Risk in Large-Scale Combat Operations: Finding Balance in Bold Action

A Monograph

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This monograph seeks to study how risk links the operational and tactical levels of war together, and how risk decisions at one level impact the other. Specifically, how bold action and risk decisions at the tactical level can have a positive or negative effect at the operational level. It will examine these linkages through a historical analysis of the decisions to use heavy bombers in support of ground forces in the European Theater of Operations during World War II. Comparing unsuccessful bombings at Cassino and the Normandy Beach landings with the successful employment of heavy bombers during Operation Cobra demonstrates the importance of finding the proper balance between risk mitigation and mission effectiveness. By studying how commanders in World War II considered risk, and how their risk decisions affected the outcome of their operations, lessons can be gleaned for future large-scale combat operations.

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Abstract

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This monograph seeks to study how risk links the operational and tactical levels of war together, and how risk decisions at one level impact the other. Specifically, how bold action and risk decisions at the tactical level can have a positive or negative effect at the operational level. It will examine these linkages through a historical analysis of the decisions to use heavy bombers in support of ground forces in the European Theater of Operations during World War II. Comparing unsuccessful bombings at Cassino and the Normandy Beach landings with the successful employment of heavy bombers during Operation Cobra demonstrates the importance of finding the proper balance between risk mitigation and mission effectiveness. By studying how commanders in World War II considered risk, and how their risk decisions affected the outcome of their operations, lessons can be gleaned for future large-scale combat operations.

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Acronyms

AD	Armored Division
ADP	Army Doctrine Publication
ADRP	Army Doctrine Reference Publication
AEAF	Allied Expeditionary Air Force
AF	Air Force
AFHD	Air Force Historical Division
ATP	Army Techniques Publication
ETO	European Theater of Operations
FM	Field Manual
SHAEF	Supreme Headquarters Allied Expeditionary Force
HQ	Headquarters
GEN	General
GPS	Global Positioning System
ID	Infantry Division
JP	Joint Publication
KIA	Killed in Action
LSCO	Large-Scale Combat Operations
LTG	Lieutenant General
MG	Major General
OB	Oberbefehlshaber (German Supreme Command)
RAF	Royal Air Force
TAC	Tactical Air Command
USAAF	United States Army Air Forces
WIA	Wounded in Action
WWII	World War II

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Introduction

As the US Army reorients on conducting large-scale combat operations (LSCO), commanders and staffs must understand the linkages which exist between the effects of risk at the operational and tactical levels.[1] More precisely, how risk decisions at one level can affect operations at the other. The high number of risk decisions anticipated during large-scale combat, and their effects in the aggregate, underscore the importance of appreciating risk across multiple echelons. In LSCO, bold action is necessary to gain and maintain the initiative.[2] However, with bold action comes increased risk and a necessity to find the right balance between risk mitigation and mission effectiveness.[3] In short, ensuring a tactical action produces positive operational effects requires balancing risk and effectiveness, while accepting the potential consequences of failure.

In considering risk, it will be valuable to consider other concepts, such as firepower, which also span multiple levels of war. Platforms such as the long-range bomber possess such highly lethal and destructive potential that their effects are measurable strategically, operationally, and tactically. But if their effects are so far reaching, so too are the risks inherent in their employment. While bombers can undoubtedly contribute considerable levels of firepower to an operation, their unintended effects have the potential to outweigh their benefit. The risks of fratricide or bombing innocent civilians are so great that decision-makers need to consider the potential consequences across the entire spectrum of operations. To disregard the impact of these

[1] *ADP 1-01* acknowledges a common misconception about the levels of war which is important to address immediately. "The levels of warfare should not be confused with effects—that can also be strategic, operational, or tactical and can be generated by any echelon, or even individuals." US Department of the Army, *Army Doctrine Publication 1-01, Doctrine Primer* (Washington, DC: Government Printing Office, 2014), 4-9.

[2] US Department of the Army, *Field Manual (FM) 3-0, Operations* (Washington, DC: Government Printing Office, 2017), 5-5, B-1.

[3] Ibid., 5-5.

risks at any one level would be to ignore the interconnectedness of warfare, and to potentially incur more risk.

To study risk decisions in LSCO this monograph makes use of historical case studies from the Mediterranean and European theaters of operations in 1944. Senior Allied commanders of World War II (WWII) routinely faced difficult decisions within a context of extreme violence and severe consequences. One such decision was whether to employ heavy strategic bombers in direct tactical support of friendly ground forces. Capable of delivering massive amounts of firepower, heavy bombers were a tempting option to commanders faced with mounting operational and tactical risk. But one with a potentially terrible price. Early employments of heavy bombers in a tactical role resulted in the tragic bombing of friendly forces or failed to achieve the desired effect on the enemy at great material cost. By 1944, contributing factors to previous incidents of fratricide, such as bomb accuracy and inadequate control measures, remained unresolved. Still, the option to harness the heavy bomber's enormous destructive capability remained if Allied commanders were willing to accept the risk.

Throughout 1944 the Allies in Europe proved their continued willingness to use heavy bombers in such a manner, but achieved varying degrees of success. The use of heavy bombers featured prominently in three important operations: Dickens (assault on Cassino), Neptune (seaborn invasion of Normandy), and Cobra (breakout from Normandy). However, only in Operation Cobra did their use provide a decisive advantage. Why then were heavy bombers repeatedly employed if they were generally ineffective in a tactical role? And what made them so effective in Cobra, as opposed to earlier operations? The answers lie within the realm of risk. This monograph will explore each operation and attempt to explain how operational and tactical risk factors affected their outcomes, demonstrating how lessons learned from these historical examples help in understanding risk in future large-scale combat operations. But to start, one must have an appreciation for the doctrinal concept of risk.

