GOC Armies," 8 June 1917, Haig Collection, 3155/114, NLS.

25Ibid. , 140, 135-38 151.

26"SB Ops," WO142/266, PRO.

27"Record of a Conference held at Second Army Headquarters," 2 October 1917, Haig Collection, 3155/118, NLS; and "Notes on a Conference at Lovie Chateau," 2 October 1917, WO95/520, PRO.

28"Fifth Army Order No. 25," 6 October 1917, WO95/520, PRO.

29"War Diary Entry," 7 October 1917, Haig Collection, 3155/118. NLS.


31"GHQ to WO," 31 December 1916, WO32/5174, PRO. The British had withdrawn the 4.7-inch guns and did not require any
more ammunition.

32 One document suggested the need to build more phosgene manufacturing capacity. See, "General Nature of Gases Used," n. d., WO142/135, PRO.


35 Ibid.

36 Ibid.


38 "Operations, 28 July to 4 August," WO95/120, PRO.


41 C. G. Douglas, "Effects of Blue Cross on Troops in the Field," 10 November 1939, Hartley Collection, Box 42, CAC.


43 "GHQ to WO," 31 December 1916, WO32/5174, PRO. The 4.7-inch gun was being withdrawn and therefore did not require any more ammunition. See also, "Army Council to the Secretary, Ministry of Munitions," 20 March 1917 and "Hulse to Rogers," 15 March 1917,
WO32/5174, PRO.


45"Director of Ordnance Services, GHQ to Director of Artillery, WO," 4 June 1917, WO32/5174, PRO.

46"For an example see, "CO 'P' Special Company to XVIII Corps," 24 June 1917, WO142/320, PRO.


48"GHQ to WO," 13 July 1917, WO32/5174, PRO.

49PS was pure chloropicrin, PG was 75 percent chloropicrin and 25 percent phosgene, while NC was 80 percent chloropicrin and 20 percent stannic chloride. Phosgene was extremely lethal, while stannic chloride was not dangerous in itself but did have remarkable penetrative powers. For the composition of these materials and others see, "Symbols for Chemicals," 29 September 1916, WO158/125, PRO.

50SK had always been in short supply and the British had diluted the active agent, ethyl iodoacetate, with 25 percent ethyl alcohol. KSK was 100 percent ethyl iodoacetate. "Director General TWS to Furse," 6 March 1917 and "Furse to Rogers," 15 March 1916, MUN5/197/1650/10; and "Report on Gas Shell Operations, Attack on Messines-Wytschaete Ridge," Section X, WO158/126, PRO. In July the Gas Service would admit that uncertainty still existed over what types of fillings to employ in gas shells. See, "Hand Written Notes to Remarks on Report of Gas Shell Operations," 6 July 1917, WO158/126, PRO.

51"Haig to WO," 2 April 1917, and "GHQ to WO," 16 May 1917, WO32/5174, PRO.
52"Quarter-Master General, GHQ to WO," 10 July 1917,
WO32/5174, PRO.

53One chemical adviser recommended that the army increase
the proportion of lachrymatory shells to fifty percent and that if it
was impossible to provide enough SK then it was necessary to
investigate other substances such as bromine. See, "Report on Gas

"Second Army, "Note on the Offensive Use of Gas and Methods
of Gas Discharge," 4 May 1917, Foulkes Collection, 6-13, LHCMA. The
Second Army developed these notes from a lecture given by Foulkes.
See also, Foulkes, "Lecture Notes," 28 October 1917, and "Lecture to
Fifth Army," 4 July 1917, Foulkes Collection, 6-10, LHCMA.

55"Some Lessons from the Recent Employment of Gas in the
Attack," 21 August 1916. RG9/IIc1/3977, NAC.

56Second Army, "Note on the Offensive Use of Gas and Methods
of Gas Discharge," 4 May 1917, Foulkes Collection, 6-13, LHCMA.

57"Report by DGS," 21 December 1917, WO142/98, PRO. Foulkes
outlines this attack in Gas!, 221-22.

58C. H. Foulkes, Report on the Activity of the Special Brigade
During the War (France, 1918), 4.

59Ibid.

60They would eventually succeed best with the DM device. See
the conclusion for a discussion of its potential.

61Second Army, "Note on the Offensive Use of Gas and Methods
of Gas Discharge," 4 May 1917, Foulkes Collection, 6-13, LHCMA. See
also, General Staff, Effect on Enemy of our Gas Attacks (n. p.,
September, 1917), 18, in CB; and "SB Ops," WO142/266, PRO.

62General Staff, Gas Warfare, no. 1, (July, 1917).

63Ibid.

64Data taken from, "Report by DGS," 21 December 1917,
WO142/98, PRO.

65Foulkes, “Lecture to Fifth Army,” 4 July 1917, Foulkes Collection, 6-10, LHCMA.

66Ibid.

67“Lecture to Second Army,” 28 April 1917, Foulkes Collection, 6-10, LHCMA. See also, Haber, Poisonous Cloud, 179-80.

68Foulkes, GAS!, 195-97, 231.

69“Employment of Special Companies,” May 1917, WO95/275, PRO. Foulkes discusses the operation in GAS! and explains its cancellation due to problems with the direction of the wind. See, Foulkes, GAS!, 217-18. Green Star was a mixture of 65 percent chloropicrin and 35 percent sulphuretted hydrogen.

70Prentiss, Chemicals in War, 352. For a summary of the characteristics of British gas shells see, “Gas Shell Characteristics,” Hartley Collection, Box 42, CAC.

71“Employment of Special Companies,” May 1917, WO95/275, PRO; Foulkes, “Employment of Projectors,” 20 March 1917, WO95/120, PRO; and Second Army, “Note on the Offensive Use of Gas and Methods of Gas Discharge,” 4 May 1917, Foulkes Collection, 6-13, LHCMA.

72Quoted in Foulkes, GAS!, 220-21.

73Prentiss, Chemicals in War, 365; and “Shell Characteristics,” Hartley Collection, Box 42, CAC.

74“Employment of 4” Stokes Mortar Bombs,” 26 March 1917, WO95/120, PRO.

75Data taken from “SB Ops,” WO142/266, PRO.

76Foulkes, GAS!, 198-99.

77For a list of these attacks see, “SB Ops,” WO142/266, PRO.

78Second Army, “Note on the Offensive Use of Gas and Methods
of Gas Discharge,” 4 May 1917, Foulkes Collection, 6-13, LHCMA.


81“SB Ops,” WO142/266, PRO; “Report on Operations,” 31/1 May-June and 2/3 June, WO95/332, PRO.


83“Report on Operations,” 7 June 1917, WO95/332, PRO; and “No. 2 Special Company’s Operation Order,” n. d., Eggington Collection, 8204-07, REM.

84Edmonds, Military Operations, France and Belgium, 1917, 2:71.

85Foulkes, Gas!, 215, 217-18; and “Employment of Special Companies,” May 1917, WO95/275, PRO. See also, “11th Australian Infantry Brigade Order No. 73,” 6 June 1917, Monash Collection, 3DRL2316, Item 42, AWM; “M.O. Circular No. 29, 3rd Australian Division,” 21 May 1917 and “Third Australian Division Order, No 37,” 27 May 1917, Monash Collection, 3DRL2316, Item 43, AWM.


87“Fifth Army Order No. 6,” 7 July 1917, and “Fifth Army Order No. 8,” 15 July 1917, WO95/520, PRO; and “SB Ops,” WO142/266, PRO. Numerous smaller gas discharges occurred on other days on Fifth Army’s front. For example, on 19 July the Special Brigade sent 276 mortar bombs into enemy positions near Wieltje. See, “SB Ops,” WO142/266, PRO.

88General Staff, Effect on Enemy of Our Gas Attacks, 18.
*9Ibid., 17-18.

*9Ibid., 17.

*9Ibid., 18.

*2General Staff, *Gas Warfare, No. 2*, (August, 1917), 2, Auld Collection, IWM.


*4General Staff, *Gas Warfare, No. 4*, (October, 1917), 2, Auld Collection, IWM.

*5General Staff, *Gas Warfare, No. 7*, (January, 1918), 4, Auld Collection, IWM.

*6Foulkes, *Gas!, 238.

*7“Report on Operation, L Special Company, R. E.,” 13 September 1917, WO95/332, PRO.

*8General Staff, *Gas Warfare, No. 4*, (October, 1917), 3, Auld Collection, IWM.

*9“Précis of Proceedings of a Conference held at the Ministry of Munitions on [?] May 1917 to consider the Future Policy of Chemical Fillings for Artillery Shell, Stokes Bombs, and Livens Drums, which should be recommended to the Field-Marshal, Commanding-in-Chief, British Armies in France,” n. d., WO32/5174, PRO.

*100General Staff, *Instructions on the Use of Lethal and Lachrymatory Shell* (France: 1917), 8, in NAM.


*102C. H. Harrington, “Notes on Training and Preparation for Offensive Operations,” 31 August 1917, Monash Collection, 3DRL2316, Item 25, AWM.
"Undated Lecture by Uniacke," Uniacke Collection, Folder XI, RAI.

In their training guide on offensive operations Second Army defined this objective thus:

In the preliminary bombardment all known machine gun emplacements, farms, dug-outs, etc., must be dealt with, and these must be kept under fire for as long as possible during the attack.

See, C. H. Harrington, "Notes on Training and Preparation for Offensive Operations," 31 August 1917, Monash Collection, 3DRL2316, Item 25, AWM.

"Notes on Employment of Lethal and Lachrymatory Shell Based on Results Obtained during the Recent Operations," 24 July 1917, AWM25/371/3, AWM.

"Report on German Defensive Tactics," 7 August 1917, Haig Collection, 3155/116, NLS.

Harrington, "Notes on Training and Preparation for Offensive Operations," 31 August 1917, Monash Collection, 3DRL2316, Item 25, AWM.

"Report on the Use of Gas in Connection with Recent Operations by Fifth Army," 8 October 1917, WO142/98, PRO.

General Staff, Artillery Notes No. 3 - Counter Battery Work, (France: February, 1918), 5 in NAM.

Ibid.

"Notes on Counter Battery Work," n. d., Uniacke Collection, Folder VIII, RAI.

Ibid.

General Staff, Artillery Notes No. 3 - Counter Battery Work, 21.

Ibid.
115“Lessons From the 1917 Battle Fighting of the Fifth Army from an Artillery Point of View,” December 1917, Uniacke Collection, Folder VII, RAI.


118“Notes on Counter Battery Work,” n. d., Uniacke Collection, Folder VIII, RAI.

119“Second Army to GCO Corps,” 31 May 1917, AWM 26/187/10, AWM. The army conducted their rehearsal barrages on 3 and 5 June. See, Edmonds, Military Operations, France and Belgium, 1917, 2:48.


122“Conditions to be Fulfilled Before the Attack Can Be Launched,” n. d., AWM26/193/29, AWM.

123Ibid.


125“Notes on the Employment of Lethal and Lachrymatory Shell Based Upon Results Obtained During the Late Operation,” n. d. ,WO158/126, PRO; and “Report on Gas Shell Operations, Attack on
Messines Ridge," 14 June 1917, WO158/126, PRO.


127Ibid.

128"IX Corps Instructions for the Offensive of 7 June 1917," Rawlins Collection, 1162/7, RAI.

129The Australians planned a three day bombardment of this position requiring nearly 9,000 gas rounds. They did carry out the program twice, but had to cancel the third effort because the enemy blew up an ammunition dump, along with a portion of the necessary gas shell. See, "3rd Australian Division Artillery Memorandum," 5 June 1917, AWM26/195/1, AWM; and "3rd Australian Division to II ANZAC Corps," 25 May 1917, AWM26/193/29, AWM.

130"Memo from HA Group," 3 June 1917, AWM26/192/19, AWM.


131For example the artillery followed up their destructive bombardment of Messines with gas shell to prevent the enemy from making repairs. See, Rawlins, "A History of the Development of the British Artillery in France," 122. Rawlins Collection, 1162/1, RAI.


"Excerpts from War Diary 54th and 55th Australian SA Brigade," AWM26/187/40, AWM; "Excerpts from IX Corps War Diary," AWM45/18/21; Extracts from War Diary CRA New Zealand Division," AWM26/190/23, AWM; "II ANZAC Corps War Diary," 31 May 1917, AWM26/191/4, PRO; and "IX Corps War Diary," WO95/835, PRO.

"10th Australian Infantry Brigade Order No. 48," 4 June 1917, Monash Collection, 3DRL2316, Item 42, AWM; and "Attack on Messines-Wytschaete Ridge, II ANZAC Corps Instructions No. 1, General Plan of Attack," 29 May 1917, AWM26/191/4, AWM.

"MGGS Second Army to CO Corps," 24 May 1917, WO158/215, PRO.

"Attack on Messines-Wytschaete Ridge, II ANZAC Corps Instructions No. 1, General Plan of Attack," 29 May 1917, AWM26/191/4, AWM.

"Revised Artillery Plan, Second Army," 20 May 1917, AWM26/187/10, AWM.


"Second Army Orders," 31 May 1917, WO95/275, PRO; and "IX Corps Instructions for the Offensive," 7 June 1917, Rawlins Collection, 1162/7, RAI.

"II ANZAC Corps Magnum Opus: Artillery Instructions for the Attack," 25 May 1917, AWM25/191/4, AWM.


"Report on the Use of Gas Shell During the Operations of Fifth
Army up to July 31st, 1917,” 14 August 1917, Hartley Collection, Box 33, CAC.


149 In most corps the policy was to engage two enemy by each of your own batteries. XIV Corps method had the benefit of assuring greater success but the cost was the exhaustion of its own gunners. See, “Report on the Use of Gas Shell During the Operations of Fifth Army up to July 31st, 1917,” 14 August 1917, Hartley Collection, Box 33, CAC. The 55th Division, a part of this corps, in its orders for the gas bombardment suggested that the scope of the commitment would place too great a strain on personnel, especially since they would have to make even greater efforts once the infantry assaulted. See, “15th D. A. No. BM/S/24,” 28 July 1917, WO95/1919, PRO.

150 “Report on the Use of Gas Shell During the Operations of Fifth Army up to July 31st, 1917,” 14 August 1917, Hartley Collection, Box 33, CAC.

151 “General Staff Memorandum No. 156, Notes on Recent Fighting,” 6 September 1917, Hobbs Collection, 3DRL2600, Item 9, AWM.

152 Amendment No. 2 to Second Army Artillery Instructions No. 2,” 13 September 1917, AWM26/274/2, AWM. For example the V Corps conducted four hour programs on 18/19 and 19/20 September, each starting at 12:30 AM. “Each enemy battery received the concentrated fire of four batteries for three minutes. . . . Batteries then proceeded to bombard deliberately . . . with lachrymatory shell.” The orders reminded the gunners to calculate time of flight carefully so that the initial rounds would arrive at the same time. The XVIII Corps conducted a similar but more generous program, and would fire a total of 9,345 4.5-inch and 7,542 60 pounder shell during their preparations. See, “Report on the Use of Gas in Connection with Recent Operations by Fifth Army,” 8 October 1917, WO142/98, PRO.
“Amendment No. 2 to Second Army Artillery Instructions No. 2,” 13 September 1917, AWM26/274/2, AWM. The British had debated whether or not gas bombardments would signal the attack. The solution they suggested was an even greater use of gas, including the firing of one complete neutralization program prior to zero hour. This decision suggests a greater willingness to use gas. See, “Report on the Use of Gas in Connection with Recent Operations by Fifth Army,” 8 October 1917, WO142/98, PRO; “Notes on Conference held at Lovie Chateau,” 30 October 1917, WO95/520, PRO; “Proceedings of Corps Commanders Conference, Second Army,” 15 September, 1917, and “2nd Army to GCO Corps,” 14 September 1917, AWM26/274/2, AWM.

General Staff Memorandum No. 156, Notes on Recent Fighting,” 6 September 1917, Hobbs Collection, 3DRL2600, Item 9, AWM.

Report on the Use of Gas in Connection with Recent Operations by Fifth Army,” 8 October 1917, WO142/98, PRO.

Ibid.

Notes on Conference at Lovie Chateau,” 10 September 1917, WO95/520, PRO.

Ibid.


See, “Capt. Graf Dohna to CA Armies,” 18 October 1917, AWM26/208/29, AWM.

Notes on Conference held at Lovie Chateau,” 30 October 1917, WO95/520. PRO.

Counter-battery Office, Canadian Corps Artillery, Order No. 52,” 31 October 1917, RG9III/C1, Volume 3922, NAC.

Counter-battery Office, Canadian Corps Artillery, Order No. 53, Table C,” 5 November 1917, RG9III/C1, Volume 3922, NAC.
General Staff, *Instructions for the Training of Divisions for Offensive Action*, 16-17.

By 1917 the use of gas doors to protect dug-outs had become widespread. However, this protection frequently failed and gas entered the shelters. These devices were difficult to construct in field conditions and required alertness, discipline, and constant maintenance to remain effective and the British relied upon enemy failure to adhere to these requirements to get gas into the dug-outs. For examples of dug-out gas barriers see, “Protection of Dug-Outs Against Gas,” Fourth Army Records, Volume 17, Rawlinson Collection, IWM; General Staff, *Defence Against Gas*.

"White Star Hand Grenades," 26 February 1917, Hartley Collection, Box 42, CAC; and “C. E. W. Bean Diary,” 20 September 1917, AWM38/3DRL606, Item 164, AWM. See also, General Staff, *The Training and Employment of Divisions, 1918*, 57-58. Shelters by this time were invariably equipped with a gas blanket to create a barrier to the entry of gas.

“Gas Operations XVIII Corps Front, During July 1917 to August 1917,” n.d., WO95/951, PRO.

General Staff, *Instructions for the Training of Divisions for Offensive Action*, 16-17.

“von Below to T. H. Adams at HQ First Army, Experience Derived from the Arras Battle,” 11 April 1917, RG9III/c1, Volume 3978, NAC.