Risk Doctrine

This section will review risk terminology and LSCO-related risk concepts contained in Army service and joint doctrine. Its purpose is three-fold: First, to establish a common set of terms and concepts for use within the case historical studies. Second, to highlight risk as an element of operational art and how it affects planning and tempo. Third, to review useful risk concepts from *Field Manual 3-0, Operations* and how they relate to LSCO. The use of modern doctrinal concepts will ensure conclusions produced from the analyses of the case studies remain relevant for current and future operations. However, this monograph will not use standards and processes contained within current doctrine to judge the actions or decisions identified within the case studies as "right" or "wrong." To do so would be unfair to those faced with the difficult task of making life and death decisions under the most strenuous of circumstances. However, these historical examples are useful as a means to test modern doctrinal concepts and theories.[4]

Army Techniques Publication 5-19, Risk Management defines risk as the "probability and severity of loss linked to hazards," which are mitigated by controls: "A control is an action taken to eliminate a hazard or to reduce its risk."[5] Staffs ensure controls are effective at mitigating the risks for each identified hazard. Any risk which remains after the application of controls is residual risk. The vital part of the commander's role during this step is to issue clear risk-tolerance levels to the staff. Risk tolerance is the "level of risk the responsible commander is willing to accept."[6] If the residual risk exceeds the commander's risk tolerance, the decision to accept it or implement additional controls is elevated to the next higher commander for a risk

[4] John Lewis Gaddis, *On Grand Strategy* (New York: Penguin Press, 2018), 10.

[5] US Department of the Army, *Army Techniques Publication (ATP) 5-19, Risk Management* (Washington, DC: Government Printing Office, 2014), 1-1.

[6] US Army, *ATP 5-19*, 1-1.

decision.[7] This ensures the risk decision is made at a rank and authority appropriate to accept the severity of the residual risk, or at an echelon with the resources available to implementing further controls. Once reduced to an acceptable level, the commander applies his or her critical judgement to determine whether potential benefits are worth accepting the residual risk. This is known as prudent risk. It is defined as "a deliberate exposure to potential injury or loss when the commander judges the outcome in terms of mission accomplishment as worth the cost."[8] By accepting prudent risk commanders can create new opportunities and gain an advantage against an adversary.

The joint force uses risk management to account for risk during operations at the tactical level. Through this process commanders and staffs seek to maximize effectiveness without accepting unnecessary risk. *Joint Publication 3-0, Operations* defines risk management as "the process to identify, assess, and control hazards arising from operational factors and make decisions that balance risk cost with mission benefits."[9] The five steps that make up the risk management process are: "identify the hazards, assess the hazards, develop controls and make risk decisions, implement controls, and supervise and evaluate."[10] The process is cyclical and continuous, which helps commanders and staffs identify emerging risks and to adjust controls as necessary.

While risk in Army service doctrine primarily focuses on actions at the tactical level, it does acknowledge risk as an element of operational art.[11] Commanders and planners use the

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[7] A risk decision is, "a commander, leader, or individual's determination to accept or not accept the risk(s) associated with an action he or she will take or will direct others to take." US Army, *ATP 5-19*, 1-1.

[8] US Department of the Army, *Army Doctrine Reference Publication (ADRP) 6-0, Mission Command* (Washington, DC: Government Printing Office, 2012) 2-5.

[9] US Department of Defense, Joint Staff, *Joint Publication (JP) 3-0, Joint Operations* (Washington, DC: Government Printing Office, 2017), III-19.

[10] US Army, *ATP 5-19,* v.

[11] US Department of the Army, *Army Doctrine Reference Publication (ADRP) 3-0, Operations* (Washington, DC: Government Printing Office, 2017), 2-4, 2-10.

elements of operational art to better understand the operational environment (OE) and develop an operational approach. Risk is an important one and must be an integral part of operational planning. Planning for risk, though, does not mean planning to avoid it at all costs. *FM 3-0, Operations*, states, "Risk, uncertainty, and chance are inherent in all military operations. Operational art balances risk and opportunity to create and maintain the conditions necessary to seize, retain, and exploit the initiative and achieve decisive results."[12] At the operational level, planners must set conditions which give tactical commanders the flexibility to quickly exploit opportunities as they arise.

Tempo is another element of operational art, and one with close ties to risk. Army *Doctrine Reference Publication 3-0, Operati*ons describes tempo as "the relative speed and rhythm of military operations over time with respect to the enemy."[13] Divisions and corps use tempo to mitigate risk at the low-operational, high-tactical levels by retaining and exploiting the initiative. With the initiative a commander can use tempo to leverage the strengths of his or her own force against the weaknesses of the enemy.

The 2017 version of *FM 3-0, Operations* directly addresses risk as it pertains to conducting successful LSCO. The following concepts, when combined with the basic risk ideas covered earlier, explain how risk can provide a potential advantage over an adversary. The first is that of balance, which directly supports the link between effects at the operational and tactical levels: "Commanders seek to understand, balance, and take risks, rather than avoid risks. When commanders accept risk in large-scale combat operations, they create opportunities to seize, retain, and exploit the initiative and achieve decisive results."[14] Balance is of vital importance when making risk decisions. Too little consideration for reducing hazards is gambling, and a

[12] US Army, *FM 3-0,* 1-20.

[13] US Army, *ADRP 3-0,* 2-7.

[14] US Army, *FM 3-0,* B-1.

commander can miss a much-needed opportunity by being too risk averse.[15] But the onus is not only on the commander to achieve appropriate balance; staffs have a responsibility to assist their commander by planning and implementing effective controls to minimize residual risk and maximize opportunities.

The execution of large-scale combat operations also requires commanders to act with audacity to seize the initiative and exploit positions of relative advantage. Even considerations of risk in LSCO call for such assertive action: "Bold, aggressive tactics may involve significant risk; however, greater gains normally require greater risks."[16] By choosing to act boldly, a commander can gain and maintain an advantage over the enemy. However, the same commander must be willing to accept the potential consequences that often come with elevated levels of risk. The Allies embraced this concept by incorporating heavy bombers into some of the boldest, most aggressive tactics used in WWII. However, as the subsequent case studies will show, firepower of such magnitude had the potential to generate negative consequences of similar proportion.

Heavy Bombers in WWII

Heavy bombers represented the deadliest weapon systems available to the Allies in Europe during World War II. The US Army Air Forces (AAF) and Royal Air Force (RAF) employed formations consisting of hundreds, and sometime thousands of B-17 and B-24 bombers, each capable of carrying between four thousand to eight thousand pounds of bombs, respectively. Operating at extended ranges these formations rained down unprecedented levels of wartime destruction in the European Theater of Operations (ETO). In 1944, heavy bombers dropped 1,593,736 tons of bombs in the ETO alone, nearly five times the amount dropped in

[15] Gambling is defined as, "staking the success of an entire action on a single event without considering the hazard to the force should the event not unfold as envisioned." *US Department of the Army, Army Doctrine Publication (ADP) 1-01, Doctrine Primer* (Washington, DC: Government Printing Office, 2014), 4-2.

[16] US Army, *FM 3-0*, 5-5.

1943.[17] Yet in that in 1944 the heavy bombers of Eighth Air Force only dropped 35,951 tons, or 2.25 percent of total tonnage, in support of ten tactical operations.[18] These numbers demonstrate how rarely heavy bombers supported tactical operations in relation to their normal strategic bombing missions, and illustrate a lack of close integration with ground forces.[19]

Heavy bombers, while highly destructive, were also highly inaccurate. In the ETO AAF heavy bombers only had a 20 percent probability of placing bombs within one thousand feet of a target.[20] To increase probability, the AAF used formation flying and attack to ensure bomb strike patterns would cover the target area. Technical aides, such as the Norden bomb sight, targeting radar, and navigational beacons, helped to improve hit percentages and enabled blind bombing through cloud cover.[21] Accuracy steadily improved into 1945, but unguided munitions coupled with a continued reliance on high-altitude bombing ensured the heavies remained an inaccurate, area weapon.

In 1944, the following doctrinal publications delineated the US use of air power in the ETO: *Army Air Forces Field Manual FM 100-20, Command and Employment of Air Power* (1943); *FM 1-5, Employment of Aviation of the Army* (1943); *FM 31-35, Aviation in Support of Ground Forces* (1942); and *FM 1-10, Tactics and Technique of Air Attack,* (1940). While the AAF published both *FM 1-5* and *FM 100-20* in 1943, *FM 100-20* superseded *FM 1-5* and remained the capstone doctrinal publication for the remainder of the war.[22] *FM 1-5* was more

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[17] The US Strategic Bombing Survey, *Statistical Appendix to Over-All Report: European War* (Washington, DC: Government Printing Office, 1947), Chart 4.

[18] Army Air Forces Evaluation Board in the European Theater of Operations, *The Effectiveness of Third Phase Tactical Air Operations in the European Theater: 5 May 1944 – 8 May 1945* (North Carolina: Etherington Conservation Services, 2008), 19; AAF Evaluation Board, *Effectiveness,* viii.

[19] Richard G. Davis, *Carl A. Spaatz and the Air War in Europe* (Washington, DC: Center for Air Force History, 1993), 515.

[20] The US Strategic Bombing Survey, *Summary Report: European War* (Washington, DC: Government Printing Office, 1945), 5.

[21] AAF Evaluation Board, *Effectiveness,* 370-76.

[22] *FM 1-5* contains detailed information relevant to the employment of heavy bombers and support to ground forces not included in the updated *FM 100-20* or other Air Forces manuals.

prescriptive regarding the specific employment of air power, whereas *FM 100-20* defined the roles and organization of the AAF in general terms. This left the employment, tactics, and techniques to other publications like *FM 31-35* and *FM 1-10*.

During WWII, AAF doctrine changed at a rapid pace. In the summer of 1943 Chief of the Army Air Forces General Henry "Hap" Arnold sent observers to North Africa and Italy to capture lessons learned for inclusion in future doctrine.[23] According to General Arnold, the intent was to "capitalize on the practical field experience…codify these lessons and make them available to training missions in the United States."[24] Key concepts added to the new *FM 100-20* were the need for joint planning, better liaison with ground forces, and the coequal nature of air and land power.[25] *FM 100-20,* based on purpose, equipment, and training requirements, split aircraft into two distinct categories: fighter and bombardment. The fighter category included fighters designed for air-to-air combat and fighter-bombers, which were fighter aircraft modified to attack surface targets.[26] Bombardment aircraft included all light, medium, and heavy bombers "designed for the air attack of surface objectives."[27] When assigned to a theater of operations, fighter and bomber units further organized into tactical air forces and strategic air forces. Tactical air forces normally included fighters, fighter bombers, light and medium bombers, and reconnaissance aircraft. Strategic air forces were comprised of heavy bombers, fighters (for bomber escort), and photographic aircraft.

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[23] Davis, *Spaatz,* 214.

[24] Henry "Hap" Arnold to Dwight D. Eisenhower, June, 1943, Principle File, Box 5, Pre-Presidential Papers of Dwight D. Eisenhower, Eisenhower Presidential Library, quoted in Thomas Alexander Hughes, *Overlord: General Pete Quesada and the Triumph of Tactical Air Power in World War II* (New York: The Free Press, 1995), 109.

[25] Hughes, *Overlord,* 109-10.

[26] US Army Air Forces, *Field Manual (FM) 100-20, Command and Employment of Air Power* (Washington, DC: Government Printing Office, 1943), 3.

[27] USAAF, *FM 100-20,* 3, 9-10.

The doctrinal role of the heavy bomber, as part of a strategic air force, was to carry heavy bomb payloads over long distances to strike strategically designated targets. These targets included, but were not limited to, ground-based counter air targets, objectives within the enemy's economic system, and others deemed of strategic importance within the enemy's lines of communication.[28] Despite the focus on strategic targets, however, doctrine allowed for the use of heavy bombers in support of ground forces. According to the 1943 version of *FM 100-20*, "The strategic air force may be assigned tactical air force missions with the tactical air force when the action is vital and decisive, but this deviation from basic employment is rare."[29]

The 1943 update to *FM 100-20*, however, was not comprehensive enough to capture all lessons learned from North Africa. Some publications received no updates until after the war. Published in April 1942, before the Tunisia campaign began in North Africa, *FM 31-35* quickly became outdated and did not receive an official update until 1946.[30] Instead, the AAF used training circulars and theater lesson pamphlets to capture and disseminate the numerous and rapid changes in both strategic bombing and tactical close air support techniques.[31]

Field Manual 31-35's significance was that it established basic controls for use in support of ground combat operations. It acknowledged the risk inherent in the use of tactical airpower — "Up to the present no satisfactory method has yet been developed that will insure immunity to troops from attacks by its own bombardment"[32] — while asserting that the implementation of the controls would minimize such risks. These fell into one of two groups: an aircrew centric group and a ground force centric group. To mitigate risks, air crews required a thorough briefing, timely notification of mission changes, clear target designations, and training in the visual identification

[28] USAAF, *FM 100-20*, 9.

[29] Ibid.

[30] US Army Air Forces, *Field Manual (FM) 31-35, Aviation in Support of Ground Forces* (Washington, DC: Government Printing Office, 1946).

[31] Hughes, *Overlord,* 82.