“Extracts from Captured German Document Belonging to 54th Division,” 11/10/17, AWM25/371/21, AWM.

“Translation of Captured Notebook,” 4 July 1917, AWM26/208/36, AWM.

General Staff, *Gas Warfare, No. 6*, (December 1917), 2.

Foulkes, “Gas Warfare in the Field,” n. d., Foulkes Collection,
6-61, LHCMA.
CHAPTER VIII

MARCH TO VICTORY

The padre suggested chlorine
would keep men away from the canteen
But the gas they produced
was the sort that induced

- Chlorine

Introduction

For more than three years the combatants on the Western
Front struggled to find the means to overcome the superiority of the
defense and the stalemate of trench warfare. Then quite suddenly,
in spring 1918, positional warfare came to an end and mobility
returned to the conflict. The characterizing trait of Ludendorff's
offences, beginning in March, and the Allied attacks commencing in
July was rapid movement and the partial return of the open warfare
that had not been possible since the war's opening months. Mobility
did not mean the cessation of casualties, as the cost of war remained
high, if not higher, than for similar time periods during the period of
trench warfare. Yet the ability to advance and to drive the opponent
from the field of battle did create a greater sense of purpose and
hope. While, for the British success seemed more possible and
progress appeared more tangible, decisive victory remained an elusive quest to the armistice.

With Russia prostrated, and having dealt Italy a devastating blow at Caporetto in October 1917, the Germans turned their attention to the critical theater of the Western Front. Ludendorff knew that the consequence of the German resumption of unrestricted submarine warfare was the entry of the United States into the war. If Germany was to emerge victorious from the conflict, it had to defeat France and Britain before the United States mobilized. The Germans struck on 21 March with specially trained storm-troopers, who, advancing behind a hurricane barrage of shells, tore a huge hole in the thinly defended line of the British Fifth Army astride the Somme in Picardy. Gough’s army virtually dissolved under the onslaught and subsequent retreat. In desperation, the Western Allies established a unified command, under Foch, by which they shared reserves and coordinated their movements, and this brought the threat to an end. Ludendorff had engineered an impressive advance, the largest since the onset of trench warfare, and Germany occupied a further swathe of French territory. Yet for all the brilliance of storm-trooper tactics, the offensive was bereft of strategic purpose. Unlike the British with their focus on moral supremacy, Ludendorff had not conceived of a physical, geographic, or intangible objective that was capable of bringing ultimate victory.

The Germans maintained the initiative with a series of attacks lasting into mid-July, but the results did not change. The stroke against the French on 27 May along the Aisne, the Chemin des Dames
Offensive, also netted a considerable amount of territory, but the
 poilus, though bent, did not break. Further offensives in Champagne
 and Flanders were less successful and became out-right defeats as
 the British and French adjusted to the new tactics. When the furor of
 the German Army was finally spent, Ludendorff had not only failed
 to end the war on favorable terms, but had lost enormous numbers
 of irreplaceable men and broken the spirit of his troops. The
 casualties left the German Army weakened, and the territorial
 reward created a longer line to defend. Finally, through it all,
 American troops were pouring into channel ports by the hundreds of
 thousands.

 Though America would provide a seemingly endless amount of
 manpower, the Allies did have to survive until the Yanks had
 readied themselves for battle. The situation in anticipation of and
 during the German attacks did appear quite grave to many Allied
 leaders, both military and political. As the prospect of the enemy's
 spring attack loomed, Lloyd George asked Robertson to report on
 whether the general staff saw any hope of winning the war either in
 1918 or 1919.² Churchill too, after Haig had begun his march to the
 Rhine, continued to expect the war to last until at least 1920. As
 Minister of Munitions, he approached General Headquarters for their
 estimates for 1919 and beyond.³ Even after Ludendorff's efforts had
 peaked, General Henry Wilson, Robertson's replacement as Chief of
 the Imperial General Staff, predicted in an analysis of future military
 policy the collapse of Italy and the prolonging of the struggle into
 1920. Haig received the report with scathing comments.⁴ Once the
enemy struck, Foch became alarmed by the declining strength of British and French formations. In an alarming report he wrote that:

The grave danger which threatens the Allies to-day is to see this number of units being reduced to such an extent that it may be impossible to keep sufficient reserves to meet fresh attacks which are sure to take place.⁵

He believed that the British Army was in particularly dire need for drafts or else it faced the breakup of large numbers of units.⁶ Lloyd George’s policy of starving Haig for men so as to seek a solution elsewhere or await the full power of the United States only exacerbated the strain upon British manpower.⁷

While the alarmist tone was understandable, it did not represent the reality of the situation. The Ludendorff Offensives had actually done more harm to the German Army than they had done to that of its opponents. By June, astute Allied leaders, notably Lieut.-Gen. John Monash, Australia’s senior commander, noted the dire state of the enemy’s morale. He would confirm this observation at the brilliantly-planned battle of Hamel on 4 July. The German Army was shaken, and the British had firmly established their superiority of morale over that of their foe. Britain had achieved one of their prerequisites for decisive victory, moral asymmetry. The situation had so improved that Haig could comment to Wilson on 11 July that the “present position is much more satisfactory than it was in March before the first great German attack.”⁸
Moral asymmetry was one of the two requirements the British sought in order to set the stage for the decisive clash. The other was the ability to maneuver, which would enhance the power of their attack as they took the enemy's forces in their flank or rear and destroyed the opponent's vulnerable line-of-communication installations. The British battles of 1918, starting with Hamel and Amiens and confirmed by their victories of the Campaign of the 100 Days, demonstrated that they, like the Germans, had also armed and trained an army that was capable of maneuver in the face of hostile defensive fire-power. Whereas the Germans had relied upon storm trooper tactics to unlock the stalemate of the Western Front the British joined small unit tactics with advanced technological support to create a combined arms force capable of overwhelming the enemy's defense. The synergy of a variety of weapon systems, but most importantly artillery, tanks, and gas, enabled the British to open up the battlefield and to push the enemy back in a relentless series of attacks that culminated in the enemy's acknowledgement of defeat.

The State of Gas in 1918

In the final year of the war the supply of gas, with one exception, reached proportions which firmly established it as a weapon that the artillery and the Special Brigade were to use whenever conditions were acceptable. While the army usually failed to receive more than half of what it had requested, it was the weather and the tactical situation, not the availability of gas, which
became the primary determinant of employment. The only agent for which lack of supply hindered operations was mustard gas which would not be available to the British Expeditionary Force until the war’s final months.

In November 1917 General Headquarters hosted a major conference to determine the army’s gas needs for the following year. The participants made it clear that they would use as much gas as the government could produce. The conference resulted in a renewal of emphasis on lachrymatory agents over lethal substances, the result of a better understanding of both the needs of counter-battery operations and the broader meteorological conditions under which gases such as KSK were effective. The renaissance for these substances would be short-lived, however, as mustard gas would prove more effective than any lachrymatory agent. On 12 November Haig set the weekly request for the 6-inch howitzer at 40,000 lethal and lachrymatory shells, an increase of 26,000 from just two months ago. For the 4.5-inch howitzer he asked for 35,000 lethal and lachrymatory shells, an increase of 20,000. These demands were still beyond the capacity of the Ministry of Munitions to deliver, and they advised that it would take until May 1918 before they could reach the requested level of production. The following week, taking little account of the Ministry of Munition’s difficulties in meeting the army’s demands, General Headquarters again revised their estimates upwards. On 17 November General Headquarters recommended the establishment of the 6-inch howitzer at 51,000 rounds, the 4.5-inch howitzer at 34,000 and the 60 pounder gun at 1,000 rounds. It also
requested that the Ministry of Munitions allocate production as 75 percent lachrymatory and 25 percent lethal. They continued to express interest in a chemical round for the 18 pounder gun but General Headquarters did not put forth any specific figures at this time. By mid-summer the Ministry of Munitions production rate would provide approximately half of the 6-inch howitzer shell, two-thirds of the 4.5-inch howitzer request, and would exceed the demand for 60 pounder chemical rounds.9

Mustard gas, however, would greatly affect the desired distribution of substances employed by the Royal Artillery. Table 8.0 outlines the estimated weekly delivery of all chemical shells from mid-summer into the autumn and illustrates the influence of mustard gas upon chemical shell requisitions.
Table 8.010
Estimated Weekly Deliveries of Chemical Shell, 1918

<table>
<thead>
<tr>
<th>Caliber and Gas</th>
<th>Week Ending</th>
<th>Week Ending</th>
<th>Week Ending</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>27 July</td>
<td>31 August</td>
<td>28 September</td>
</tr>
<tr>
<td>18 Pdr. HS</td>
<td>8,000</td>
<td>24,000</td>
<td>32,000</td>
</tr>
<tr>
<td>4.5&quot; How. HS</td>
<td>5,000</td>
<td>22,500</td>
<td>22,500</td>
</tr>
<tr>
<td>4.5&quot; How. NC</td>
<td>26,500</td>
<td>5,000</td>
<td>4,000</td>
</tr>
<tr>
<td>4.5&quot; How. CG</td>
<td>7,500</td>
<td>7,500</td>
<td>7,500</td>
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<tr>
<td>4.5&quot; How. Total</td>
<td>39,000</td>
<td>35,000</td>
<td>34,000</td>
</tr>
<tr>
<td>60 Pdr. HS</td>
<td>nil</td>
<td>nil</td>
<td>2,000</td>
</tr>
<tr>
<td>60 Pdr. NC</td>
<td>1,000</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>6&quot; How. HS</td>
<td>6,500</td>
<td>10,500</td>
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<td>27,000</td>
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<td>3,500</td>
</tr>
<tr>
<td>6&quot; How. SK</td>
<td>6,000</td>
<td>nil</td>
<td>nil</td>
</tr>
<tr>
<td>6&quot; How. CG</td>
<td>9,000</td>
<td>12,500</td>
<td>12,500</td>
</tr>
<tr>
<td>6&quot; How. Total</td>
<td>48,500</td>
<td>50,000</td>
<td>50,000</td>
</tr>
<tr>
<td>8&quot; How. HS</td>
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<td>nil</td>
<td>1,500</td>
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<tr>
<td>9.2&quot; How HS</td>
<td>nil</td>
<td>nil</td>
<td>1,500</td>
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<tr>
<td><strong>Grand Total</strong></td>
<td><strong>96,500</strong></td>
<td><strong>110,000</strong></td>
<td><strong>122,000</strong></td>
</tr>
</tbody>
</table>

A second report of estimates drawn up later in the year, which projected needs for 1919 as well, also illustrated the growing dominance of mustard gas. Table 8.1 outlines these figures.
Table 8.1

Weekly Requirements in Chemical Shells: 1918-1919

<table>
<thead>
<tr>
<th>Nature</th>
<th>Persistent (Mustard Gas)</th>
<th>Non-Persistent (Lethal Agents)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 Pounder</td>
<td>50,000</td>
<td>nil</td>
<td>50,000</td>
</tr>
<tr>
<td>4.5&quot; Howitzer</td>
<td>22,500</td>
<td>7,500</td>
<td>30,000</td>
</tr>
<tr>
<td>60 Pounder</td>
<td>20,000</td>
<td>7,000</td>
<td>27,000</td>
</tr>
<tr>
<td>6&quot; Howitzer</td>
<td>37,500</td>
<td>12,500</td>
<td>50,000</td>
</tr>
<tr>
<td>6&quot; Gun</td>
<td>4,000</td>
<td>nil</td>
<td>4,000</td>
</tr>
<tr>
<td>8&quot; Howitzer</td>
<td>7,000</td>
<td>nil</td>
<td>7,000</td>
</tr>
<tr>
<td>9.2&quot; Howitzer</td>
<td>6,000</td>
<td>nil</td>
<td>6,000</td>
</tr>
<tr>
<td>Grand Total</td>
<td>147,000</td>
<td>27,000</td>
<td>174,000</td>
</tr>
</tbody>
</table>

Both tables reveal a definite trend in the type of chemicals that the British planned to employ. Not only was mustard gas to continue to increase in actual amounts but it would also represent a greater proportion of all chemical agents. Additionally, they intended to provide mustard gas for all major ordnance types, except for the super-heavy calibers, giving virtually every battery a chemical potential. The allocation of mustard gas to the long-range weapons helped widen the scope of the chemical war as these guns could reach more deeply into the enemy's lines, which extended their harassment and counter-battery capabilities. Despite the potency of mustard gas the British had decided that it could not be their only agent, however. When released, HS had a delayed action, as it took
time for it to evaporate and for its corrosive action to take hold. If it was necessary to quickly neutralize an enemy position, such as a battery firing on a British position or at the commencement of a battle to shut down the enemy’s guns when the infantry advanced, then it was essential to have phosgene with its almost immediate effect. If the Ministry of Munitions had met the production figures of Table 8.1, mustard gas would have accounted for nearly 85 percent of British chemical munitions, with the remainder mainly phosgene. These amounts were never obtained, but they did represent the direction the British intended to go with chemical agents.

Despite this enthusiasm there would be little HS available, except for captured German ordnance, until the breaching of the Hindenburg Line in late September, and gunners would have to undertake considerable stock-piling to obtain desired levels. Thuillier and Foulkes both undertook missions to England to get an explanation for the delay in mustard gas production and to spur the Ministry of Munitions on to greater efforts. Foulkes reported in February that production for the 6-inch howitzer shell would commence in June and that demand would be met within three months. The start-up was subsequently put back to July, but a breakthrough in the manufacturing process did result in a modest savings of time. The problem was in the complexity of manufacturing and the British chemical industry’s lack of experience with this type of substance. W. J. Pope, one of the key scientists working on the project, outlined the problems as a combination of a
multi-stage manufacturing process, and the range of chemicals required, both of which factors placed a strain upon the nation's resources. Further complicating the issue was that the British process produced a compound with a high percentage of impurity.¹⁵ Further reports in March and August provided greater insight into the problems but also implied that full production would not begin until the following year.¹⁶

These reports also suggested that the limit on the production of gas munitions would not be due to the limits of the chemical infrastructure, but to supply problems with other components in the manufacturing process. The greatest non-chemical bottle-neck was the availability of steel. By early 1918 the threat had become serious enough that the Chemical Warfare Department in London warned Foulkes that his request for Livens Projectors and drums would not be met and that their production might have to cease altogether. Furthermore, he was told that there were not enough containers to fill his order for cylinder gas. The shortage of steel even imperiled the production of chemical shell. Consequently, the manufacture of ammunition for the 4.5-inch howitzer continued to use cast iron even though the thinner-walled steel shell provided greater capacity for gas.¹⁷

Throughout 1918 the British continued work on another chemical that promised to be a great success, although it was not available until just after the war. As discussed in the last chapter, the German introduction of Blue Cross was a complete failure although the agent, diphenylchlorarsine, was a highly effective
sternutator. The problem lay in the method of dispersal. The blast effect of an artillery shell was unable to pulverize the substance finely enough to create a particulate cloud. The British, who gave the compound the designation DA along with DM, a related material composed of diphenylaminechloroarsine, focused research upon the use of candles, which, as they burned, would heat up and release the agents into the atmosphere. By March the Ministry of Munitions had placed an order for DA for experimental purposes. In June Foulkes ordered that there be no mention of the experiments with arsenic compounds, as the Germans had not modified their masks and he wanted to preserve surprise. By mid-September DA had entered production in limited quantities and the Chemical Warfare Committee anticipated the large-scale manufacture of DM within a few weeks. The British were on the right track, and candles would prove an effective way to create a particulate cloud. The Russians, however, not the Germans, would be the weapon’s initial victim when the British used against the Red Army in 1919.

The potential of DA and DM lay in their ability to penetrate respirators. As inert solids they were not neutralized by the protective agents contained in the wearer’s mask. The only way to prevent their inhalation was with a filter. The German mask of 1918 afforded no such protection, and indeed neither did the British. Therefore, DA and DM offered a potential means to injure enemy soldiers even after they had donned their masks. To protect their own troops, British chemical researchers, also sought the means to improve the protective value of the Small Box Respirator just in case
the enemy won the race to develop this weapon. Such an enhancement was relatively easy to effect. The problem was that an additional filter would increase the resistance to breathing and lower the flow of oxygen to the wearer. Researchers had a solution in place by March, but as feared it did decrease the breathableness of the Small Box Respirator by 25 percent. They hoped to have an improved pattern available by May in which the flow of air was unaffected. While an increase of resistance was of concern to the British, it was even more critical for the Germans due to the design of their mask. The German equipment already had a considerably lower flow rate of air than the Small Box Respirator and a further decrease would impair the efficiency of the soldier. The British were therefore on a promising path in chemical warfare research. The successful introduction of DA or DM would have made the continued wearing of a mask impossible, forcing the defender to remove the device and thereby expose him to other toxic agents. The decision to employ an aerial delivery system also meant that German installations well beyond the range of British artillery would now be vulnerable to chemical attack, which signalled a further willingness by the British to expand the chemical war.21

As with gas shell, the army also reassessed the needs of the Special Brigade. Foulkes decided to radically change the direction of his unit’s operations for the following year, choosing to emphasise cylinder discharges over projector attacks. His decision requires some explanation since it went against the assessment of his staff and the preference of the infantry. In 1917 the Special Brigade had
launched only twenty-one cylinder attacks as opposed to 246 for projectors. The cylinder operations tended to be larger, the brigade releasing on average 593 cylinders per attack, as against 376 projector. In terms of gas content, too the cylinders contained more than twice as much as the projectors, 65 pounds versus 30. Although there was, in an average attack, a greater volume of gas released from cylinders, the Livens Projector still dominated Special Brigade operations. Additionally, it was the method preferred by the other arms, while the Ministry of Munitions’ priority list ranked cylinders distantly after gas shells, mortar bombs, and Livens drums. Despite these factors, Foulkes requested 200,000 cylinders for the end of March 1918. The Ministry of Munitions replied that their maximum output was 132,500 and then only if they suspended the production of munitions for the projector. Foulkes replied in December with his authorization to cease the filling of drums so that the ministry could concentrate on cylinders. Due to other demands for cylinders, particularly by the navy, he would get only 55,375. Despite his request, the Ministry of Munitions also continued to fill drums, while the Special Brigade received, in the same period over 25,000 rounds for the projector.22

Foulkes outlined his intentions in a document issued on 1 April 1918 in which he compared the pros and cons of both cylinder and projector attacks. He identified his goal as the restoration of the cylinder as the primary weapon of the Special Brigade. Projectors still had a role but he anticipated their use in only one-fourth of Special Brigade operations. Despite his efforts, Foulkes would not get
his way, as projector attacks would dominate his units operations throughout 1918. His troops used cylinders on a number of occasions and released large quantities of gas, but it is clear that his superiors overruled him and that projectors remained the preferred operation.\textsuperscript{23}

While he was unable to win the argument, Foulkes’ reemphasis on the cylinder made sense from the perspective of the changes that had occurred in German defensive tactics in 1917. The German decision to no longer strongly hold the front line but to keep the bulk of their forces further back meant that the center of the enemy’s strength lay beyond the range of the Special Brigade’s projectile weapons. If the Special Brigade was to maximize its ability to inflict casualties upon the enemy, and retain a role in the wearing down process, Foulkes believed he had to have the means to strike in depth at a more distant foe. At a conference in November 1917 Foulkes pointed out that, “it is necessary that cloud gas should be toxic after travelling long distances.”\textsuperscript{24} Cylinders offered this potential because the cloud, borne by the wind, could penetrate deeply into the enemy’s lines and, with sufficient quantities of gas, would retain its potency. Foulkes first tried to alter the gas mixture to achieve a cloud that would not disperse as readily as pure phosgene. He requested experiments to determine if the addition of KJ to PS and Red Star would achieve this goal. However, the effort failed as there was no chemical solution to the problem of cloud spread.\textsuperscript{25}
The difficulty was to create a cloud that was sufficiently concentrated to pose a threat to the enemy’s rearward troops. Another possibility was to massively increase the amount of cylinders in the attack so that the cloud kept its strength deep into the enemy’s lines. At a conference regarding gas policy, with Churchill in the chair, the participants discussed the possibility of gas attacks employing up to a half million cylinders. The objective was to cleanse an entire front of the enemy’s troops. Several problems immediately arose which suggested the hopelessness of the suggestion. Due to the steel shortage, and the need to share the cylinder supply with the navy, the Special Brigade could never accumulate such a stock-pile. Furthermore, even if 500,000 cylinders were to become available, Foulkes lacked the personnel to install and manage such a number in a single attack, and although Churchill discussed the expansion of the Special Brigade, the shortage of manpower prohibited such an increase. Finally, the French would have objected to an indiscriminate release of gas as the wind would blow it into territory, behind the enemy line, inhabited by civilians. While the British could flippantly suggest that French civilians had to take their chances just as British ones did in the face of German bombs, the government in Paris would no doubt have taken a different view.26

With a grand attack impossible, Foulkes proposed to achieve the concentration of gas needed for a deep penetration not by increasing the number of cylinders but by narrowing the discharge front. Standard cylinder procedures called for the installation of the
devices into bays cut into the trench parapet at twenty-five yard intervals. Foulkes suggested to pack as many cylinders as possible, in a standing position, on light rail trucks and discharge them from a position directly behind the front line. He termed this kind of flotation a “gas beam” attack. The British would withdraw the troops guarding the sector just before the release of the gas. The simultaneous opening, by an electrically fired charge, of more than 1,000 cylinders would create a cloud of incredible density which would remain lethal, despite dispersion, for several miles behind the enemy front. The concentration would be so great that it would overwhelm the protective agents in the defender’s mask. Furthermore, the potential for surprising the enemy’s rearward installation was great since they would not hear the noise of the discharge.

On the night of 23/24 May the chemical engineers undertook a typical beam attack. On 6 May the Special Brigade had proposed to undertake the operation on XVIII Corps’ sector on Third Army’s front. The objective was to produce a cloud that would “penetrate in lethal strength to a great depth behind the enemy lines up the Scarpe Valley.”27 The plan required twenty ten-ton rail trucks, each loaded with 120 cylinders for a total of 2,400 cylinders. With a discharge front of only 140 yards, with seventeen cylinders per yard, the ensuing cloud would be incredibly dense and it would be lethal to a depth of at least 10,000 yards.28

Technical details modified the plan so that the Special Brigade had to employ a broader front, but they were also able to increase
the number of cylinders. The cloud, while not as dense as in the initial proposal, would still be of impressive concentration. The planners had to split the attack among three rail spurs, and the corps’ engineers had to extend some of the lines and ballast all of them sufficiently to bear the great weight of the trucks. Tractors pulled the trains most of the distance but the infantry had to provide 900 soldiers to pull the heavy rail cars the rest of the way and into position. Instead of the original twenty cars the operation now consisted of seventy-five cars containing 4,725 cylinders evenly divided among the three rail heads. Nearly 2,000 yards separated the left and right discharge points but General Headquarters estimated that the beams would merge into a single great cloud within one mile of their discharge. The Special Brigade succeeded in firing only 3,789 cylinders, as a collision and the overturning of a number of cars damaged the delicate firing apparatus on the remainder. At 1:30 AM, covered by the sound of a Lewis Gun, the chemical engineers detonated the charges holding the cylinder heads closed. They released over 120 tons of phosgene into the atmosphere which the South West wind of 10-12 mph swiftly carried towards the enemy.²⁹

Despite the absence of the need to install cylinders, beam attacks still required an investment of considerable labor, and the effects of the operation were difficult to evaluate since the victims lay well behind the enemy’s front. For the discharge on the night of 23/24 May Foulkes had to allocate six of his companies, the infantry had to provide 900 troops to haul the cars into position, and he
engineers had to undertake considerable construction of track and strengthening of line. Additionally, there was the work at the depot, the loading of the gas tanks into the rail cars and the attaching of the fuses and the delicate electrical wiring to the cylinder heads. Finally, the infantry who occupied the trenches in front of the discharge point were certain to receive the enemy's retaliation, and they would also suffer the discomfort of eviction from their positions during the attack and the wait while members of the Special Brigade checked their dug-outs for pockets of gas. The Special Brigade would conduct a number of other "Beam Attacks," such as the release of 2,011 cylinders on the 49th Division front on the morning of 24 July, but the procedure did not supplant the projector as the unit's most important method of attack.30

The beam attack was the most complete of Britain's chemical innovations in 1918 but it was not the only one. The British conducted experiments in a number of other areas to discover and exploit an advantage over the enemy. Throughout the spring and summer, scientists attempted to jam enemy machine guns by exploding over them an 18 pounder corrosive shell. The substances tried were titanium chloride, aloxite, and carborundum. They all failed.31 The Chemical Warfare Committee considered an anti-aircraft shell filled with liquid chlorine peroxide, a substance which, theoretically, would explode on contact with an airplane. Tests found that substance was impractical and that high-explosives were more effective.32 The committee also attempted to render the enemy's
respirator ineffective by clogging its air intake with silicon
tetrachloride, but these experiments also failed.\textsuperscript{33}

Between October 1917 and June 1919 researchers in Britain
investigated a wide range of materials, seeking any that were more
effective than the agents already in use. Substances tested included
the oil from poison ivy which was rejected as being too seasonal, the
pepper-derivative compound capsaicin which received another look
but was turned down due to difficulty of supply, and powdered glass
which was found harmless when dispersed as a cloud. They passed
on nicotine, too, not because it was not deadly, but because it was
less so than the established war gases.\textsuperscript{34}

The desire to get DA into service led to the suggestion of
floating pans containing the compound in the Moselle River and
pouring flammable liquid onto the water. Once the mixture reached
the logistical center of Metz, the British would ignite it with
incendiary shells. The burning oil would heat the pans and generate
a toxic particulate cloud.\textsuperscript{35} Less fantastic, and more feasible, was a
plan for an aerial incendiary weapon. Since 1916, the Special
Brigade had employed Livens drums filled with oil to set fire to
woods and to cause casualties just before an attack. This new idea,
however, had the potential of being a much more devastating
weapon, as its in air detonation would also consume the oxygen in
the target perimeter. The Chemical Warfare Committee investigated
the use of coal dust as the fuel. The goal was to create an inferno by
bursting a pattern of drums filled with the powdered coal over a
target and, while the dust was still airborne, igniting it with an
incendiary charge. During testing in late September, the researchers succeeded in setting fire to a wooden hut thirty yards from the point of propagation. The committee was sufficiently satisfied with progress to order further tests using dummies and live animals to measure its destructive effect, however, the end of the war interceded before they completed the next stage.\textsuperscript{36}

Curiously, as the British were about to gain the ability to use mustard gas, they suddenly became alarmed by one of its principle attributes, its persistency. Its ability to contaminate an area for a considerable period was a useful feature when trench warfare dominated the struggle, but the persistency of HS could became a liability if the attacker intended to push troops rapidly forward. Experience gained from exposure to the enemy’s mustard gas suggested that an above-ground position contaminated with the agent would be untenable for at least forty-eight hours, and dugouts and cellars possibly for weeks.\textsuperscript{37} Its use in mobile offensive warfare also suggested the intended path of advance and gave the defender the opportunity to make adjustments accordingly. Furthermore, if the enemy were to suddenly collapse during a battle, the presence of mustard gas infected terrain might prevent the advance of the cavalry and other mobile formations, and the British would miss the opportunity to convert the enemy’s defeat into a rout. It would be ironic if, after so desperately desiring mustard gas, its use would prevent the British from obtaining a decisive victory. Thus, in late September, when British attacks consistently resulted in the enemy’s retreat, Foulkes reported that he considered it
important that they reduce the persistency of HS. Researchers came up with a quick fix by suggesting the replacement of part of the chemical content of a shell with high explosives, which should have resulted in a shorter period of contamination. However, the British did not undertake any modifications and the war’s end rendered the issue moot. Foulkes’ proposal, although not acted upon, is interesting as it illustrates the complexity of chemical warfare and the difficulty of integrating it into the tactical environment, as well as the problems the constant changes in direction posed for the Ministry of Munitions.38

The British continued to employ chemical weapons within the mission objectives that they had defined after the Somme. Gas continued to participate in the wearing-down process by inflicting casualties and misery upon the enemy, both to lower German morale and efficiency and to use up reserves prior to the commencement of a battle. Gas also assisted in all phases of battle. First it helped reduce the enemy’s fitness and firepower during the preparatory bombardment, then it assisted in neutralizing the enemy’s artillery during the infantry assault, and lastly it aided the establishment of interdiction zones to prevent enemy counter-attacks during consolidation. In 1918 gas maintained these roles both on attacking and non-attacking fronts. The only difference was that gas was now much more available and therefore more readily used. Unlike at the beginning of 1917, when the gunners had to stockpile gas munitions in order to have sufficient quantities available for the Battles of Arras, Vimy, and Bullecourt, the artillery in 1918 could freely use
gas whenever the situation permitted. Accumulation remained necessary for big offensives, just as it did for other shell types, however Britain was producing gas rounds in numbers that still permitted the artillery to fire chemical ordnance in wearing-down missions during non-attacking situations. Gas had thus achieved pervasiveness.

As a percentage of total shell expenditure, by all types during the entire war, the share represented by chemical munitions is quite modest. Gas first had to overcome its late start, and the British did not really begin to use it till the Somme. Chemical shells were not available in large numbers until spring 1917. Additionally, chemical supplies were so constrained, and the demand for high explosives so great, that until the war's final year gas shells were not available for most gun types, including the 18 pounder, which was easily the most voracious consumer of munitions. While the overall share remained small, a definite trend existed and gas represented an increasing percentage of shell composition as the war progressed.39

By 1918 the artillery routinely exceeded the 1916 standard of ten percent chemical shell for the calibers for which chemical munitions were available, and in some instances the share of gas actually reached 50 percent. The 6-inch howitzers of the 36th Australian Heavy Artillery, RGA, conducted such a bombardment when they fired a mix of 50 percent gas and 50 percent high explosive shells in October in support of a feint infantry attack.40 Another instance occurred on 7 July when the 11th Australian Field Artillery, as part of a larger gas program, fired seventy-two high
explosive and 300 NC 4.5-inch howitzer shells for a chemical composition of 80.6 percent.\textsuperscript{41} On 10 July the guns of the 2nd Australian Division fired 240 high explosive and 472 gas shells resulting in a chemical presence of 66.3 percent.\textsuperscript{42} More typical was the performance of the Fourth Australian Division, whose expenditures over a six-month period were representative of the trend towards a greater use of gas. During the month of June the division’s 4.5-inch howitzers fired 5,573 4.5-inch shells, of which only 698 were gas for a percentage of 14.3 percent, but the ratio for the year through 1 July revealed a higher chemical share of 21.3 percent, (39,604 high explosive versus 8,428 gas shells).\textsuperscript{43} For the Battle of Hamel the division increased the ratio further, and at the end of June it set the establishment of rounds with the batteries at 250 high explosive and 300 gas which represented a chemical allocation of 54.5 percent. The artillery commander would shortly order his batteries to fire gas at every favorable opportunity.\textsuperscript{44} For one exceptional mission, the gunners received orders that on the night of 23/24 June the 4.5-inch howitzer contribution to the harassment program was to be 95 percent chemical and 5 percent smoke while other calibers would provide the high explosives.\textsuperscript{45}

Gas shell appeared, on occasion, to be available in such quantities that its abundance brought comment. The Chemical Adviser of XI Corps complained to his superior at Fifth Army Headquarters that the 6-inch howitzers were receiving only chemical munitions and the absence of high explosives forced them to waste “stinks” by firing them on unsuitable targets in poor weather
conditions. While perhaps a temporary situation, W. A. Rigden, a sergeant in the 196th Siege Battery believed that his unit had an enormous supply of chemical munitions, and he was glad to finally be able to give the Germans more gas than he received. The General Officer Commanding Royal Artillery of Canadian Corps summed up the situation with his recommendation that artillery headquarters should use gas freely in support of an aggressive policy to inflict casualties upon the enemy at every opportunity.

On occasion, gas shells would dominate a bombardment. On 7 and 8 June Fourth Army blasted enemy positions with a heavy barrage of gas and other shells. Table 8.2 lists the number of rounds and percentage of chemical shells expended by those calibers that had gas.
Table 8.2
Shell Expenditure and Percentage of Gas Shell Fired by Fourth Army on 7-8 June, 1918

<table>
<thead>
<tr>
<th>Caliber</th>
<th>Expended on 7 June</th>
<th>Percentage on 8 June</th>
<th>Expended on 8 June</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5&quot; How. HE</td>
<td>2,000</td>
<td>71.6 percent</td>
<td>2,844</td>
<td>37 percent</td>
</tr>
<tr>
<td>4.5&quot; How.</td>
<td>5,043</td>
<td>1,669</td>
<td>37 percent</td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 Pdr. HE</td>
<td>522</td>
<td>1,132</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 Pdr. SR</td>
<td>1,410</td>
<td>1,439</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 Pdr. Gas</td>
<td>212</td>
<td>13.1 percent</td>
<td>nil</td>
<td>0 percent</td>
</tr>
<tr>
<td>6&quot; How. HE</td>
<td>4,036</td>
<td>13.1 percent</td>
<td>3,882</td>
<td></td>
</tr>
<tr>
<td>6&quot; How. Gas</td>
<td>2,412</td>
<td>37.4 percent</td>
<td>1,421</td>
<td>26.8 percent</td>
</tr>
<tr>
<td>Overall</td>
<td>15,635</td>
<td>49.0 percent</td>
<td>12,387</td>
<td>24.9 percent</td>
</tr>
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</table>

Nearly half the shells on the 7th were gas, with the figure for the 4.5-inch howitzer being the extraordinary 72 percent, while on the 8th chemical munitions represented a reduced but still considerable 25 percent. The Fourth Army carried out a similar shoot on 30 July. On that occasion the gunners fired 8,716 4.5-inch howitzer shells of which 7,638 (87.6 percent) were chemical and 8,731 6-inch howitzer shells of which 4,257 (48.8 percent) were gas. On the previous day only the larger howitzers undertook a major gas bombardment and again the representation of stinks was nearly half (48.6 percent). The expenditure by the other calibers, on both days, was average.\textsuperscript{50}
The gunners stock-piled mustard gas so that on its British debut they fired, during the night of 26-27 September, 26,101 18 pounder rounds which represented 34 percent of the total for that weapon, and 6,236 6-inch howitzer rounds which equaled 30 percent of that weapon’s expenditure. The howitzers also fired an additional 2,713 rounds of other gas types which raised their chemical contribution to 43 percent. The day after their success at Hamel the Australians fired large quantities of chemical munitions to deter a counter-attack by the Germans. On 5 July, of the 12,513 4.5-inch howitzer shells they fired 30 percent were gas and of the 15,810 6-inch howitzer rounds 24 percent were chemical.