[32] USAAF, *FM 31-35*, 17.

of enemy forces.[33] Ground forces, in turn, were responsible for the establishment of a safe bomb line and visually marking friendly positions.[34] One last control, "radio communication with aircraft in flight," obviously applied to both groups.[35]

Use of Heavy Bombers in a Tactical Role

The commanders and staffs responsible for planning and approving Operation Cobra did not solely rely on doctrine to inform their decision making. They also used the lessons learned and insights gleaned from recent uses of heavy bombers in a tactical role. Two examples from 1944 worth noting are the bombardment of Cassino during Operation Dickens and the assault phase bombings during Operation Neptune.[36] These instances demonstrate the risks associated with the employment of heavy bombers in this type of mission, and their varying degrees of effectiveness.

Between February and March 1944, the Allied Fifth Army in Italy found its progress halted by German paratroopers in Cassino. With the Allied Eighth Army scheduled to assume responsibility for the Cassino section of the front, Fifth Army made one last offensive effort to seize the town. On March 15th, Operation Dickens opened with a heavy bombardment of Cassino by 320 heavy bombers and 200 mediums. Combined, they dropped 1,000 tons of 1,000-pound demolition bombs fused to detonate at basement depth to cause maximum destruction in the urban area.[37] While most of the heavy crews succeeded in destroying large portions of the target location within the city, others made grave errors. Unfamiliar with the target location and confused by the smoke and dust from previous sorties, many of the heavies dropped their bomb

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[33] USAAF, *FM 31-35*, 17.

[34] Ibid., 18.

[35] Ibid.

[36] Operation Dickens took place one month after the infamous bombing of Monte Cassino. The bombings conducted during Dickens targeted the town of Cassino, not the monastery.

[37] Wesley Craven and James Cate, eds., *The Army Air Forces in World War II*, vol. 3, *Europe: Argument to V-E Day, January 1944 to May 1945* (Chicago: University of Chicago Press, 1951), 366-70.

loads on the wrong towns, or short of Allied bomb lines. Altogether, approximately 100 Allied soldiers died of fratricide and an additional 250 were wounded.[38] The follow-on ground assault by the New Zealand II Corps was slow and ineffective, and quickly became pinned down in the Cassino rubble.[39] The one thousand-pound bombs had produced enormous mounds of rubble and left large craters throughout the town. This halted the armored assault and severely limited infantry mobility and resupply efforts.

Operation Dickens failed. The New Zealand II Corps suffered twenty-one hundred casualties, becoming temporarily combat ineffective, and Cassino remained German hands. Fifteenth Air Force opened an investigation to determine negligence of the heavy crews responsible for the errant bombings.[40] News of the Cassino misfortunes spread to commanders in other theaters, including to Lieutenant General (LTG) Omar Bradley, the First US Army commander, then in England preparing for the invasion of Normandy: "The reports that reached us in England on the accidental spillage within the Allied lines tended to discourage field employment of strategic air power against tactical objectives."[41] The effects of Cassino continued to resonate months later during the risk averse decision-making for the Normandy beach landings.

Operation Neptune, the Allied amphibious assault of Normandy in June 1944, was part of the larger Battle of Normandy, code-named Operation Overlord. The air plan supporting Neptune consisted of three phases: The preparatory phase (D-90 to D-Day), assault phase (D-Day), and follow-up phase (D-Day to D+11).[42] The preparatory phase, which combined Overlord and Neptune objectives, primarily focused on gaining air superiority in Northern France and destroying transportation related infrastructure. The assault phase called for heavy and medium

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[38] Rick Atkinson, *The Day of Battle: The War in Sicily and Italy, 1943-1944* (New York: Henry Holt and Co., 2007), 462.

[39] Atkinson, *The Day of Battle*, 455-66.

[40] Ibid., 462.

[41] Omar N. Bradley, *A Soldier's Story* (New York: Henry Holt and Company, 1951), 339.

[42] AAF Evaluation Board, *Effectiveness*, 43-49.

bombers to strike the German coastal defenses as the landing forces approached their designated beaches. The landings would begin ten minutes after the bombing ceased to reduce the risk of fratricide.[43] The follow-up phase planned for the use of medium and fighter bombers to provide close air support during the initial expansion of the Normandy beachhead.

On June 2nd, just days prior to the Normandy invasion General Eisenhower, at the request of his senior Air Chiefs, approved the assault phase of the Neptune air plan. Senior air commanders were concerned over the expected high number of civilian casualties from the bombing of towns surrounding Normandy. Eisenhower, though, knew the importance of the invasion and viewed the French collateral damage as an "operational necessity."[44] The Allies had already knowingly bombed thousands of French civilians as part of the Transportation Plan in the months preceding Neptune.[45] However, to mitigate the risk to civilians during the assault phase bombings, the Allies planned to drop leaflets on D-Day to warn the French of the attacks.[46]

By June 6th, the poor weather which had delayed the invasion had finally began to clear. However, a low cloud cover remained over the English Channel and Northern France. The medium bombers supporting the assault could fly below the 3,500-7,000 foot ceilings, but the heavy bombers required the use of the relatively new H2X radar to find their targets through the clouds.[47] The H2X radar could accurately depict the French coastline but would be useless at identifying individual targets or discerning friend from foe.[48] Armed with this information,

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[43] Craven and Cate, *The Army Air Forces*, 190. The window from bombing cessation to beach landings was extended from five to ten minutes as part of the "through-the-overcast bombing plan."

[44] Supreme Headquarters Allied Expeditionary Force, "Minutes of Meeting held in the ANFX Conference Room…. 2nd June, 1944" Eisenhower Presidential Library, accessed September 04, 2018, https://www.eisenhower. archives.gov/research/online_documents/d_day/Minutes_of_the_SCAEF.pdf.

[45] Arthur W. Tedder, *With Prejudice: The War Memoirs of Marshal of the Royal Air Force Lord Tedder* (Boston: Little, Brown and Company, 1966), 55. The Transportation Plan was an Allied bombing campaign focused French transportation networks with the intent of limiting German mobility and ability to reinforce coastal defensed during Operation Neptune.

[46] SHAEF, "Minutes."

[47] Craven and Cate, *The Army Air Forces*, 190-91.

[48] AAF Evaluation Board, *Effectiveness*, 374-75.