**The March to Victory**

The first signs that the German Army was nearing collapse came on the Australian front. Starting in May, while guarding the approaches to the critical rail junction of Amiens, the Australians recommenced a policy of “peaceful penetration” which the Germans had interrupted with their spring offensives. “Peaceful penetration” was anything but what its name suggested. It involved the nightly dispatch of small bodies of men, frequently as few as three or even a single individual, into No man’s Land to inflict casualties on or take prisoners from German OPs, machine guns posts, and patrols. Bean explained that part of the reason for these operations was the desire to escape the more odious order from division or corps headquarters for a raid to ascertain the identity or pilfer documents from their opposite enemy formation. The troops disliked raids because they
were large and usually bloody affairs that involved an entire platoon or even a company, and for which the higher command gave the local officer far too little time to properly choreograph. Accompanied by artillery and trench mortar fire, or even gas feints, the operation was sure to result in casualties and subsequent retaliation by the enemy’s guns. The Australian method brought in a steady stream of prisoners, identity badges cut from bodies, and captured documents that kept intelligence officers sated and avoided the need to launch the far more risky raid.53

“Peaceful Penetration” also had another objective, the domination of No Man’s Land, a feat that was quickly accomplished. The enemy’s inability to oppose the Australians in this deadly game signalled to local commanders that they had gained a superiority over the Germans. Additionally, senior officers such as Monash and Rawlinson also interpreted the German failure to defend themselves as a sign that the British had obtained their long sought moral superiority. This was not a surprising deduction given that the relative worth of the individual was a key factor in their assessment of the relative strengths of the two armies and one of the areas in which they planned to secure an asymmetric advantage.54

The British accepted the need to test the degree of their own superiority in order to evaluate the true strength of the enemy and gauge the potential for large-scale offensive action. Monash had commenced work on a plan for the capture of part of the enemy line in late May, and on 23 June Rawlinson sought approval from General Headquarters for an attack by Australian Corps to seize the village of
Hamel and the Vaire Woods. In a letter to General Headquarters he outlined the objectives of the attack as:

- Straighten and shorten the line.
- Deepen the defences.
- Increase the ground available to the artillery and improve observation.
- Disorganize the enemy defences and to preclude any German intentions to launch an attack of their own.
- Inflict losses on the enemy and further lower the morale of his already shaken units.
- Maintain the initiative on the Australian front.

Edmonds describes Hamel in the British official history as a minor affair, an accurate assessment if derived solely from Rawlinson’s modest objectives listed above and the size of the forces involved. Hamel was, at its heart, a limited scope, divisional scale operation and at no point in the planning or implementation did the British consider it a breakthrough or decisive battle. While the presence of four companies of Americans fighting alongside the British for the first time since the Boxer Rebellion, was a harbinger of things to come, it in itself did not represent anything of striking importance. Yet the battle was far more significant than its size, style or the employment of American troops would suggest. Hamel represented the successful convergence of a number of technological and tactical innovations that the British had begun after the Somme
and had refined during the campaigns of 1917. The integration of tanks into the infantry assault, the mastery of precision indirect artillery fire, the perfection of the Counter-Battery Staff Officer, and the incorporation of gas into all aspects of the attack, along with increases in the infantry’s integral fire power and its training in fire and movement tactics, led to a system that maximized the offensive potential of the attack and enabled the British to overcome the inherent advantages modern fire-power vested upon the defense. The British had combined man and machine into a methodology that restored maneuver to battle.

Rawlinson described the essence of the plan as its reliance on surprise, and accordingly the Australians eliminated the preliminary bombardment from their preparations. The British had previously used the preliminary bombardment as a means to clear the defender’s wire obstacles and to reduce the enemy’s numbers and morale. These necessities did not exist at Hamel since the Australians already enjoyed a considerable moral advantage, and the enemy had not bothered to strongly fortify or wire their defenses after their spring offensives had advanced them to these positions. The German failure to undertake the construction of defensive works, whose strength in the past had enjoyed a justifiable reputation, was taken by the British as a further sign that the enemy was in a serious state of moral decline. Efficiency was a hallmark of the Germans, and the lack of effort in readying their defenses was a sign that a rot had set in the German Army. Monash, who was to have sixty tanks for the attack, believed that these vehicles were
sufficient to clear paths through the wire, although if necessary the infantry were prepared to cut it themselves. The ability of tanks to clear obstacles for the infantry and the decision to forgo the preliminary bombardment meant that the achievement of surprise was feasible and the British would gain all their advantages over an unprepared and un-alerted foe.  

Although there would be no preliminary bombardment, the Australian gunners undertook a considerable harassment program on enemy trenches, dumps, headquarters and other targets, for about two weeks preceding the attack. These bombardments were undertaken with some care, and the artillery kept their fire within normal ranges while reinforcement batteries maintained their silence until the battle's commencement so as not to alert the enemy to the attack's imminence. The operation's initial plans also recommended the extensive use of gas in order to continue to attack the enemy's morale and thereby maintain a British advantage. Once the preparations were underway the Fourth Australian Division required that, "full use will be made of chemical shell and every opportunity taken when conditions are favourable to include 4.5" howitzers with chemical shell in all harassment concentrations." An additional component of the harassment program, which Brig.-Gen. T. A. Blamey, Monash's chief-of-staff, described as the "morning hate" was a special early hour bombardment consisting largely of gas shell, with some smoke and the remainder high explosives. Its objective was to condition the enemy into putting on their masks and to lull them into complacency, thereby helping the attackers to
achieve surprise. On the day of the attack the artillery would fire its “morning hate” routine but the gunners would substitute smoke for the gas. The British hoped that the enemy would respond to their conditioning and dutifully put on their masks and thereby be at a disadvantage when the attackers stormed their defenses.62

The wind did not always allow the artillery to include gas in their harassment and “morning hate” bombardments, but the evidence suggest that they did so at every opportunity. The 14th Australian Field Artillery Brigade did so in their program on the night of 15/16 and 18/19 June, although poor weather conditions forced its deletion from the bombardment on the night of the 3rd/4th.63 The 10th and 11 Australian Field Artillery Brigades employed gas on 24/25, 25/26, 26/27 and 30 June/1 July.64 The five batteries of the right group mixed gas into their harassment fire on the evenings of 24/25, and 26/27 June.65 The Fourth Australian Division’s intelligence report noted the inclusion of gas in bombardments on the nights of 16/17 against Hamel and Vaire Woods, while on 23/24 June the targets were various trenches and dug-outs.66 The Second Australian Division’s guns, on the right of the battle zone, assisted with the harassment agenda and contributed its own chemical munitions on 1 through 4 July.67 As noted previously, the Fourth Australian Division ordered its howitzer batteries to maintain 300 chemical rounds in their positions.68 Additional gas bombardments no doubt occurred, but the records frequently did not distinguish between chemical and ordinary shells. However, battle instructions insisted that, weather permitting, the batteries were to
include gas in their plans. The conditioning of the enemy also appeared to have had an effect as some Australian units, once in the enemy’s positions, reported finding opponents wearing masks.\textsuperscript{69}

Monash scheduled zero hour for 3:10 AM on 4 July and the artillery were forbidden to fire gas during the final night so as not to interfere with the forward movement of the infantry.\textsuperscript{70} The gunners staged their normal “morning hate” on battle day except that this time it did not include any gas. Starting at zero minus eight minutes, a limited portion of the artillery fired a program of 90 percent high explosives and 10 percent smoke. The objective was to mimic a gas discharge and cause the enemy to put on their masks, while the firing also served to cover the noise of the tanks. Only at zero hour did the full weight of the Australians’ artillery preparation reveal itself. The gunners intensified their fire and the silent batteries commenced to shoot as the artillery carried out its responsibilities. The Australian Corps had considerable gunnery resources, especially for such a limited operation. General Headquarters had reinforced the Fourth Army with seven brigades of guns, allowing Rawlinson to allocate to the attack 326 field guns and howitzers and 302 heavy weapons. The near equality between field and heavy guns represented an exceptional concentration of fire power and helps to explain the fury of the attack’s counter-battery fire.\textsuperscript{71}

The field artillery, with the assistance of some heavier calibers, formed a creeping barrage of high explosives, shrapnel, and smoke, behind which the infantry advanced.\textsuperscript{72} Simultaneously, the heavy artillery commenced its counter-battery program. Intelligence had
accurately noted that the enemy had concentrated their artillery on
the Australian front in groups located in the Lamotte-Cerisy Valley
two miles to the east of Hamel. The neutralization of these weapons
was essential to ensure the survival of the exposed infantry as they
crossed No Man’s Land and to prevent the enemy from using their
guns in any counter-attacks. Furthermore, dealing successfully with
the enemy’s artillery was more critical than usual since, for the sake
of obtaining surprise, there had been no preliminary bombardment
by which to physically destroy the German guns and battery
positions and exhaust their personnel.\textsuperscript{73} Accuracy, both in the
location of the enemy’s batteries and in the firing, was therefore
essential. To preserve surprise Monash had even forbidden the use
of registration rounds. To ensure targeting precision the Fourth
Australian Division issued, at the end of June, detailed instructions
for the accurate fixing of the location of the division’s guns, and
required the artillerymen to undertake a detailed inspection and
repair of each weapon’s platform, aiming gears, range dials and
clinometers.\textsuperscript{74}

Monash had allocated two-thirds of his heavy guns to counter-
battery and the gunners had planned for the extensive use of gas.
The Australian Corps Heavy Artillery Headquarters ordered the 6-
inch howitzers to commence fire with lethal shell followed by
lachrymatory rounds. The program was to last from zero to zero +
150 minutes. While it is not possible to ascertain the exact number
of gas shells dedicated to the neutralization of the enemy’s guns,
since the British also employed gas in counter-preparation missions
the same day, the 6-inch howitzer did fire 8,573 "stinks" along with 12,360 high explosive shells on the 4th for a chemical composition of 41 percent. If one extends the comparison to include all heavy caliber weapons, 60 pounder guns through 12-inch howitzers, the figures become 25,543 high explosive and shrapnel and 8,573 gas, for a chemical percentage of a still considerable 25.1 percent. The counter-battery program proved a complete success as the enemy gunners in the Cerisy Valley failed to fire their defensive barrages and were unable to affect the conduct of the battle. The British had indeed achieved neutralization, and for some time after zero they could report that the hostile artillery was practically silent. The divisional 4.5-inch howitzers did fire some gas on the 4th but the plan limited their role principally to the direct support of the infantry.\textsuperscript{75}

Coinciding with the commencement of the battle, the Special Brigade made its own contribution to the attack. The mortarmen of No. 1 Special Company dropped over 720 WP and 154 NC bombs onto the high ground just north of the Somme and a further 612 smoke rounds on the southern flank of the attack. The northern attack was the more important one because from the heights the enemy could observe the assault. The objective of these bombardments was to isolate the battle zone from adjacent enemy positions, a mission in which the Special Brigade was entirely successful. The III Corps to the left and the French Army on the right provided additional assistance by firing artillery missions to neutralize the enemy guns
on their fronts that could enfilade the Australian advance, while the III Corps also simulated an attack as a diversion.\textsuperscript{76}

The infantry left their trenches promptly at 3:10 AM and, protected by the creeping barrage and the counter-battery fire, they had one of the easiest advances of the war. By 5 AM the attackers had reached all their final objectives and had begun to dig in. While the British plan had called for a limited advance - at its greatest depth it was not more than 2,000 yards - its complete success was still an impressive accomplishment. The casualties were also relatively minor. The total, for the Australians and Americans combined, was slightly more than 900 officers and men. Exact German losses are not known but prisoners alone exceeded 1,450 men.\textsuperscript{77}

Having reached their goal, the infantry began to dig in and prepare their defenses while the artillery undertook counter-preparation fire in order to provide the troops with the time they needed to consolidate their gains. When the creeping barrage reached the final fire line, the participating 6-inch howitzers switched to chemical shell.\textsuperscript{78} The gas would envelope the Aussie's new front in a protective cloud of gas and deter enemy counter-attacks. The artillery staff officers had also prepared two plans in anticipation of the need to repel enemy counter-attacks and thereby prevent a repetition of the embarrassment that occurred after Cambrai when the enemy retook the ground they had lost to the British attack. Counter-Preparation Phase IA provided for heavy concentrations of fire upon known hostile batteries and was under
the control of the Counter-Battery Staff Officer. Counter-Preparation Phase IB planned for fire upon likely enemy assembly points and communications and was under the direction of the Commander Corps Heavy Artillery. Plan IB contained a list of forty-eight targets, including railway cuttings, roads and road junctions, bridges and other concealed positions, and transportation choke-points, and noted that the batteries were to use gas, weather permitting.

The British implemented both plans IA and IB the evening of the battle. Commencing at 10 PM the heavy artillery opened fire with gas on German artillery positions in the La Motte-Cerisy Valley. Seventy 6-inch howitzers shelled twenty-four targets containing of one or more enemy batteries. The program, fired at intervals, consisted of each gun shooting five rounds and lasted until 3:20 AM. Each target received three bursts of fire, and in total the British expended over a 1,000 rounds. Additionally, the heavy artillery engaged silenced enemy batteries four times during the night when they began to fire. The Fourth Australian Division’s 4.5-inch howitzers also contributed to these bombardments. The British undertook neutralization missions on subsequent nights and the 6-inch howitzers continued to fire large quantities of gas shell through to 10 July.

The divisional 4.5-inch howitzers also commenced harassment fire according to Counter-Preparation Plan IB on the evening of the 4th, at 10 PM. On the morning of the battle the division’s artillery commander ordered each battery to have 300 rounds on hand in anticipation of the bombardment. During a pre-planned twenty-
seven minute program, twelve batteries expended 3,600 chemical rounds onto potential enemy assembly points in anticipation of the Germans concentrating their local reserves for a counter-attack. The 18 pounders contributed shrapnel and high explosives to the bombardment. The artillery completed another gas harassment mission on the 6th at 3:15 AM, nearly the same time that the British had attacked on the 4th. The division’s howitzers remained active with larger than normal expenditure of gas shells up to 10 July when they doused enemy positions with a further 2,216 rounds.82

The British continued to invoke Counter-Preparation Plans IA and IB on each evening after the battle until 10 July when firing patterns resumed a more normal pattern. In total, from the end of the battle to the 10th, Fourth Army consumed nearly 10,000 4.5-inch howitzer and 15,210 6-inch howitzer gas shell, an extraordinary amount for a battle of this size. On some days the consumption of chemical shells challenged high explosive munitions for dominance. For example on 6 July 48.5 percent of the 6-inch howitzer shells fired were gas and on 10 July the ratio for the 4.5-inch howitzer reached 49.2 percent chemical. In addition, the Special Brigade made a modest contribution to the counter-preparation programs with two small projector shoots on the mornings of 6 and 7 July. The Australian planners had drawn up their counter-preparation programs both to protect their own infantry and to upset the enemy’s offensive plans. In this mission they were absolutely successful. The Germans did not retake the ground.83
The success of Hamel suggests two conclusions. The first, the more obvious, is that the British had indeed gained a superiority over the Germans and that the wearing-down process had worked. The British had inflicted, since the Somme, such damage, both through casualties and harassment, that in summer 1918 the enemy’s morale precipitously declined to the extent that it adversely affected the efficiency of their army. By Hamel the British had achieved one of their essential preconditions for decisive victory, a moral asymmetry over the enemy. The second conclusion regarding Hamel is more subtle. The ability of the Australian infantry to leave the protection of their trenches, survive the passage of No Man’s Land, and speedily penetrate to all their final objectives, at minimal cost, indicated that the British had also succeeded in restoring mobility to battle. At the Somme the British artillery had attempted to obliterate the enemy so that the infantry could simply move forward and occupy their objectives. The bombardment’s failure resulted in 60,000 casualties. At Hamel, the artillery had a far easier task. Instead of aiming for complete destruction, the guns would merely neutralize the defenders during that brief, critical period when the infantry assaulted. In their prewar principles, the British assigned to firepower a number of tasks including the gaining of a fire ascendancy over the enemy and the necessity of preventing the defenders weapons from interfering with the attack. By Hamel the British had developed the means to suppress the enemy’s fire so that the infantry could advance and close with their opponent.
The essential question, therefore, is what was different about Hamel? Superficially, the defining characteristics of warfare on the Western Front were its massive casualties combined with no appreciable gain in territory. Yet movement did not guarantee a reduction in the "butcher's bill" as the Germans discovered during their offensives in the spring 1918. The Allied blows in the second half of the year resulted in fewer but still considerable casualties. Incremental attacks, as tried after the failure of the initial strikes at the Somme and Passchendaele, did gain territory but it did not come cheaply. Nor were limited objectives the solution, as the stunning victories at Vimy and Messines eventually saw significant casualties when the enemy counter-attacked to regain their positions. Even the bold victory at Cambrai led to disappointment as the Germans soon regained all they had lost. But it would be a mistake to suggest that trench warfare and massive attrition were the definitions of warfare in the west. In fact, they were the symptoms, and the actual problem facing commanders in France had been what senior officers had feared since the beginning of the war, namely the difficulty the attacker had in overcoming the firepower advantage that modern weapons conferred upon the defense. Imposing entrenchments further augmented the strength of the defense, although these can be overstated as it was the weapons, and the men manning these weapons, not the fortifications that made the defense so formidable. The key to victory, then, was to find a method of attack that redressed this imbalance or even shifted it in the favor of the attack. In a sense the attack had to learn how to manage the defense.
Returning to the question posed above, what was it at Hamel that allowed the attack to dominate the defense? Part of the answer was the collapse of German morale. The enemy’s soldiers no longer had the stomach to resist the British with the same determination that they had in the past the frequent use of gas in the “morning hate” and other forms of harassment fire assured that enemy morale would remain poor. No matter how efficient weapons are, they become useless in the hands of troops who look only for a chance to surrender. The deplorable state of the German Army showed the effectiveness and correctness of Haig’s policy of wearing out the enemy.

The other explanation for the Australians’ success at Hamel lies in their employment of a number of critical technologies which, in combination, allowed the attacker to suppress the defender’s firepower. The first was the tank, although, writing after the battle, Rawlinson did exaggerate the improvements incorporated into the Mark V model when he claimed, “it arrives in time, keeps well up with the infantry sometimes in front of them and is handier than a polo pony twisting and turning whenever it likes.” While the tank’s cannons, machine guns, vast bulk, and daunting appearance certainly played a role in suppressing the enemy positions, its ability to clear lanes through wire obstacles was its most important contribution. With the tank the British no longer needed to destroy the enemy’s defenses with a prolonged bombardment which would have alerted the enemy to the immediacy of an attack. Furthermore, dispensing with a preliminary bombardment also meant that the British did not
have to accumulate massive amounts of ordnance. The enemy might have noticed the enormous stockpiles of shells, or, at the very least deduced the possibility of an attack by the proportionally increased levels of logistical activity behind the British line. Either occurrence would have resulted in the loss of surprise. The importance of preserving surprise can not be minimized, as its achievement typically helped the attacker to gain a position of superiority over the defender. Although its most dramatic effect was upon the German defenders caught in the battle zone, it also had a broader effect on the result of the battle. Caught by surprise, the enemy’s high command did not foresee the need to bring reinforcements to the sector or prepare counter-attack divisions. Thus surprise at Hamel had both tactical and operational-level implications and Rawlinson was correct to place the high degree of importance on its attainment that he did.