Eisenhower approved and Eighth Air Force request to amend the heavy bomber's orders.[49] All crew briefings stressed the danger short bombing posed to ground troops. Then they received orders to delay the release of their payloads by five to thirty seconds after reaching the beach to prevent such occurrences.[50]

The time delay tactic in conjunction with H2X generated a poor showing from the 1,361 the heavy bombers striking Omaha beach. The majority of the 2,944 tons of bombs failed to hit their designated targets, falling up to three miles inland.[51] Except for the few engaged by medium bombers, German coastal defenses were relatively untouched. In their report conducted in 1945, the AAF Evaluation Board stated, "the non-effectiveness of the heavy bombardment of Omaha Beach contributed to the difficulty experienced in gaining a foothold in that sector."[52] The assault-phase heavy bombings, however, were not a complete failure. In many areas, the bombs dropped long of the targets cleared large sections of minefield behind the coastal defenses, though this would have been little consolation to the assault forces on the beach.[53] Also, the psychological effects of the bombings "contributed to the general disruption of the enemy on D-Day."[54] But heavy bombing operations later in the war would clearly demonstrate how such morale effects only bestow an advantage on the attacker for a relatively small window of time.[55]

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[49] Craven and Cate, *The Army Air Forces*, 190.

[50] Rick Atkinson, *The Guns at Last Light: The War in Western Europe, 1944-1945* (New York: Henry Holt and Co., 2013), 55-56.

[51] Gordon, A. Harrison, *Cross-Channel Attack*, United States Army in World War II: The European Theater of Operations (Washington, DC: Center of Military History, 2004), 301.

[52] AAF Evaluation Board, *Effectiveness*, 41.

[53] Craven and Cate, *The Army Air Forces*, 192.

[54] AAF Evaluation Board, *Effectiveness*, 72.

[55] Supreme Headquarters Allied Expeditionary Force, "Theater Lesson: Use of Heavy Bombers in a Tactical Role, 1945," Combined Arms Research Library, 2, accessed September 03, 2018, http://cgsc.contentdm.oclc.org/cdm/singleitem/collection/ p4013coll8/id/4200/rec/6; AAF Evaluation Board, *Effectiveness*, 173; Slow or delayed follow-up assaults, as in Cassino and Operation Queen demonstrate the necessity to act quickly before any advantage gained from the bombing is lost.

Operations Dickens and Neptune, while important in their own context, also serve as significant waypoints on the Allies' course to Operation Cobra. The lack of controls during Cassino directly led to the bombing of friendly forces. The types of controls missing from Cassino already existed in doctrine but lacked implementation because both air crews and the ground forces were inexperienced in this method of tactical air support.[56] Subsequent review by the AAF did not call for new mitigation techniques. Rather, it highlighted the necessity to plan for, and implement, existing doctrinal controls to mitigate risk during tactical bombing operations.[57] Cassino also highlighted the need for speed in the follow-on ground operation. The belated assault of II Corps allowed German defenders in the town enough time to reorganize after the bombings. A quicker assault would have taken greater advantage of the Germans' disorientation and allowed the Allies to retain the initiative.

The Normandy example, in turn, demonstrates how varying levels of risk tolerance can impact an operation. General Eisenhower's willingness to accept a high level of risk, in the form of collateral damage to French civilians, severely limited the German's ability to counter attack while preserving the element of surprise during the Neptune landing.[58] However, his lower risk tolerance concerning his own forces severely limited the effectiveness of the assault phase bombings. The assault troops on Omaha beach felt these negative tactical effects when they faced the heaviest fire of all the Normandy landing sites.[59] By seeking to prevent fratricide by the heavy bombers, Eisenhower only increased the risk they faced on the beach in the form of fully functional coastal defenses.

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[56] US Air Force Historical Division, *The Employment of Strategic Bombers in a Tactical Role: 1941-1951,* April 1954, US Air Force Historical Study No. 88, Box 21, Series I – USAF Historical Studies, Dwight D. Eisenhower Presidential Library, 63.

[57] AFHD, *Employment,* 63.

[58] AAF Evaluation Board, *Effectiveness,* 41.

[59] Peter R. Mansoor, *The GI Offensive in Europe: The Triumph of American Infantry Division, 1941-1945* (Lawrence, KS: University Press of Kansas, 1999), 140.

Both Operations Dickens and Neptune were bold actions, but neither found the right balance between risk and effectiveness with respect to the use of heavy bombers. During Operation Dickens, commanders did not implement adequate controls to protect the ground force during the heavy bombing, which delayed the Allied operational advance through Italy. In Neptune, risk aversion reduced the effectiveness of the assault bombings, and put the beach landings in jeopardy, threatening the operational and strategic objectives of establishing a beachhead in France. The following analysis of Operation Cobra will demonstrate how the right balance can produce dramatic operational success.

Operation Cobra

Following the beach landings at Normandy, Allied forces lost tempo (see Figure 1.) The Germans succeeded in slowing the Allied advance to a crawl by using the difficult terrain of the *bocage* to their advantage. By early July, the entire campaign was at risk. The Allies needed to break out of Normandy or face the possibility of a stalemate or even worse, defeat. Eisenhower and his generals, under enormous pressure from the mounting operational risk, looked for a way to regain the initiative and increase tempo.[60] The need for bold action was becoming apparent, and they sought the right opportunity.

[60] Steven, J. Zaloga, *Operation Cobra 1944: Breakout from Normandy*, Praeger Illustrated Military History Series (Oxford: Osprey, 2004), 7-10.

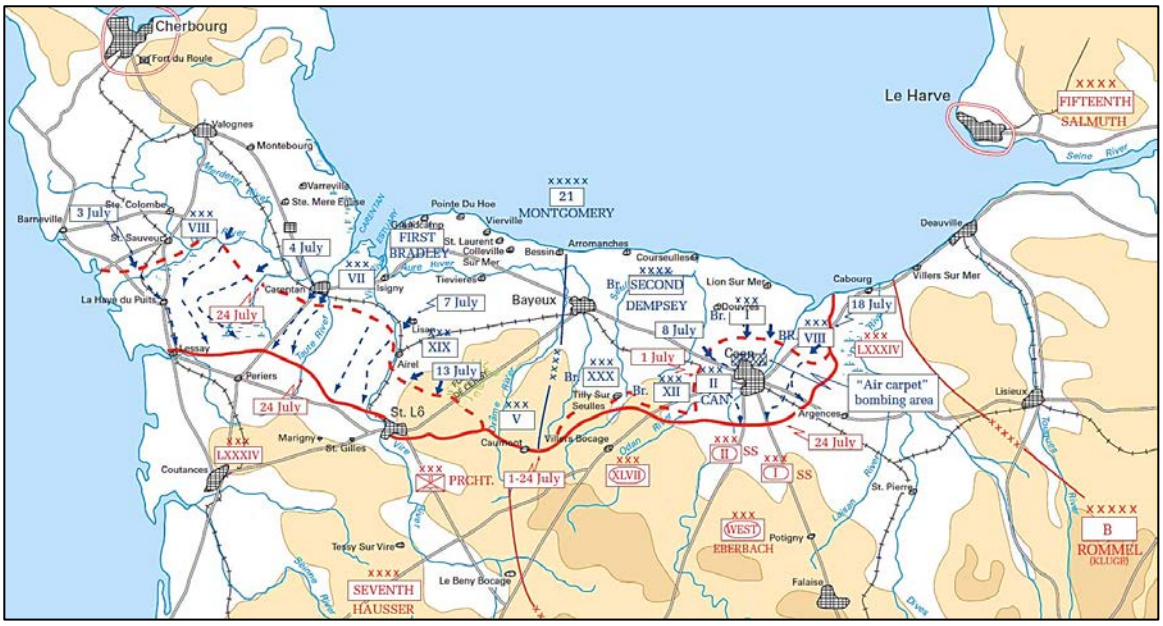

Figure 1. Expanding the Beachhead, 1-24 July 1944. "Atlases, World War II European Theater," Department of History, US Military Academy, accessed January 01, 2019, https://westpoint.edu/sites/default/files/inline-images/academics/academic_departments/history/WWII%20Europe/WWIIEurope59.pdf.

Fighting through the hedgerows and marshes of Northern France had proven more difficult than previously anticipated. While the marshlands of the Cotentin Peninsula restricted movements to the congested roadways, the bocage proved even more menacing. Four-foot-high earthen dikes covered with thick foliage, surrounded small fields and orchards.[61] Martin Blumenson, in the official US Army history *Breakout and Pursuit,* described them as a "continuous band of strong points in great depth all across the front."[62] The Germans took full advantage of the terrain and put up a formidable defensive effort, negating the advantage the Allies' motorized infantry. As the 21st Army Group's advance south slowed, the bocage, it seems, frustrated LTG Bradley more than most:

[61] Hughes, *Overlord,* 177.

[62] Martin Blumenson, *Breakout and Pursuit,* United States Army in World War II: The European Theater of Operations (Washington, DC: Center of Military History, 1984), 178.

> No one disliked more than I did the disagreeable necessity for inching our way through those St-Lô hedgerows and Carentan marshlands. For while we sloughed afoot toward the Périers road, our vastly superior motorized equipment lay wasted under its camouflaged nets. Nevertheless, until we reached the carpet and broke through to the terrain beyond it, we could do nothing but belly ahead and swallow those heavy losses.[63]

First Army sustained nearly forty thousand casualties by July 19th when it reached the Lessay-Périers-St-Lô-Caumont Line.[64] Rick Atkinson, in his book *The Guns at Last Light*, highlights First Army's slow and costly progress. "VIII Corps—with three divisions on a fifteen-mile front—took ten thousand casualties in twelve days while advancing only seven miles through swamp and bocage."[65] The fight south and the capture of St-Lô (July 18th) had also cost First Army dearly. Suffering nearly eleven thousand casualties over the course of just two weeks, and with infantry replacements in short supply, it would likely not be at full strength when the time for the bold action finally came.[66]

High casualty rates and slow advances were not the only reasons a breakout was becoming increasingly necessary. The Allied beachhead in Normandy was congested with additional troops, equipment, and supplies. In mid-July the Allies controlled little more than they had in June and were far short of the original goals set during planning for Overlord. Nearly twenty-six thousand tons of supplies per day were being consumed, and what limited roads did exist were extremely congested.[67] First Army's slow push south to St-Lô did provide much-needed room to stage the necessary forces to exploit the Cobra breakthrough.[68] Still, the

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[63] Bradley, *A Soldier's Story*, 335-36.

[64] Blumenson, *Breakout and Pursuit*, 175.

[65] Atkinson, *Guns at Last Light*, 125-26.

[66] Stephen E. Ambrose, *The Supreme Commander: The War Years of General Dwight D. Eisenhower* (Garden City, NY: Doubleday & Company, 1969), 459.

[67] Hughes, *Overlord*, 201.

[68] Forrest C. Pogue, *The Supreme Command*, United States Army in World War II: The European Theater of Operations (Washington, DC: Center of Military History, 1996), 192.

beachhead was only 25 to 35 miles deep and did not encompass vital infrastructure, like airfields or ports, which the Allies so desperately needed.

Air bases were a specific concern. By July, according to Overlord planning, the Allies were to have either captured or built twenty-seven airfields in Northern France. This would ensure adequate refueling capacity and basing for eighty-one tactical air command squadrons.[69] In reality, the Allies had captured no airfields and of the thirteen built, enemy fire or overuse had rendered five unserviceable.[70] Only thirty-eight squadrons had been brought over from England, but more airfields were needed before more could be based in France. Lack of airfields would also limit the range of close air support as the Allied ground forces moved east toward Germany.[71] The benefit of close air support had proven essential for US forces through their first two and a half years of war in Africa and Europe, and the thought of advancing into Germany without it made Eisenhower and his senior commanders nervous.[72] Additional airfields would not only allow the tactical air command to keep pace with their dedicated units, the moves would greatly decrease transit times between England and the front line. Before this could happen, however, the Allies had to seize airfields currently under German control.

Brittany, and particularly the ports of Brest, Quiberon Bay, and Morlaix, were seen as the short-term solution to the Allies' growing logistics problem.[73] Despite reopening the port of Cherbourg on July 19th, Allied supplies were still primarily flowing into Northern France via open beaches.[74] While this temporary method provided sufficient logistics during the slow expansion of the Normandy beachhead during through July, severe winter weather would

[69] Tedder, *With Prejudice,* 555-56.

[70] Ibid.

[71] Carlo D'Este, *Decision in Normandy* (New York: Harper Perennial, 1994), 209.

[72] Pogue, *The Supreme Command,* 258.

[73] Ibid., 193.

[74] Ibid.

significantly slow throughput. The Allies needed access to deep water ports which could operate year-round to support the extended lines of communication that would come with offensive operations deep into France and Germany. As of mid-July, Antwerp and Marseilles, the two best ports in Europe and France respectively, remained under German control. Eisenhower, focused intently on Brittany, turned up the heat on his senior ground commanders: "Time is vital. We must not only have the Brittany Peninsula — we must have it quickly." wrote Eisenhower in a letter to Montgomery on July 21st: "So we must hit them with everything."[75] If Bradley's Operation Cobra failed to force a breakout of Normandy, it could deprive the Allies of logistical capacity needed to sustain operations in the winter.