Improvements in British gunnery accuracy, intelligence and target allocation were other areas of important advances. The ability to fire with precision obviated the need to shoot registration rounds which might have warned the enemy of a potential attack. Accuracy also freed the artillery from dependence on aerial observation, which was not only slow but could suggest to the enemy that something was in the wind. Furthermore, it permitted the reinforcement batteries to remain silent until zero hour. Finally, the British mastery of state of the art artillery technology gave them a decided edge over their opposition and assured that at the required moment they could eliminate the enemy’s guns from the battle.
British coordination of artillery intelligence collection and analysis in the office of the Counter-Battery Staff Officer was another major breakthrough in the application of gunnery firepower. Its staff, relying upon information collected from its many observers, successfully located virtually all of the enemy's battery positions. The British knew not only that the German artillery was in the Cerisy Valley but also precisely where in the valley it was located valley. The combination of improved accuracy with the ability to locate the enemy would prove devastating to the German guns. At zero hour the enemy artillery remained silent.

What then did gas, the final critical technology, add to the mix that tanks and improved gunnery did not already provide, and what was its contribution to victory? The vision of the assault is much like a choreographed dance. Alone, each participant is meaningless, but, combined they achieve a synergy previously unattainable. At zero hour the tanks rolled forward to clear paths through the wire, while the divisional artillery established a creeping barrage to suppress the enemy's small weapon's defensive fire from the trenches and machine-gun strong-points. Meanwhile, the Special Brigade and the artillery created smoke clouds and obscured the enemy's line-of-sight. Simultaneously, the Australians rose up and attacked across No Man's Land fully open to the wrath of the enemy's defensive fire. Tanks could clear the way, but they could not protect the exposed soldiers. The barrage upon the enemy's defensive works did minimize the normally lethal rifle and machine-gun fire, and the smoke did hide the Australians from view of enemy
observers posted on the heights above the Somme River. However, there remained the enemy's strongest defensive weapon— their artillery, whose preprogramed defensive barrages could obliterate anything that attempted the traversing of No Man's Land. The Australians made it across, into the enemy's defensive works and on to their final objectives, because the German gunners were choking in clouds of gas from British counter-battery fire, and could no fire their weapons. The Australians succeeded so easily because they had countered every capability of the German's defensive fire.

Was gas an essential ingredient? Certainly, because it was the most effective method of neutralizing the enemy's guns. If the wind had been too strong, greater that 12 mph, the British would have had to substitute high explosives, as gas remained weather dependent and from that perspective it was a difficult weapon to employ. However, it is possible that the use of explosive munitions, in place of chemical shell, would have resulted in greater activity by the enemy's artillery with the result being a higher level of Australian casualties. Consequently, publications, reports, orders, and training materials make it abundantly clear that gas was the preferred shell for counter-battery, counter-preparation and harassment fire and, if more had been provided, more would have been used.

Gas afforded a number of advantages over more traditional ordnance. It had a wider tolerance for aiming error than high explosive shells since gas was an area weapon and its cloud spread to engulf all in its path. This does not contradict the statements above regarding improvements in artillery precision, but rather points out
that chemical shells were actually more accurate that any other type of ordnance, with the possible exception of smoke. Artillerymen had a larger area in which to land their ammunition and still obtain neutralization of the target. Gas also had a prolonged effectiveness and was capable of causing casualties until dissipated by the elements, unlike high explosives that ceased to be dangerous once they exhausted their kinetic energy. Another advantage was that a concentrated burst of gas shells more quickly silenced the firing of a weapon, than explosive munitions, since the targeted personnel had to stop, put on their masks, and attempt to continue to fire in an encumbered state. Once a gun crew had put on their masks their efficiency, both in rate of fire and accuracy, declined dramatically. If the concentration of gas was high, the manning of the weapon would become impossible, and the artillerymen would have to either flee the position or seek the shelter of their dug-out. Finally, the likelihood of the continued working of an artillery piece was greater during a high explosive or shrapnel barrage than in a gas bombardment as gun pits afforded a degree of protection from virtually anything but a direct hit. Gas, however, sought the lowest level and it tumbled into the gun pits, converting them to death traps of extremely concentrated toxic vapor.

Gas had one additional major benefit as it, like the tanks, made surprise possible. It had the power to stop a firing battery, or prevent one from commencing fire virtually instantly, as opposed to explosive-based munitions which relied upon the incremental causing of casualties and damage to reduce the efficiency of a gun
crew. This final advantage was critical for the sake of the advancing infantry. At Hamel, since surprise was such an important factor in the plan, the British artillery had to ensure the silence of their opponent’s guns at zero hour. Without gas the British artillery would have had to commence their counter-battery bombardment before the instant of the attack, perhaps even days earlier. The gunners would have needed time to master the enemy’s artillery through the methodical destruction of the enemy’s pieces with aerial observed shoots. Not only was such a procedure time-consuming but it would also have cost the British the advantage of surprise and given the Germans sufficient warning so that they would have taken counter-measures in anticipation of an attack. The consequences were high, as the lack of surprise would have changed the nature of the operation and raised the spectre that its outcome would have resembled the blood-baths of 1916 and 1917.

Gas also served another role. As soon as the advance came to a halt the guns established a protective boundary of gas and the heavy artillery readied to implement Counter-Preparation Plans IA and IB. Monash chose to rely upon artillery fire, including large quantities of gas, to deter enemy attempts to regain their lost positions. Monash’s attention to this phase of the battle was probably due to his fear of a repetition of the aftermath of the hollow victory at Cambrai when a subsequent German counter-attack regained all the lost ground, converted Britain’s celebration into the ignominy of defeat, and forced the army to convene a court of inquiry. Accepting the possibility of a German counter-attack, the Australian gunners
undertook harassment and counter-preparation missions on the seven nights following the battle. In reality, the opposition’s efforts to regain their original positions never became terribly vigorous. Although the Germans did not test the Australian defenses, counter-preparation fire acted as a form of insurance, and its presence would have impeded any serious enemy effort. Only on the 11th, when it was evident that the enemy would not attempt an assault, did the artillery cease its efforts.

After the battle wound down, it became increasingly obvious that the German Army’s morale was in a serious state of collapse. On the 11th a patrol of four men from the 1st Australian Division entered the German line near Merris at mid-day and captured fifteen prisoners. By the end of the day, succeeding excursions by Australians in pursuit of “peaceful penetration,” brought the total to three officers and sixty-nine other ranks. Disconcerting for Ludendorff, the evidence of the next few days suggested that the German malaise had spread far beyond the Australian zone. The 31st Division, on the Second Army front in Flanders, netted a number of prisoners on the 11th, followed by fifth-eight on the 13th. The following day bought further success when a minor operation undertaken by the Second Army’s 6th Division near Dickebusch, also in Flanders, resulted in 268 captives.85

However it was on the French front that the Germans provided the most definite evidence of their decline. Ludendorff's final offensive began on 15 July against the French Fourth, Fifth, and Sixth Armies in Champagne as forty-three German divisions attacked on
both sides of Reims. Expecting the attack, the French to the east of Reims held the Germans to virtually no gain, while, to the west of the city, the defenders contained the enemy’s advance. By the following day the Germans had lost their momentum, and French counter-attacks, with American assistance, began to drive them back. On the evening of the 17th the German High Command admitted the attack’s failure and brought it to a halt. However the French had not only prepared a defense, they had also planned a massive counter-stroke. On the 18th, the French 10th and then the 6th Armies, including two U. S. divisions, struck the western side of the Chateau Thierry salient. Supported by over 200 tanks and thousands of guns the Germans quickly gave way before the attackers. A few days later the French extended their attacks to the fronts of their Ninth and Fifth Armies as they penetrated the salient from the east and south. The German retreat now became a broad one as they vacated the salient. The battle lasted until the 3 August as the French, with British and American support, pressed the enemy back. At its conclusion the German Army had retreated nearly twenty miles, and its troops had received another drubbing.86

Encouraged by Hamel and Chateau Thierry, Haig sought a further success on the Fourth Army zone in front of the important rail hub of Amiens. The Australians had already demonstrated the enemy’s weaknesses and Rawlinson reported to General Headquarters that the Germans had done little to rectify their defensive deficiencies. He noted that the enemy’s defenses were disorganized and were not properly protected by wire. Furthermore,
Rawlinson continued, the opposition's units were severely under-strength and they had few reserves with which to counter an attack. Finally, he pointed out the great morale superiority the Australians had established and the advantage this would convey on the attackers. Haig required little convincing of the desirability of another attack. Two of his most strongly held beliefs were that only through the attack could a combatant achieve decisive victory, and that an injured foe should never be given the opportunity to rest and recover. The British needed to maintain the initiative, press the Germans and widen their superiority. They would attack.\footnote{87}

On 13 July Lawrence, from General Headquarters, asked Rawlinson to draw up a plan for an army-wide assault on the German positions opposite his lines. Rawlinson submitted his ideas to headquarters on the 17th. On the same day Haig approached Foch for assistance from the French Army, adjacent to Fourth Army to the south, to widen the attack front. Foch ordered General Debeney, the commander of the First French Army, to cooperate with Rawlinson. The following week, at a commanders-in-chief conference he hosted at Melun, Foch included the operation in the list of offensive priorities for the rest of the year.\footnote{88}

Rawlinson’s plan was rather simple, as it was basically a repetition of Hamel except on a grander scale. Instead of ten battalions and sixty tanks he would employ nine divisions and 400 armored fighting vehicles. Additionally, Haig promised him the powerful Canadian Corps. With their arrival, and including the already present Australians, Fourth Army would contain most of the
best fighting troops available to the British Expeditionary Force. Although he possessed a strong offensive force, Rawlinson kept the objectives limited and essentially defensive. In his letter to General Headquarters Rawlinson outlined the attack’s advantages as:

a) Assuring the safety of Amiens, and driving the enemy out of shell range of the town.
b) The improvement of out position as regards its junction with the French.
c) The gain of further valuable observation and the improvement of out positions defensively.
d) The shortening of the Allied front.
e) The possibility of inflicting a serious blow on the enemy at a time when his morale will be low owing to the failure of the Champagne Offensive.  

Only one of the goals suggests the offensive potential of the attack while the remainder focus upon the advance as a means to improve the defensiveness of the British line and strengthen the hinge with the French. The absence of ambition to set bolder objectives suggests that the British leadership had not fully grasped the seriousness of the enemy’s condition. The outcome of the battle would make the dire nature of Ludendorff’s situation patently clear.

On 5 August Haig held a conference with Rawlinson, Debeney and Kavanagh at Fourth Army’s headquarters in Flixecourt. Haig
explained that he and Foch had decided upon a more extended operation in light of the success the French were having in driving the enemy from the Chateau Thierry salient. While the first day’s objective was to remain the old British Amiens defensive line, a distance of about five to seven miles, Fourth Army and the First French Army were to attempt to press the advance further the following day. Kavanagh’s Cavalry Corps was to ready itself for open warfare, and General Headquarters placed some mounted units, whippet tanks and horse artillery at the disposal of the Canadian and Australian Corps, whose commanders would be in a better position to exploit any local success. Haig still did not describe the battle in terms of breakthrough or decisive victory but he had certainly revised his expectations upward.91

Like Monash at Hamel, Rawlinson believed that the key to the operation’s success was the attainment of surprise. Once again the gunners would not conduct a preliminary bombardment and the army would rely upon the tanks to clear paths through the enemy’s thin wire screen. To move the enemy out of shelling range of the Amiens rail lines, however, Rawlinson did require a deeper penetration than the two miles the Australians accomplished on 4 July. Consequently, he drew the final stop position to include the German gun line. While he hoped for a rapid advance that would capture most of the enemy’s batteries before they could escape, the inclusion of the German artillery positions within the advance zone did raise some complications for the British counter-battery program. Gas was the most effective means to neutralize hostile
artillery. However, if the infantry were to advance beyond the German gun line, the British artillery could not use gas shells to silence the enemy’s pieces. Contaminated ground within the advance zone would pose a risk to the attacking troops and channel the British advance away from the enemy’s guns, thus allowing them to escape. The desire for rapid movement thereby limited the opportunities for the employment of gas, and the artillery would fire just under 3,000 chemical shells on the first day of the attack. On the days following, when the attackers hoped for a further advance, the artillery continued to employ gas but in modest quantities.\textsuperscript{92}

Rawlinson had at his command three corps consisting of, from right to left, Canadian Corps, Australian Corps, and III Corps. The attack by III Corps was the least significant of the three, as its role was to establish a defensive flank on the north side of the battle to protect the advance of the Dominion troops. The terrain on this section was rough and not suitable for tanks, and Rawlinson did not plan for as large an advance as he expected from the Australians and Canadians, who would benefit from flatter ground. Since the troops on the left would not move as rapidly as those on the center or right, Rawlinson decided that gas could support the northern flank. Therefore, only on III Corps sector did Fourth Army authorize the use of gas by the artillery to neutralize the enemy’s guns. However, while the Australian and Canadian gunners would not fire chemical munitions in the advance zone, their use by III Corps’ artillery was more significant than the limited role its infantry would play in the advance. A disproportionate amount of the enemy’s batteries
remained positioned in the Cerisy Valley, which lay within III Corps’ counter-battery zone. Although limited to only one-third of the front, gas would still play an important role in neutralizing hostile firepower which could interdict the exposed Canadians and Australians as they advanced through the enemy’s lines. Once the attacking infantry had reached their final stop positions, the artillery would fire a protective bombardment of high explosives and gas, beyond the furthest advancement point, to disrupt enemy counter-attacks while the army consolidated along their new line. Finally, the artillery had prepared a counter-preparation scheme for use after the battle against concentrations of enemy troops or likely points of assembly. Periodically, the gunners would fire bursts of shells. On suspected targets these shells could be up to 50 percent gas.93

To secure surprise Rawlinson ordered his artillery to maintain normal firing patterns during the lead-up period the week before the battle. Artillery commanders carefully monitored the expenditure of ammunition and checked that the character of harassment and counter-battery fire remained unchanged. The gunners fired measured doses of gas shell on each of the seven nights preceding the assault.94 The Special Brigade’s contribution, both before and during the battle, was also quite modest. On 6 August they fired 570 Stokes Mortar Bombs against the village of Sailly Laurette on the extreme left of the attack perimeter and dispatched 240 projector drums against the Bois d’Arquaire in front the Australians. On the next day they sent a further 175 drums of
phosgene into enemy positions near Morlancourt, also on the III Corps front. Fourth Army’s plan did call for additional minor discharges of gas and smoke on the day of the battle although the Special Companies did not fulfil these operations. At 4:20 AM on 8 August, Fourth Army’s artillery suddenly unleashed a furious bombardment of shells on the enemy’s front line and battery positions. Once again the British filled the Cerisy Valley with lethal gas, choking the enemy’s gunners, who had been retained in this locale despite the lesson of Hamel. Simultaneously, the tanks rolled forward, followed by the infantry who advanced behind a creeping barrage. The outcome of the battle was remarkably similar to that of Hamel. The infantry rounded up large numbers of prisoners, and the advancing battalions reported no interference from the German guns. The force of the British counter-battery program had virtually silenced the enemy and only a few hostile batteries eluded capture. Intelligence proved critical in this success as the British had successfully located most of the enemy’s artillery. Again the infantry succeeded in crossing No Man’s Land and pressed into the enemy’s defenses. Once the assault reached the enemy’s battery positions specially delegated artillerymen, advancing just behind the infantry, took over the enemy pieces and fired off the ordnance at the fleeing Germans. While orders forbade them from discharging any mustard gas shells they had permission to fire all the explosive and other chemical munitions they found as the situation permitted. The advance of the Canadians and Australians went swiftly and deeply into the German lines, and by
the day’s end they had reached their objectives. Only on the left, in III Corps zone, did the attackers fail to reach their goals. The next day the British and French renewed their attack. They continued to make gains but by the 11th it was clear that the enemy had succeeded in bringing up reserves and that the opportunity for an even greater success had passed. Fearing the steep rise in casualties that typically occurred after an attack had lost its impetus, Rawlinson closed down the offensive.88

The attack on the 8th succeeded brilliantly, and Ludendorff was completely justified in calling it Germany’s blackest day. At a low cost, not more than 9,000 casualties, Fourth Army had secured the safety of Amiens and its rail lines. More importantly, it had inflicted a massive defeat upon the enemy. During that first day nearly 17,000 Germans entered the Anglo-French prisoner cages. A further 10,000 were killed or wounded, and they German Army also lost over 400 guns and huge numbers of machine guns and mortars. More importantly, the attackers had inflicted upon the enemy’s morale a blow from which it would not recover, and the ease of the Australian -Canadian success removed any remaining doubts about the efficiency of the German Army at that stage of the war. Amiens convinced Haig that the war could be won in 1918 if the enemy were given no opportunity to recover. The British had achieved moral superiority and they would use the initiative they possessed to hammer the enemy relentlessly, for the war’s remaining months, as they exploited their opponents weakness and drove the Germans backwards.99
In addition to revealing the extent of the enemy's weakness, Hamel and Amiens also suggested that mobile warfare would hinder the use of gas. If the infantry were to advance then the artillery could not contaminate the ground over which they were to attack. After Amiens the Australian Corps instituted a scheme for mobile warfare that prohibited the use of gas shell unless specifically ordered. Casu-alities caused by "friendly gas" since Loos had always been a great concern for British planners, and they did not want to risk the potential loss of morale, and their asymmetric advantage, through the indiscriminate use of chemical munitions. The British would continue to practice chemical warfare but its employment had peaked. Fourth Army's expenditure of chemical munitions, except for a few instances such as the crossing of the Hindenburg Line, would remain modest and on many days they would not fire any gas at all. The operations of the Special Brigade also suffered a decline, and Foulkes complained of lost opportunities and wasted effort as his men prepared their attacks only to have the enemy retreat before his engineers could discharge the gas. From Amiens to the armistice the Special Brigade installed but failed to discharge 9,000 cylinders and 8,000 projector drums due to the enemy falling back from the target. In September there was a small rise in the number of projector operations but respite proved temporary and the overall trend was one of decreasing activity. Table 8.3 summarizes the scale of Special Brigade attacks as the war came to an end.
### Table 8.3

Number and Size of Special Brigade Operations, July to November 1918

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Cylinder Attacks</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>No. of Cylinders</td>
<td>8,263</td>
<td>3,197</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Projector Attacks</td>
<td>42</td>
<td>33</td>
<td>41</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>No. of Drums</td>
<td>13,464</td>
<td>12,365</td>
<td>13,069</td>
<td>3,443</td>
<td>630</td>
</tr>
<tr>
<td>Mortar Attacks</td>
<td>11</td>
<td>8</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>No. of Bombs</td>
<td>6,399</td>
<td>5,833</td>
<td>2,914</td>
<td>345</td>
<td>1,645</td>
</tr>
<tr>
<td>Total Operations</td>
<td>59</td>
<td>43</td>
<td>46</td>
<td>15</td>
<td>6</td>
</tr>
</tbody>
</table>

Further contributing to British hesitation to use gas as freely as they had in the past was the increased likelihood of civilians being in the target zone. As the Germans retreated they did not evacuate the civilian population, who remained behind awaiting liberation by the western armies.