Pressure to breakout also came from the inevitable end of Operation Fortitude, the Allied deception operation designed to simulate the fictious one hundred fifty thousand man strong First US Army Group in England.[76] The deception successfully reinforced the German belief that the Allies would attempt an additional amphibious landing north of the Seine River. As a precaution, Hitler kept the German Fifteenth Army in the Pas-de-Calais through early July. However, the newly appointed commander in the west, Field Marshal Günther von Kluge, was in desperate need of reinforcements in Normandy. As the last suitable moon-and-tide combinations for an amphibious landing in Calais had come and gone during the first week of July, Hitler released six divisions from Fifteenth Army on the 8th for duty in Normandy.[77]

The Plan

By early July the combined Allied ground forces in Northern France controlled a front stretching roughly eighty miles, from the west coast of the Cotentin peninsula just south of

[75] Ambrose, *The Supreme Commander*, 456-57; Eisenhower to Montgomery, July 1944, in *The Papers of Dwight David Eisenhower*, ed. Alfred Chandler, vol. 3, *The War Years* (Baltimore: Johns Hopkins Press, 1970), 2018.

[76] Atkinson, *The Guns at Last Light*, 26-27.

[77] David Eisenhower, *Eisenhower at War, 1943-1945* (New York: Random House, 1986), 351-52.

Barneville to the northern coast of Normandy just east of Caen.[78] However, this was far short of the gains anticipated by Overlord planners.[79] Given the congestion in the beachhead, there was insufficient room for Eisenhower's SHAEF headquarters until it could be expanded. Meanwhile, General Bernard Montgomery would retain command authority over all Allied ground forces in Northern France.[80] However, in the months leading up to Overlord the Allied air forces had won air superiority over Northern France.[81] German Luftwaffe resistance was thus virtually non-existent during Neptune landings, and continued to benefit the Allies in subsequent operations.

The senior US commander in Northern France, and First Army commander, was LTG Omar Bradley. A former classmate of General Eisenhower's, and a veteran of the North Africa campaign, he was Eisenhower's most trusted commander.[82] In July 1944 First Army consisted of four corps: V, VII, VIII, and XIX.[83] This gave Bradley command of fifteen divisions on the western half of the Allied line. Eisenhower, who had already chosen Bradley to command the new US 12th Army Group, agreed to his request to delay the reorganization until August 1st.[84] The senior British commander in France was Field Marshal Bernard Montgomery. His 21st Army Group consisted of two operational armies: the British Second Army, commanded by Lieutenant General Miles C. Dempsey, and Bradley's First US Army. The Second British Army was Montgomery's primary source of combat power on the Allied Eastern Flank, until the addition of the First Canadian Army in late July.[85] Montgomery, also an experienced commander from the

[78] Pogue, *The Supreme Command*, 192.

[79] Ibid., 181.

[80] Montgomery was not promoted to Field Marshal until September 1944.

[81] Ambrose, *The Supreme Commander*, 460.

[82] Dwight D. Eisenhower, *Crusade in Europe* (Garden City, NY: Double Day and Company Inc, 1948), 215.

[83] Blumenson, *Breakout and Pursuit*, 209.

[84] The reorganization would place Hodges in command of First Army, and Patton in command of the newly operationalized Third Army.

[85] Blumenson, *Breakout and Pursuit*, 343.

North Africa campaign, kept himself heavily involved in the day-to-day operations of the British Second Army. Conversely, he gave Bradley a free hand in the planning and execution of First Army operations.[86]

Opposite the Allied 21st Army Group was German Army Group B, commanded by the newly appointed Field Marshal Günther Has von Kluge.[87] The previous commander, Field Marshal Erwin Rommel, had been badly injured in mid-July when an Allied Spitfire strafed his car.[88] A recent reorganization within Army Group B had also divided the Normandy defensive line: Seventh Army was responsible for the western portion opposite the US First Army, with Panzer Group West opposite the British and Canadian armies in the east, near Caen.[89]

The end of June through early July was a difficult period for the Germans. By July 17th, they had suffered nearly one hundred thousand casualties in Normandy, but were only able to replace 12 percent of their losses with fresh troops.[90] Despite Seventh Army's repeated warnings of US troop concentrations in its sector, Supreme Command, *Oberbefehlshaber* (OB) West, Army Group B, and Panzer Group West, all believed the Allied main attack would come from the British-Canadian sector near Caen.[91] Thus, most replacements arrived at Panzer Group West, causing Seventh Army to creatively deploy its continously thinning ranks. Lacking the combat power to provide a strong, continuous front across its entire sector, its commanders instead defended strongpoints at convergences of key terrain. Combat power centered around its

[86] Blumenson, *Breakout and Pursuit*, 36.

[87] Von Kluge was also the OB West commander, but after Rommel's injury, von Kluge assumed the command of Army Group B to quickly consolidate efforts in Normandy.

[88] Zaloga, *Operation Cobra*, 15.

[89] Ibid.

[90] Michael D. Doubler, *Busting the Bocage: American Combined Arms Operations in France, 6 June – 31 July 1944* (Fort Leavenworth, KS: Combat Studies Institute, 1955), 61.

[91] David C. Isby, *Fighting the Breakout: The German Army in Normandy from 'Cobra' to the Falaise Gap* (Mechanicsburg, PA: Stackpole Books, 2004), 23-25.

remaining panzer divisions that were continously engaged on the front line.[92] By July 24th, Lieutenant General Fritz Bayerlein's Panzer Lehr division had still not received reinforcements or replacement equipment following an unsuccessful counter attack at St-Lô on July 11th. His division remained at 50 to 60 percent strength as it manned the German front line running east-west along the St-Lô–Périers road.[93]

The Allies needed a bold action to regain the initiative and to achieve tactical and operational objectives delayed by the slow fighting in Normandy. Though the terrain on the eastern flank was more passible than the bocage facing the Americans in the west, the city of Caen had proven to be a difficult objective for the British. Originally a D-Day objective, Caen remained beyond Montgomery's grasp until Second Army took the northern half of the city during Operation Charnwood on July 8th and 9th.[94] Panzer Group West took heavy losses during Charnwood, losing an estimated four battalions of men and twenty tanks.[95] By early July it was becoming evident Second Army could not break through near Caen. Montgomery and Eisenhower decided the British would instead maintain pressure in their sector to operationally fix the Germans, while the Americans would deliver the decisive blow.[96] The Germans, in turn, continued to reinforce Panzer Group West. They considered the areas around Caen to be the best suited for large-scale maneuver and planned to launch a major counter offensive through the area to drive the Allies from Normandy.[97]

Montgomery left planning for Operation Goodwood to Second Army Commander Lieutenant General Sir Miles Dempsey. Facing a shortage of infantry and a surplus of tanks,

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[92] Isby, *Fighting the Breakout*, 29-30.