While these prohibitions impeded the employment of gas, there remained a place for its employment in the British method of waging war. Whenever the campaign returned to trench warfare, however temporarily, such as when the Germans retreated into the Hindenburg Line, the opportunity for the full employment of gas resumed, particularly as part of a preparatory bombardment. Gas
still retained its potency as a harassing weapon to attack the enemy's morale and to cause casualties on non-attacking fronts or when the British did not anticipate an advance by the infantry. As well, low-persistency lethal gases, such as phosgene, could dissipate in as little as an hour or less, depending upon the terrain and weather. Foulkes, in particular, sought ways to keep his unit relevant. He was able to motorize a few extemporized parties that could keep up with the advance, and in September he received a few supply tanks to carry projectors and drums across the devastated roads of northern France.104

The final months of the war, known collectively as the Campaign of the 100 Days, featured relentless pressure upon the enemy by the combined armies of the Western Allies. A series of major battles, with smaller engagements in between, forced the enemy back upon their defensive bastion, the Hindenburg Line. Second Army resumed offensive operations in Flanders on 18th August with the seizure of Outersteene Ridge. On 21 August Third Army opened the Battle of Albert. It was joined a few days later by the Fourth and First Armies, leading to the occupation of Bapaume and Péronne. On 2 September the Canadians stormed the Drocourt-Quéant Line, throwing the enemy's defenses into disarray and causing a rapid retreat along the entire German line. As the enemy fell back, the British pursued, attacking whenever the Germans attempted a stand. The Third Army dislodged the enemy from Havrincourt on 18 September, and Fourth Army, with French assistance, gained Epéhy. By the end of the month the British had
reached the approaches of the Hindenburg Line and prepared to breach its defenses. First and Third Armies began the assault on the 27th towards Cambrai and the Fourth Army pierced the fortifications on the 29th. Elsewhere, with French assistance, the Americans finally attacked in force and cleared the enemy from the St. Mihiel salient on 12 September. At the end of the month they commenced the Battle of the Argonne.

The Hindenburg Line, the fortified positions the enemy had retreated to in spring 1917, represented the last refuge of the German Army. If it could stem the Allied advance before its defenses they would have the upcoming winter in which to rebuild their army. If the British breached this line, the Germans had no more lines prepared, and only the Rhine could serve as a barrier behind which to reorganize. From the Allied perspective there could be no pause. If the Germans were given a lengthy interval of quiet they would succeed in improving their army’s efficiency, which would fulfil London’s prediction of of the war lasting into at least 1919. Despite its imposing strength, Haig was determined to push through the Hindenburg Line and to win the war before winter shut down the offensive season. While the British would attack the line at several points, it fell to Rawlinson’s Fourth Army to make the most important breach.

Rawlinson did not intend to pursue surprise, which his army had used to such affect at Hamel and Amiens. Its attainment would have been an impossibility, for the enemy understood that the blow would fall, and fall soon. Although not occupied since earlier in the
year, prior to Ludendorff's spring offensives, the Hindenburg Line on the Fourth Army front was an extremely strong defensive system. Augmenting interlocking fire of machine gun posts and strong points, several belts of wire, and multiple lines of trenches, was the St. Quentin Canal which lay as a moat directly in front of the German works. There was one exception, where the canal ran underground through a tunnel from Bellicourt to Vendhuille. Realizing that this was the weak point in its natural defense the Germans guarded the gap with particularly tenacious fortifications, including several layers of wire and five systems of trenches. Despite its strength, the gap was precisely the point that Rawlinson selected to make his principle effort. It fell to Monash's Australians, along with two American divisions, to batter their way through the heart of the enemy's defenses and seize the gap. Leading the way would be the American 27th and 30th Divisions who would make the initial breach. The Australian 3rd and 5th Divisions would then leap-frog past the Yanks, enlarge the hole, and push through the enemy's defenses, allowing the waiting cavalry and armored cars to break into the open. In support, the IX Corps would force a passage across the canal to the south of the tunnel while III Corps would establish a defensive front on the left of the Australians and Americans and maintain contact with Third Army to the north. 105

In lieu of surprise Rawlinson planned a powerful preliminary bombardment to overcome the defenders. He gave its objectives as:

a) To complete the demoralization of the enemy.
b) The destruction of the enemy’s defenses, including wire and
dug-outs.¹⁰⁶

Fourth Army had at its disposal over 1,000 field guns and nearly
600 medium and heavy pieces, and the artillery would begin its
work on the evening of 26 September. Rawlinson divided the
artillery’s role into five concentrations: a special gas (BB)
bombardment, counter-battery fire, harassing fire, wire destruction,
and the shelling of select strong-points and localities.¹⁰⁷

The most unusual aspect of the preliminary work was the use
of BB, the British designation for shell mustard gas.¹⁰⁸ The Battle of
the St. Quentin Canal was the first use of mustard gas by the British,
more than fifteen months after the German introduction of the gas.¹⁰⁹
The army had in its stores over 26,000 18 pounder and more than
6,200 6-inch howitzer rounds. Additionally, the gunners would fire
an unknown amount of German yellow cross shell employing
captured enemy guns.¹¹⁰ Rawlinson scheduled the BB bombardment
from 10 PM on 26 September to 6 AM on the following morning.
The targets were the enemy’s artillery and centers of
communication, such as headquarters and phone exchanges. After
the conclusion of the special BB bombardment the British fired only a
handful of additional mustard gas shells, (eighty-five 18 pounder
rounds on the 28th), as the planners estimated that it would take
two days for the gas to fully evaporate and for the ground to be safe
to cross. Infantry units did issue to the assaulting troops an
additional warning not to enter cellars and dug-outs as the gas would
remain dangerous underground for two to three weeks. The infantry advanced fifty hours after the end of the bombardment and did so without any inconvenience.\(1\)

The British were greatly pleased by the results of the BB bombardment. They silenced many enemy batteries and inflicted a great number of casualties over a wide area. Some enemy companies lost over one-quarter of their complement, although a more dispersed pattern of injury was typical. Besides causing casualties, the British had another objective. They wanted to increase the misery, and thereby lower the already weak morale, of the German soldiers. Mustard gas was an insidious weapon, and although a mask afforded protection from fatal poisoning, its ability to vesicate made its effect on the skin and eyes a torment for its victims. The British had two additional reasons to employ mustard gas at this time. The first was that it was finally available and they had the opportunity to pay back the enemy for all the suffering they had undergone at German hands. The second reason was less vindictive and more strategic. Haig believed it was absolutely essential to provide the enemy with no respite if the Allies were to win the war in 1918. If the Germans succeeded in holding the Hindenburg Line, it would act as a bastion behind which they could recover their morale and rebuild their forces, thus denying the British the superiority they had fought so hard and long to achieve. Blasting through the Hindenburg Line was critical in order to deny the enemy a refuge short of the Rhine. Mustard gas would provide additional power to the attack and, by its ability to cause casualties
and misery, make the task of Fourth Army easier. Such was the determination to use mustard gas on this occasion that the gunners received orders instructing them to ignore the meteorological conditions, even if the wind was too strong for the gas' effective use, and to instead commence the program despite the weather.\textsuperscript{112}

The rest of the preliminary bombardment represented the application of firepower in areas which had become routine. After the end of the special BB bombardment, Fourth Army's guns commenced intensive harassment fire, counter-battery fire, and the bombardment of selected strong-points, all of which incorporated large quantities of gas shells. Only the shelling of the enemy's wire, a purely destructive mission, was free of gas.\textsuperscript{113} The gunners maintained harassing fire along the whole front, day and night, up to zero hour, firing burst of shells at irregular intervals. Its effect was to disorganize the enemy and to lower morale through the cutting off of units, the interruption of reliefs and resupply, the prevention of ration parties from reaching their units and the causing of casualties. The counter-battery schedule also ran around the clock, hitting targets identified by the Counter-Battery Staff Officer. Once again the program was highly successful and the enemy's guns inflicted few casualties on the attackers on the 29th. The advancing infantry captured some enemy batteries who were so thoroughly neutralized that they had not even opened fire. The final task was the bombardment of the enemy's strong-points in order to inflict casualties upon their garrisons and physically destroy their defenses. Some targets, such as the entrances to the canal tunnel, were
impervious to high-explosive shells, so that gas was the only means by which the British could reach the defenders. The British were aided in the planning of the destruction of the enemy's positions by the fortuitous capture of a complete set of drawings, detailing the layout of the defenses and the location of German dug-outs and strong-points. The demoralization of the enemy was so complete that on the day of the attack many enemy soldiers failed to man their defenses and emerged from their deep dug-outs only to surrender. For all of these operations the artillery fired a mixture of high-explosive shells, gas, either CG or NC, and smoke. However, the British did not fire any gas onto the path of advance after zero minus six hours in order to protect the infantry.\textsuperscript{114} The Special Brigade's role in the battle's preparations was virtually non-existent, and they undertook only one small projector discharge on the 26th on III Corps front. The only other contribution occurred at zero hour when mortarmen of No. 4 Special Company established a heavy smoke screen to protect the attack from enemy flanking fire.\textsuperscript{115}

The assault did not succeed as well as Rawlinson hoped, as he was unable to employ the cavalry or armored cars for exploitation into the enemy's rear. The 27th and 30th Divisions did mostly reach their objectives but the Australians, who were to pass through the Yanks, were delayed by German hold-outs which the American mopper-uppers had failed to eliminate. However, the Australians pressed sufficiently far into the Hindenburg Line position to render its continued defense by the enemy an impossibility. IX Corps also succeeded in leaping the moat and had even captured a bridge over
the canal, winning a close race with an enemy demolition team. Over the next few days Fourth Army would press the enemy back further and widen their footholds in the enemy's defensive system until the breach became irreparable. Combined with the break-throughs further north in the First and Third Armies zones, in the Battle of the Canal du Nord, the British had broken the Hindenburg Line. The Germans no longer had a refuge upon which to defend and reorganize their army. The final six weeks of the war witnessed a further collapse of the enemy's army as it recoiled from the now incessant attacks of the British, French, Belgian, and American armies. The German position on other fronts was even more grave as its Allies deserted and made a separate peace with the western democracies. Bulgaria capitulated on 30 September, Turkey on 31 October, and Austria-Hungary 4 November. As the Allied advance reached ground that they had not seen since August 1914, such as Mons and Le Cateau, Germany finally conceded the inevitable. At last, on 11 November, the Western Front fell quiet.

Conclusion

While the British had not achieved decisive victory as defined by the prewar Napoleonic ideal, they had certainly destroyed the combat effectiveness of the German Army and rendered they foe prostrate. At the armistice, the enemy's cohesion was on the verge of collapsing and its retreat was accelerating, a situation not helped by Germany's exposed southern flank after Austria's surrender. This situation was made all the more dramatic by the rapidity by which
events had changed. The past spring, Ludendorff's offenses had forced the Allies back bringing forth dire predictions in London and Paris on the war's indefinite continuation and ultimate outcome. However, less than six months later, at Amiens on 8 August, the immediacy of the Allied victory became apparent.

While this radical change of fortune came suddenly, it was not due to a novel turn of events, but rather a result of the British Army's successful mastery of the problems of the Western Front. Victory came from the officer corps' incorporation of new ideas into their ethos, their integration of weapons and other components into operations, and their mastery of combined arms coordination. The British had begun the processes of adaptation in 1915 and it had taken nearly four years for the ingredients to reach maturity. The British had not suddenly gotten it right, they had learned how to achieve victory through the hard lessons of war and through the correct application of new technology and combat adaptation.

By the beginning of 1918 the British had in place the weapon systems and intellectual controls that would lead to victory the next year. The Special Brigade continued to discharge gas both to kill the enemy or to make their opponent's troops lives miserable. If Foulkes' engineers found it difficult to keep up with the advance, once the German Army began its collapse, the Special Brigade did show the determination to adapt to mobile conditions and to continue to make a contribution to the enemy's destruction. While their use of supply tanks to haul gas stores, and the Foulkes idea for a projector sled, proved of limited practicality the chemist troops
fought the enemy to the armistice. Furthermore, during the Campaign of 100 Days, whenever the Germans attempted to stem the Allied advance and reestablish a stable position, the Special Brigade entered the line and released their poisons against the enemy. If Foulkes found it difficult to maintain his units operations in the war’s closing months, the position of the artillery in the chemical war reached new heights. The Ministry of Munitions had successfully guided the enormous expansion of Britain’s chemical plant and the army would now benefited from a consistent supply gas shell. While mustard gas would arrive nearly too late the stocks of other agents were approaching desired levels.

But it was when gas was employed with the other arms that the British realized its full effectiveness. Without its incorporation into the combined arms matrix, gas would have remained a mere accessory, useful for wearing down the enemy but unable to contribute directly to victory. However, employed upon the integrated battlefield, gas became an important player in the phases of battle and in the destruction of the enemy’s determination to resist. Utilizing the intelligence gathering and coordination functions of the Counter-Battery Staff Office, the artillery gained the ability to quickly silence the enemy’s artillery at zero hour, thereby making the achievement of surprise a reality. Furthermore, gas prevented the German gunners from undertaking their defensive fire missions which permitted the infantry to assault across No-Mans Land relatively unscathed. Without this contribution the task of the infantry would certainly been more bloody, if not impossible. The
victories of 1918 showed that gas had aided the British officer corps in achieving the preconditions they believed essential for the decisive battle. Employed to lower morale gas proved itself to be a formidable weapon and a crucial component of the wearing down process. During the assault it denied the Germans the use of their defensive fire and thereby contributed to the restoration of mobility to the battlefield.

Once the Allies had withstood the German attacks that they had anticipated for the beginning of 1918, the way became clear to finish the destruction of the German Army's morale and secure the restoration the mobility which would lead to the enemy's collapse. After the experiment of Hamel, Haig authorized a full test to the enemy's capabilities for 8 August. The great achievement of Amiens, and the French success at Soissons, indicated that the conditions were right and that the morale of their opponent's troops was in a dire state. The British had achieved their critical asymmetric relationship and the time was now ripe to attempt to fulfill the prewar concept of the phases of battle and to seek decisive victory.

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1 From a limerick competition in Chlorine, (Trench Journal of the 6th Mounted Brigade), no. 2, (February, 1918), IWM.


3 "Munitions Policy - 1919 or 1920," 5 September 1918, Haig Collection, 3155/131, NLS.

“Memorandum on Situation Regarding Allied and Enemy Forces,” 1 June 1918, Haig Collection, 3155/128, NLS.

Ibid.

For a brief rationale of Lloyd George’s policy see, Bean, The Official History of Australia in the War of 1914-1918, 5:52-53.

“War Diary,” 11 July 1918, Haig Collection, 3155/129, NLS.

“Report on Conference on the General Gas Policy and the Chemical Shell Program,” 27 November 1917, MUN5/187/1360/10, PRO; and “Chemical and Smoke Shells Issued to War Office, 1916 to Date,” 24 July 1918, MUN5/198/1650/30, PRO.

Estimated Weekly Deliveries of Chemical Shell,” n.d., MUN5/198/1650/30, PRO.


“Report by Foulkes on Visit to England,” 12 February 1918, WO142/98, PRO.

“Churchill to Haig,” 16 June 1918, Haig Collection, 3155/128, NLS.

W. J. Pope, “The Manufacture of ββ-Dichlorehyl-Sulphide,” 23 February 1918, Haldane Collection, MS20234, NLS.

“Report by Foulkes on Visit to England,” 11 March 1918, WO142/98, PRO; and “Memorandum on the Delays in Providing Gas Shells,” 1 August 1918, MUN5/198/1650/30, PRO.

“Report by Foulkes on Visit to England,” 12 February 1918, WO142/98, PRO.
18"Report by Foulkes on Visit to England," 11 March 1918, WO142/98, PRO.

19The technical name for the device was Thermo-Generator Type M or the M Device. See, "Foulkes to Members of Special Brigade and Chemical Advisers," 30 June 1918, WO142/98, PRO.

20"Minutes of the Chemical Warfare Committee," 20 September 1918, WO142/72, PRO.


24"Meeting of the Chemical Warfare Committee," 16 November 1917, WO142/71, PRO.

25Ibid.

26"Minutes of Proceedings at a Conference to Consider the Supply of Gas for 1919 as Affected by the Policy of the General Staff," 19 March 1918, MUN5/198/1650/29, PRO. General Headquarters would reject a number of Special Brigade proposals for massive discharges on the grounds of the threat to civilians. See, "Foulkes to OC Special Companies, R.E., First Army," 15 May 1915, WO142/324, PRO. This concern also had ramifications for the artillery once warfare became more mobile in the fall. Lieut.-Gen. H. A. Lawrence, CGS, ordered Fifth Army not to place gas concentrations on towns or villages unless they knew that the civilian population had evacuated. Curiously, there was no prohibition against the use
of high explosives. See, “Lawrence to Fifth Army,” 19 October 1918, AWM27/314/7, AWM.

27“Scheme for a “Gas Beam” Attack on the XVIII Corps Front,” 6 May 1918, WO142/324, PRO.

28Ibid.


30For a report on the 14 July discharge see, “Report on Operation P/4 on 49th Division Front, 24th July 1918,” 26 July 1918, WO95/332, PRO.


32“Minutes of the Chemical Warfare Committee,” 14 June 1918, WO142/72, PRO.

33“Minutes of the Chemical Warfare Committee,” 18 October 1918, WO142/72, PRO.

34“List of Substances Examined but not Recommended for Adoption During the Period October 1917 to June 1919,” n. d., WO142/332, PRO.


36“Minutes of the Chemical Warfare Committee,” 20 September 1918, WO142/72, PRO.


38“Minutes of the Chemical Warfare Committee,” 20 September
and 27 September 1918, WO142/72, PRO.

Unfortunately data on number and type of ordnance fired during the war must be collected from reports found in unit records as the summaries contained within the official history's statistics volume do not provide a separate category for chemical shell. This in itself may be an admission that chemical shell had become just another weapon of the artillery or an attempt by the army to hide just how widespread the use of gas had become by 1918. See, The Official History of the First World War. Statistics of the Military Effort of the British Empire during the Great War (London: HMSO). The effort of the Special Brigade also needs to be considered. The Special Brigade expended 5,700 tons of gas discharged from nearly 88,000 cylinders, almost 197,000 projector drums, and about 139,000 mortar bombs. As with the artillery Special Brigade operations intensified in the latter half of the war. See, C. H. Foulkes, Report on the Activity of the Special Brigade During the War (France: Army Printing and Stationery Service, 1918), 3, in SUPP10/292, PRO.

40"Operation Order No. 104, 36th Australian HA, RGA," 12 October 1918, AWM26/480/1 AWM. The gas program was indeed carried out. See, "War Diary of the 36th Australian Brigade, RGA," 12 October 1918, AWM26/480/1, AWM.

41"Ammunition Expenditure, 11th Australian Field Artillery War Diary," 7 July 1918, AWM4/13/38/30, AWM.

42"2nd Australian Division Intelligence Summary," 10 July 1918, AWM5/1/44/38, AWM.

43"Summary of Ammunition Expended During Month of June 1918 by Fourth Australian Division Artillery," 1 July 1918, AWM26/410/6, AWM.

44"Fourth Australian Divisional Artillery Administrative Instruction No. 32," 23 June 1918, AWM25/519/28, AWM; and "Fourth Australian Divisional Artillery Order No. 167," 6 July 1918, AWM26/410/6, AWM. The orders issued to the five howitzers composing the right fire group on the attack's front also specified the provision of 250 HE and 300 chemical rounds. See, "Right Group - B Division Artillery, Australian Corps," n. d., in War Diary, 10th Australian Field Artillery Brigade, AWM4/13/27/24, AWM.
“Night Firing for Night 23/24 June 1918, Fourth Australian Division Artillery,” 23 June 1918, AWM25/519/28, AWM. On the night of 24/26 June the proportion was modified to 90 percent chemical and 10 percent smoke. See, “Synchronized Shoots to be Carried out During Night of 24/25 June 1918 by 4th Australian Division Artillery,” 25 June 1918, AWM25/519/28, AWM.

“F. J. Wilson to CA Fifth Army,” 19 September 1918, AWM27/314/7, AWM. Stinks was a commonly used slang expression for chemical shells. See, “Fifth Army Quartermaster War Diary, Daily Expenditure Report,” 16 July 1917, WO95/525, PRO.

“W. A. Rigden Memoirs,” April 1918, Ref. 80, LC.

“GOCRA Canadian Corps to Canadian Corps Artillery HQ,” 3 October 1918, RG9/IIIc1/Volume 3924, NAC.

“Summary of Operations,” 7 June 1918 and “Summary of Operations,” 8 June 1918, Montgomery-Massingberd Collection, 69, LHCMA. Unfortunately, the summary reports do not identify the purpose of this shoot, although the shell expenditure by the other calibers on these days was normal. By this stage of the war the 60 Pounder gun was rarely used to fire gas shells as the British had largely replaced it with the 6-inch howitzer. It continued to play an important role in gas bombardments, however, as a delivery system for shrapnel as the howitzers did not have that kind of shell.


“Summary of Operations,” 5 July 1918, Montgomery-Massingberd Collection, 71, LHCMA.

Bean outlines the principles and successes of “peaceful penetration” in the Australian official history. See, C. E. W. Bean, The Australian Imperial Force in France, vol. 6, During the Allied

"Notes on Probable Offences on Australian Corps Front," 28 May 1918, White Collection, PR85/83, item 33, AWM; and "Rawlinson to GHQ," 23 June 1918, Monash Collection, 3DRL2316, item 28, part 2, AWM.

"Rawlinson to GHQ," 23 June 1918, Monash Collection, 3DRL2316, item 28, part 2, AWM.


Edmonds, *Military Operations, France and Belgium, 1918*, 3:198. The employment of Americans touched off another round in the acrimonious debate between General John Pershing, the commander of the American Expeditionary Force, and Haig and Foch over the use of Yanks in combat by the British and French armies. Originally, Monash's plan called for the use of ten American companies but on the 3rd Pershing withdrew six and wanted the other four pulled out. They remained only because Monash threatened the postponement of the attack. See, Bean, *The Australian Imperial Force in France*, 6:257-64, 276-79.

The British described the relative morale between the two forces as German fair and Australian high. The subsequent operation would show that they minimized the difference. See, "Operations by the Australian Corps Against Hamel, Bois de Hamel and Bois de Vaire," 4 July 1918, 1, Rawlinson Collection, 5201-33-77, NAM.

"Rawlinson to GHQ," 23 June 1918, Monash Collection, 3DRL2316, item 28, part 2, AWM; "Notes on Probable Offences on Australian Corps Front," 28 May 1918, White Collection, PR85/83, item 33, AWM; and General Staff, *Notes Complied by G. S. Fourth*
Army on the Operations by the Australian Corps Against Hamel, Bois de Hamel and Bois de Vaire, on 4th of July, 1918, (1918), 2, 6.


62T. A. Blamey, “Lecture on the Battle of Hamel,” n. d., Blamey Collection, 3DRL6643, 5/3, AWM; “Notes on Probable Offences on Australian Corps Front,” 28 May 1918, White Collection, PR85/83, item 33, AWM; and “Operations by the Australian Corps Against Hamel, Bois de Hamel and Bois de Vaire,” 4 July 1918, 10, Rawlinson Collection, 5201-33-77, NAM. See also, General Staff, Notes Complied by G. S. Fourth Army, 5.

63“War Diary, 14th Australian Field Artillery Brigade,” 4, 16, and 19 June 1918, AWM4/13/41/25, AWM.

64“War Diary 11th Australian Field Artillery Brigade,” 1 July 1918, AWM4/13/38/30, AWM; and “War Diary 10th Australian Field Artillery Brigade, 25, 26, 27 June 1918, AWM4/13/37/23, AWM.

65“Right Group Intelligence Report,” 25, 27 June 1918, AWM4/13/27/24, AWM.

66“Fourth Australian Division Intelligence Summary No. 286,” 17 and 24 June, AWM26/408/4, AWM.

67“Second Australian Division, Intelligence Summary,” 1-4 July 1918, AWM5/1/44/38, AWM.

68“Fourth Australian Divisional Artillery Administrative Instruction No. 32,” 23 June 1918, AWM25/519/28, AWM.

69“Operations by the Australian Corps Against Hamel, Bois de Hamel and Bois de Vaire,” 4 July 1918, 10, Rawlinson Collection, 5201-33-77, NAM; and General Staff, Notes Complied by G. S. Fourth Army, 6. See also, “General Report on the Action of the Horse and Field Artillery Covering the Attack by the 4th, 6th and 11th Australian Infantry Brigades on Hamel and Vaire Wood and on the High Ground to the East, on the 4th July 1918,” 9 July 1918, AWM25/519/28, AWM.

70“War Diary, 4th Australian Division Artillery,” 3 July 1918,
AWM26/410/6, AWM; and "Synchronized Shoots to be Carried Out 3/4 July 1918 by 4th Australian Division Artillery," 3 July 1918, AWM25/519/28, AWM.

"Fourth Australian Divisional Artillery Order, No. 163," 1 July 1918, AWM25/519/28; and Edmonds, Military Operations, France and Belgium, 1918, 3:201.

For the creeping barrage the 18 pounders fired a mixture of 60 percent shrapnel, 30 percent high explosives and 10 percent smoke and the 4.5-inch howitzers employed a combination of 90 percent high explosives and 10 percent smoke. See, General Staff, Notes Complied by G. S. Fourth Army, 5.


"Fourth Australian Divisional Artillery Order No. 160," 29 June 1918, AWM25/519/28 AWM. A clinometer is a device for the measuring of angles of elevation.

"Operations by the Australian Corps Against Hamel, Bois de Hamel and Bois de Vaire," 4 July 1918, 9, Rawlinson Collection, 5201-33-77, NAM; Rawlins, "A History of the Development of the British Artillery in France, 207; and Australian Corps, HA, "Notes on Counter-Battery Work in Battle, 8 August 1918 and the Advance From Villers-Bretonneux to the Hindenburg Line," October 1918, AWM26/494/2, AWM. See also, "Agenda for Hamel Offensive," 4 July 1918, Rawlinson Collection, 5201-33-77, NAM; "Counter-Battery, Australian Corps HA, Operation Order - No. 7," n. d., AWM26/364/12, AWM; and Edmonds, Military Operations, France and Belgium, 1918, 3:204. Fourth Army headquarters decided that, "the failure of the enemy’s artillery on this occasion was, without a doubt due to effective counter-battery work. See, "Fourth Army Fortnightly Artillery Report, July 1st to 15th 1918," Montgomery-Massingberd Collection, 71, LHCMA. Figures for the shell expenditure are taken from "Intelligence Summary," 4 July 1918, Montgomery-Massingberd Collection, 71, LHCMA.

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77 Edmonds, Military Operations, France and Belgium, 1918,

78 “Australian Corps, HA Order No. 143,” 1 July 1918, Monash
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79 “Australian Corps Heavy Artillery Defence Scheme,” July
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80 “Counter-Preparation Phase IB,” n. d., AWM26/364/11, AWM.

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War Diary,” 5 - 10 July 1918, AWM26/365/13, AWM; and “War
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82 “Messages, Right Group, 10:24 AM,” 4 July 1918,
AWM4/13/27/24, AWM; “Synchronized Shoots to be Carried out
During Night 4th/5th July, Fourth Australian Division,” 4 July 1918,
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83 “Summary of Operations,” 5 - 10 July 1918, Montgomery-
Massingberd Collection, 71, LHCMA; and “Australian Corps GOCRA
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84 Rawlinson to Cavan,” 7 July 1918, Rawlinson Collection,
5201-33-76, NAM. The Australians were also enthusiastic about the

85 “Cipher CP 502, 11 July 1918; Cipher CP 506, 13 July 1918;
and Cipher CP 510, 14 July 1918,” all in Haig Collection, 3155/129,
NLS.
See, John Terraine, To Win A War, 1918: The Year of Victory (London: Sidgwick & Jackson, 1978), 90-100; and Edmonds, Military Operations, France and Belgium, 1918, 3:228-310.


Ibid., 311-314; “Haig to Foch,” 17 July 1918, in Ibid., 365-66. See also, “Extracts From Letters and Conferences Concerning the Preparations for the Operations on August 8th 1918,” n. d., Monash Collection, 3DRL2316, item 28, part 4, AWM.

“Extracts From Letters and Conferences Concerning the Preparations for the Operations on August 8th 1918,” n. d., Monash Collection, 3DRL2316, item 28, part 4, AWM.


Edmonds, Military Operations, France and Belgium, 1918, 4:30-31.

“Extracts From Letters and Conferences Concerning the Preparations for the Operations on August 8th 1918,” n. d., Monash Collection, 3DRL2316, item 28, part 4, AWM. For figures on the amount of gas rounds expended see, “Summary of Intelligence,” August 1918, Montgomery-Massingberd Collection, 73, LHCMA. For an explanation of Rawlinson’s plan see, Budworth, “Fourth Army Artillery in the Battle of Amiens, 8 August 1918,” 25 August 1918, Monash Collection, 3DRL2316, item 34, AWM.

“Australian Corps Heavy Artillery Order No. 150,” 6 August 1918, and “Counter-Battery Australian Corps HA Operation Order No. 12,” 6 August 1918, AWM26/494/2, AWM; “SOS and Counter-Preparation Scheme - SOS 48,” 4 August 1918, AWM26/479/9, AWM; and “Fourth Army Artillery in the Battle of Amiens, 8 August 1918,” n. d., Rawlinson Collection, 5201-33-78, NAM. For the III Corps gas bombardment program see, “III Corps Artillery Instructions No. 3,” 5 August 1918, AWM26/476/8, AWM. For an outline of III Corps gas program see, “III Corps, Project of an Operation to be Carried out on 8 August 1918,” 31 July 1918,
AWM45/23/43, AWM. Apparently, Fourth Army planned to use more gas than they actually employed. The allocation for Australian Corps alone, which did not use gas in counter-battery fire on the 8th, was 2,000 4.5-inch howitzer gas shells per divisional artillery group and 12,000 6-inch howitzer rounds divided among the heavy artillery batteries. They did not fire anything near these amounts. See, “Australian Corps, Artillery Instruction 251,” 1 August 1918, Monash Collection, 3DRL2346, item 44, AWM. A post-war analysis gave the gas munitions stocks for the Fourth Army for Amiens as 10,000 4.5-inch and 50,000 6-inch howitzer gas shells. See, Rawlins, “A History of the Development of the British Artillery in France,” 213, Rawlins Collection, 1162/1, RAI.

94“Daily Intelligence Summary,” 1-7 August 1918, Montgomery-Massingberd Collection, 73, LHCMA; and “War Diary Australia Corps BGHA,” 1 August 1918, AWM26/494/1, AWM.

95“SB Ops,” WO142/266, PRO; and “Fourth Army General Instructions No. 37(G),” 2 August 1918, Montgomery-Massingberd Collection, 73, LHCMA.

96After the battle Uniacke, spoke enthusiastically on the effectiveness of gas in the counter-battery work during the battle. In a lecture at the Staff College, he related an incident in which advancing troops captured intact an enemy 8-inch howitzer battery whose crew lay dead around their weapons. The gas had apparently penetrated their masks. See, “Lecture, Artillery in Offensive Operations,” 29 August 1918, Uniacke Collection, XI, RAI.

97After Rawlinson halted the battle on the 11th he authorized the use of captured mustard gas stocks. See, “Fourth Army Order No. 20/8(G),” 14 August 1918, Montgomery-Massingberd Collection, 73, LHCMA.

because they did not use tanks and had to wait for sufficient daylight so that their gunners could break up the defender's wire. See, Edmonds, *Military Operations, France and Belgium, 1918*, 4:34.

99 For prisoner figures see, “Cipher, CP 500,” 10 August 1918 and “Cipher, CP 597,” 13 August 1918, Haig Collection, 3155/130, NLS. Edmonds also provided estimates. See, Edmonds, *Military Operations, France and Belgium, 1918*, 4:84-85. By the conclusion of the battle on the 11th, the total number of captured Germans would reach nearly 30,000 and the British estimated the enemy's killed and wounded at over 75,000. The attackers also seized just under 500 pieces of artillery. See, Ibid., 154-55.

100 “Australian Corps Heavy Artillery, Scheme for Mobile Warfare,” 11 August 1918, AWM26/474/2, AWM.

101 For statistics on shell expenditure by Fourth Army during the war's closing campaign see, the summary of daily intelligence reports found in Montgomery-Massingberd's war diary located in the LHCMA.

102 Foulkes, *Gas!,* 287.

103 Data collected from “SB Ops,” WO142/266, PRO. Table includes only those attacks which involved gas, thermite or oil. The Special Brigade also undertook, in this period, a number of Stokes Mortar bombardments that exclusively involved smoke.

104 Foulkes, *Gas!,* 289.

105 James E. Edmonds, *Military Operations, France and Belgium, 1918*, 5:95-99; and “Battle Instructions, Series E, No. 2, Australian Corps,” 22 September 1918, Monash Collection, 3DRL2316, item 44, AWM.

106 “Battle Instructions, Series E, No. 2, Australian Corps,” 22 September 1918, Monash Collection, 3DRL2316, item 44, AWM.

107 Edmonds, *Military Operations, France and Belgium, 1918* 5:95; and “Artillery Instructions, Series B, No. 1,” 24 September 1918, Rawlins Collection, 1162/7, RAI.
The British used the term HS as the general code for mustard gas and reserved BB specifically for the shell version of this agent.

Between 13 October and 9 November the British would employ BB twelve more times. The expenditure for the Battle of St. Quentin Canal was easily the largest with the next greatest amount occurring during the night of 13/14 October when the artillery fired 11,000 mustard gas rounds. The principle target was the enemy's artillery. From 26 September to the end of the war the British would fire approximately 44,760 18 pounder and 17,028 6-inch howitzer rounds. For a summary of this activity see, “The Use of BB Shell,” n. d., AWM27/314/17, AWM.

“Fourth Army Artillery in the Attack on the Hindenburg Line, 29 September 1918,” 23 October 1918, Rawlinson Collection, 5201-33-78, NAM; and “Battle Instructions, Series E, No. 4, Australian Corps,” 24 September 1918, Monash Collection, 3DRL2316, item 44, AWM.

Ibid. See also, “Artillery Instructions, Series B, No. 1,” 24 September 1918, Rawlins Collection, 1162/7, RAI; and “Battle Instructions, Series E, No. 13, Fifth Australian Division,” 28 September 1918, Hobbs Collection, 3DRL2600, item 19, AWM.

“Results of Bombardment with BB Gas Shell on the night of September 26/27th on Fourth Army Front,” n. d., AWM26/474/2, AWM; “Artillery Instructions No. 268 by GOCRA Australian Corps,” 24 September 1918, Monash Collection, 3DRL2316, item 44, AWM; and “Australian Corps Heavy Artillery Order No. 162,” 26 September 1918, AWM26/494/8, AWM. As with all the war gases, high winds or other adverse conditions could make the release of gas pointless or even dangerous for ones own troops. The wind limit on mustard gas was twelve MPH and a heavy rain could wash the liquid away. See, “Report on Mustard Gas,” 27 June 1918, WO142/91, PRO.

“Summary of Operations,” 29 September 1918, Montgomery-Massingberd Collection, 78, LHCMA.

“Battle Instructions, Series E, No. 4, Australian Corps,” 24 September 1918, Monash Collection, 3DRL2316, item 44, AWM; “Fourth Australian Divisional Artillery Instruction No. 7,” 27 September 1918, AWM26/495/8, AWM; and “Precis of Fourth Army

115“SB Ops,” WO142/266, PRO; and “Battle Instructions, Series E, No. 15, Australian Corps,” 25 September 1918, Monash Collection, 3DRL2316, item 44, AWM.
CHAPTER IX
CONCLUSION

Ample and generous provision must be made for the continuous study of chemical warfare both as regards offence and defence during peace, in order to ensure the future safety of the fighting forces of the Empire.¹

This work began with a number of questions regarding the British adaptation to the introduction of gas in World War I, and the intellectual reaction of the institution of the army as its leadership grappled with the issues of innovation and adaptation. However, the work also had another objective which, although not overtly stated, has existed as a subtext through these pages. Gas was a pervasive weapon, a fact that the historiography of the Great War has largely ignored. With few exceptions, histories of the Western Front fail to suggest the ubiquitous presence of gas, and do little more than recount its introduction by the Germans at 2nd Ypres. The tank, instead, helped no doubt by its success in the next war, garnered the adulation while gas sunk into obscurity. This work should help to redress the balance and demonstrate that by 1918 there could be no escape from gas.

Contributing to this condition was the fact that almost immediately after the war's end the analysis of the efficiency of the
employment of gas became obscured by questions of the morality of its use. As early as January 1919 Foulkes reported that the press had already seized the high-ground and had denounced the presence of gas in modern war. Even as recently as the Gulf War, commentators fed the fear of the potential dispersal of toxic agents by Iraq more on the basis of psychological than tactical factors. To counter these arguments, the proponents of gas went to great lengths, during the interwar years, to point out that relatively few gas victims died or became permanently disabled from their gas wounds, unlike those injured by machine-gun bullets or shrapnel. Still it was hard to explain to war weary populations that one of the primary appeals of chemical weaponry was its ability to increase the enemy’s level of misery, thus furthering the objections of those who wanted to base the acceptability of a weapon on moral criteria. This work has shown that there was another side to the question of whether or not nations should employ chemical munitions in war and that decision-makers need to take into account the tactical environment when determining the efficiency of a weapon.²

Had the war had gone into the new year, the realization of the prevalence of gas might have had the opportunity to become undeniably established. The term “Plan 1919” is generally associated with the proposal by Fuller to win the war in that year with a massive tank army. What has been forgotten is that gas proponents had the parallel intention of securing victory through the use of gas, although they did not state it as clearly and compactly, or have it published, as Fuller managed to do. Had the war lasted into
1919, the western democracies would have had available a tremendous stockpile of poisonous gases that would have vastly exceeded anything to date. Churchill planned to treble the 1918 capacity of Britain's chemical weapons infrastructure, and by 1919 the Allies would have completed the expansion of their chemical manufacturing plants, affording them a massive superiority over the enemy. By the armistice Allied production of chemical agents had drawn abreast of that of Germany, and, at maturity, the production programs of Britain, France, and especially the United States would have vastly exceeded Germany capacity. The consequences for the Germans were indeed grave, particularly in the competition over mustard gas, a forum the Germans had controlled unopposed for over a year. By 1 May 1919, the production of mustard gas by the United States would have reached 200 tons a day, by Britain 100 tons a day, and by France eighty tons a day, whereas German production had averaged only fourteen tons per day since they had introduced the substance. A ratio of three hundred and eighty to fourteen would have provided the Allies with an overwhelming superiority, and rendered the war an unmerciful disaster for the enemy's soldiers.³

The British chemical intentions for 1919, however, went far beyond the issue of supply. The weapon system which did, in fact, dominate the war was the artillery and its role as a gas delivery system would have become even more significant. Even Britain, the most conservative of the four major powers, estimated the need for chemical shell, for every tube up to and including 9.2-inches, as
between ten and thirty percent of production of all shell types, depending upon caliber and mission. These figures, however, overstate the numerical superiority of traditional munitions because the deleterious potential of gases, especially mustard, remained in effect long after the force of a high explosive shell had disappeared.

Additionally the British would have had the DM device, an airborne candle which, when ignited, released the substance as a particulate cloud. German masks offered no protection from this agent’s sternutator effect. DM would have permitted the Royal Air Force to enter the gas war for the first time in an offensive role, as the newly-arrived Handley-Page bomber, with its long range and relatively high lift capacity, could have served as a formidable delivery platform. The intensification of chemical warfare and the attack from the air with poison gases that Douhet, and other interwar air power theorists predicted, would have become a reality in 1919.

Foulkes also had plans to adapt his unit to the changing conditions of the war and thereby establish a permanent role for the Special Brigade within the army. Late in the war he deployed the first sled-mounted projector carrier. Easily positioned and fired, it carried a battery of sixteen projectors. The crew could then reload, drawing materials from their supply tank. The sled was also labor-saving because it absorbed the recoil, obviating the need to bury the device in the ground and thereby freeing the Special Brigade from its reliance upon the infantry for labor details. This would have benefited both parties, by giving the Special Brigade greater flexibility in conducting their operations and releasing the infantry
from one of their more onerous special duties. As the weapon never saw action, its effect can only be guessed at, but it would most likely have resembled the German Nebelwerfer of World War II.

British gas policy for 1919 would also have affected the tactical employment of infantry in the attack. On 10 October 1918 the Chief of the General Staff widely distributed a memorandum calling for the employment of lethal gas shell in a novel manner. To date, planners had assiduously avoided dispersing gas upon terrain over which the infantry was to advance. Now the Chief of the General Staff suggested that it was possible for the infantry to advance behind a barrage of CG exactly in the way they attacked when protected by a conventional barrage. It explained that the good gas discipline of the British soldier and the superior knowledge the troops possessed regarding gas presented the opportunity to exploit a tactical superiority over the enemy. CG, while lethal, did have a short persistency in the open, especially on warm, sunny days. The authors continued that the Germans would have to don their masks because they would not know which gas the British had employed, whereas the British infantry could advance without the debilitating effects of their respirators and thereby gain an advantage over the enemy. The memorandum harkened back to the objectives of the initial use of gas by the British at Loos, its ability to create panic. At the moment of attack, gas increased the strain the enemy were under while it also sowed confusion in their ranks. In effect the British intended to expand their use of gas as a weapon of terror and thereby enhance the possibility of the enemy's soldiers breaking,
leading to a rout. The experiment was never carried out, nor is there any record of the infantry’s reaction to the proposal.7

The widespread availability of mustard gas, the increased range of the larger-caliber guns, the penetrative power of the bomber, the enhanced mobility of the Special Brigade, and changes in assault tactics, would all have contributed to making 1919 the year in which gas became unavoidable. From its beginnings in 1915, chemical warfare grew from an experiment into one of the war’s biggest points of competition between the combatants. By demonstrating the widespread employment of gas and its incorporation by the armies into their everyday routines it is hoped that this work will help redirect the discussion of gas onto the neglected question of its tactical employment rather than the much-debated one of its position on the moral spectrum compared to other weapons of war.

Another theme of this work was the combatants’ belief in the necessity of decisive battle and the relentless attempts by the British to create the asymmetry essential to its achievement. By the closing months of the war the British had met their two critical prerequisites. They had obtained an obvious moral superiority and had developed the technologies, tactics, and training necessary to maneuver upon the battlefield. However their quest remained elusive and the war ended without a decisive victory. They had come close, and successes such as Amiens and the Crossing of the Hindenburg Line were stunning, choreographed victories which demonstrated the British Army’s acquired staff skills and
professionalism, as well as its ability to orchestrate the diverse components of modern warfare into a symphony of crushing might. Yet the enemy did not crumble, nor did the British reach the final phase of battle when the Germans broke and the cavalry rode forth to convert the enemy’s defeat into a rout. Their relentless pressure pushed the enemy back, but the Germans retreated in an organized manner, their rear protected by elite machine-gunners. Was the quest then a foolish pursuit? A chimera upon which Haig’s single-minded focus resulted in the waste of British lives?

The answers to both questions are complex but in their essence they could be rendered as a simple no. The British were on the path to decisive victory, and they had successfully obtained their necessary prerequisites. However, they still lacked two ingredients that were beyond the grasp of all the combatants in the war, communications and logistics. These elements are all that distinguished the capabilities of the armies in 1918 from those of 1939. Decisive victory remained elusive because the British did not have access to the technologies necessary to sustain an attack sufficiently deeply into the enemy’s defences so that the attackers could break into the open. Furthermore, they did not have the means to maintain the pressure along the battle’s edge at a level greater than the defender’s ability to dispatch reinforcements to the threatened sector. Nor did they have the command control equipment that would allow headquarters to monitor the flow of a battle and to intercede with reinforcements or adjustments in the plan at critical moments. Even their highly competent Counter-
Battery Staff Officers relied upon mature plans developed from lengthy intelligence studies, and they would have difficulty adjusting to the more mobile conditions of the war's final months.

Further complicating the achievement of decisive battle was that in addition to enormous firepower, modern weapons also possessed tremendous range. The World War I battlefield had reached such depths that the attacker could not cross it with foot-mobile infantry and horse-pulled guns before the physical exertion brought the attack to a halt, allowing the defender to bring up fresh troops and artillery and further extend the battle zone. The British did have tanks, but even the best, the Mark V, was thoroughly unreliable, and they were more of a logistical drain than a benefit. What the British needed were trucks and radios. Both were present in primitive states but not in the numbers or technical sophistication necessary to sustain a drive which could break through and enable the attacker to reach the final phase of battle that would result in decisive victory. The Kirke Report of 1934, undertaken as a study of the war's lessons, reached a similar conclusion. The report characterized the battles of the Great War as "Break-Ins" and discussed the question of what was needed to achieve a "Break-Through." The Kirke Committee concluded that the army needed a powerful motorized/mechanized reserve that could strike at the decisive moment and carry through the enemy's defences into their vulnerable rear installations and line of communications. Additionally, the timing of the decisive blow required a commander who had the means to coordinate all the branches of the army.
Decisive victory eluded the British for want of a proper truck and a radio net.  

Did gas contribute to the pursuit of decisive battle and to the defeat of the enemy? While in the postwar, gas did not engender the romance of the fighter airplane, or the technological mastery of the tank, or the dominance of the guns, it still played an important role in the successes of 1918. Gas was a weapon with great ability to lower morale, and the British became masters at using it to this end. Its employment by the artillery for counter-battery was critical for the neutralization of the enemy’s guns. No other munition could silence a battery as effectively or quickly as gas. Its incorporation into all aspects of British operations is a tribute to its efficiency and its concordance with the principles of the British method of waging war.  

The last subject this work touched upon was the processes of innovation and adaptation and the limitations culture places upon an army’s options. Gas was a novel weapon and, theoretically, should have provided the British with fertile ground for the development of weapons, substances, and tactics that could have expanded their method of waging war. Did this occur? Was the introduction of chemical warfare an opportunity for the British to change how they perceived the nature of war or were its unique properties immaterial to its employment? In fact, despite the outward manifestations of change, and the constant struggle for new gases, delivery systems, and defensive appliances, the British did not utilize chemical warfare to reassess radically their principles or make any
central alterations in how they approached the problems of the Western Front and the pursuit of decisive battle. Successful innovation needs both a modification in how an army perceives the nature of war and changes in the method of inculcating these values throughout the institution. For most combatants this would have required a reassessment of their doctrine, but for the doctrine-less British it would mean a new ethos. The British remained true to the principles of war that they had enunciated in the FSR and other manuals before the war, and to their perception that superiority, particularly in the moral arena, was an essential condition for victory. Thus gas was seen as another auxiliary by which to obtain asymmetry in the two areas of competition with the enemy on which the British had chosen to focus. Instead of forcing innovation, gas underwent a process of incorporation. Loos suggests a partial exception, since Haig rested the success of the battle almost entirely upon the effectiveness of this new technology. However gas still operated completely within the existing framework for waging battle, and its principle function at Loos was to induce panic, a form of moral collapse.

Was this failure to innovate, to reassess their method of waging war, a representation of an inability by the British to master technology-driven weapons and tactics? Was their methodology too heavily focused upon man-centered concepts of war to accept a warfare that relied upon a machine model? These suggestions can be readily dismissed, as Britain’s record of implementing and adapting to new technologies and weapon systems was superb. Due
to new inventions, such as the tank, or the improvements in existing weapons, such as the artillery, the British came to dominate the opposite German arms. Even in coordination agencies, such as the Counter-Battery Staff Office, and in intelligence collection, such as the technology-dependent sound-ranging engineers, the British were the pioneers and kept well ahead of equivalent efforts by the enemy. The failure to embrace innovation was not due to an aversion to seeking and trying new technologies but instead lay at the heart of how the British army thought.

If they did not innovate, why then did the implementation of chemical warfare constantly change? Was this on-going adaptation to the war’s changing environment a symptom of the innovation process? In reality, no. Adaptation is not a manifestation of innovation but rather an entirely separate process that may or may not be representative of real change. The British method established before the war prized adaptation and resisted the establishment of a doctrine because the leadership feared it would lead to stereotypical responses. The great majority of officer corps accepted that in a diverse empire it was not possible to predict every situation commanders would encounter, nor to anticipate the best solutions. Instead, the army expected its officers to find their own answers to the problems they faced. The vastness of World War I, when compared to the conditions an officer might operate under in the African hinterland, did not create an exception.

As the quotes at the beginning of Chapter Three demonstrate, the army’s leaders accepted that a few timeless, inviolate principles
guided the practice of war. Throughout the carnage of the Western Front neither Haig, nor his staff and other senior officers, questioned the correctness of these principles. If innovation was to have occurred the army would have had to undertaken a review of these principles, an intellectual exercise which did not take place. Without this process of introspection innovation was impossible, even within the dynamic environment of chemical warfare. The pre-war mental attitude set the parameters within which adaptation was allowed to happen. Furthermore, the army had firmly rooted their principles in the cultural context of late-Victorian and Edwardian Britain. The ideas which guided the army during the war were in place before it commenced and could not be separated from the nation’s cultural milieu.

Does this mean that the British Army suffered from a prewar ossification of its ideas and, consequently, during the war the result was a rigid interpretation of the strategic and tactical environments? Was the army’s loyalty to its principles a fundamental liability? Perhaps, but inflexibility of operational parameters was also a benefit whose positives out-weighed the negatives. Armies are social institutions that operate within the cultural environment of their parent society. It requires some speculation, but what are the consequences for a military institution that attempts to disregard or violate, within the course of a war, the controlling boundaries set by the overarching culture? In a time of war, the overturning of the existing mental order would be the equivalent of the collapse of the social fabric of the nation. Within the perspective of the parent
culture, a military institution would no longer have a frame of reference by which to analyse new problems or to pose new solutions. To have jettisoned their prewar principles would have required the abandonment of the ethos by which the officier corps defined itself. Had the British undertaken this task, had they thrown away the existing principles, they would have also lost the cultural connection with British society. The result of such an innovation would have been serious. Lacking in an ethos, bereft of principle, they would no longer have the mechanisms for adaptation. The army would have no longer been able to rise up against the challenges of the war and find the modifications in implementation that would bring victory.⁹

Throughout the war the British Army marched relentlessly towards the institutionalized objective of decisive victory by means understood by all. It was a bloody route, but not nearly as much as it was for some of the other combatants, and it was a sure road that led to victory. The potential result of systemic, intellectual innovation is the loss of the vision necessary for victory, without the guarantee of finding a suitable substitute. War is a dynamic forum and the effect on an army which was without an ethos, would be an adrift force lacking in the means to identify, analyze and solve problems. Armies must not be static and they require the means to adapt to the changing nature of war. Innovation can be a dangerous process whose results are unpredictable and are best left to a period of peace when there is opportunity for reflection and inculcation. The ultimate potential consequence for the British, if they had
thrown away their principles, was not only the loss of the ability to adapt but even more gravely the prospect of defeat.

1"Report of Committee on Chemical Warfare Organization, [Holland Report]" 7 July 1919, WO142/272, PRO.

2"Summary on Gas Warfare," 28 January 1918, Foulkes Collection, 6-39, LHCMA.


4The requirements for chemical shells in 1919 placed a heavy demand upon mustard gas. All the chemical rounds for the 18 pounder, 6-inch gun, 8-inch howitzer and 9.2-inch howitzer were to be mustard gas. The filling for the 60 pounder was to be 66 percent mustard gas while shells for the 4.5-inch and 6-inch howitzers were to be 75 percent mustard gas. See, "Weekly Requirements in Chemical Shell: 1918-1919," MUN5/198/1650/30, PRO.

5See, Douhet, The Command of the Air.


7CGS to Second Army," 10 October 1918, AWM26/468/10, AWM.


9The question of when it is best for armies to innovate is beyond the scope of this work but for a discussion see, Rosen, Winning the Next War, 57-105.
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