[93] Ibid., 247.

[94] D'Este, *Decision in Normandy*, 318-20.

[95] Blumenson, *Breakout and Pursuit*, 122.

[96] Eisenhower, *Crusade in Europe*, 267-68.

[97] Isby, *Fighting the Breakout*, 25-29.

Dempsey chose to make an armored thrust onto the Caen-Falaise plain two days prior to the First Army offensive.[98] An aerial bombardment by RAF heavy and medium bombers would proceed the offensive and target German strong points to open a path to the plain.[99] The combination of heavy bombardment and armor would surely keep the German's attention on Caen and away from the real objective in the west.[100]

With Eisenhower still in England, and the British relegated to a supporting role, the onus was on Bradley and First Army to plan and execute the breakout. Bradley had been in Northern France since D-Day and possessed a tacit knowledge of the tactical situation. His close ties and near constant communication with Eisenhower also gave him and a solid understanding of the growing risks at the operational level. This combination made him the right commander, and First Army the right echelon, to achieve results at both levels. In early July, with the help of his senior staff and a few trusted commanders, Bradley developed the plan for Operation Cobra.[101]

Bradley selected VII Corps to lead the Cobra attack, putting the operation in the hands of his most trusted commander, Major General Collins.[102] Like First Army, VII Corps would swell well beyond its normal strength for Cobra. Collins would lead six divisions: 9th Infantry Division (ID), 4th ID, 30th ID, 1st ID (Motorized), 2nd Armored Division (AD), and 3rd AD.[103] Bradley's plan would open with a carpet bombing of an area 7,000 yards by 2,500 yards, just south of the St-Lô–Périers road, to weaken the German front line.[104] (See figure 2) Immediately following the bombardment three infantry divisions, supported by artillery and fighter bombers, would

[98] D'Este, *Decision in Normandy,* 352-55.

[99] David Eisenhower, *Eisenhower at War,* 355.

[100] D'Este, *Decision in Normandy,* 358.

[101] Omar N. Bradley and Clay Blair, *A General's Life* (New York: Simon and Schuster, 1983), 272.

[102] Bradley, *A Soldier's Story, 332.*

[103] Blumenson, *Breakout and Pursuit,* 215.

[104] Davis, *Spaatz,* 464.

penetrate south through the "carpet" area to hold open a north-south corridor.[105] VII Corps' remaining armored and motorized divisions would then strike south through the corridor and exploit the penetration by seizing Coutances and Avranches before turning west into Brittany.[106] Simultaneously, the remaining First Army Corps would attack across the western front to fix the German defenders in place and prevent their interference in the Cobra exploitation.[107]

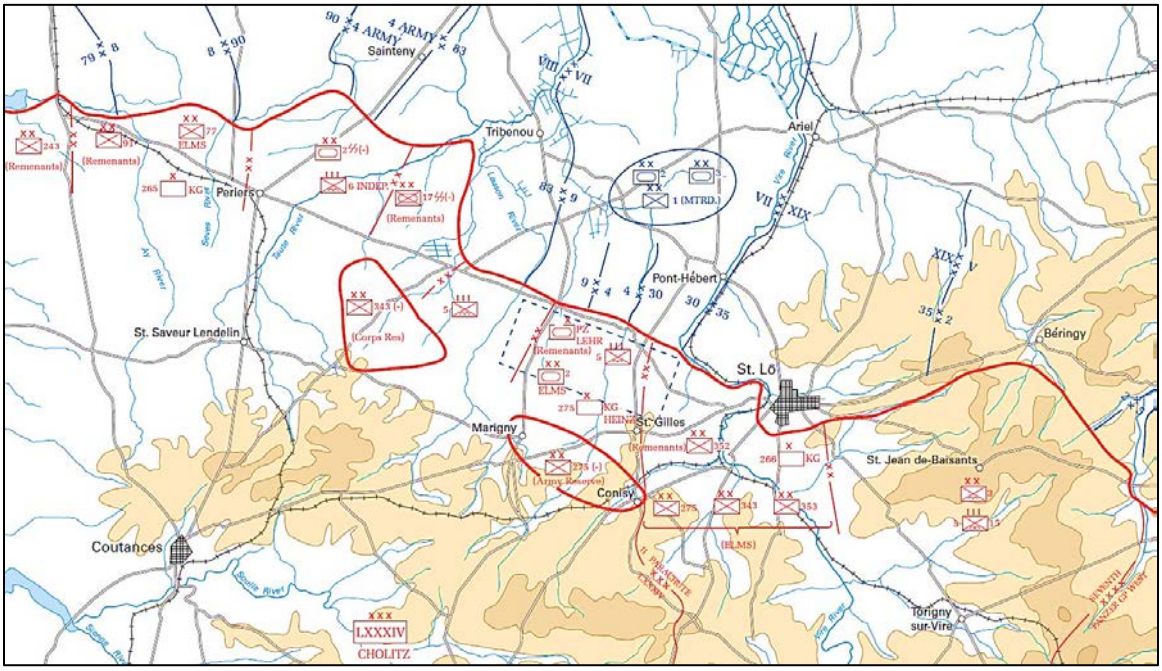

Figure 2. St. Lô, German Dispositions, Night of 24-25 July 1944. "Atlases, World War II European Theater," Department of History, US Military Academy, accessed January 01, 2019, https://westpoint.edu/sites/default/files/inline-images/academics/academic_departments/history/WWII%20Europe/WWIIEurope61.pdf.

The fifteen hundred heavy bombers planned for use in Cobra would come from LTG James H. Doolittle's Eighth Air Force.[108] Based in England, the Eighth's strength came from the

[105] Blumenson, *Breakout and Pursuit*, 215.

[106] James Jay Carafano, *After D-Day: Operation Cobra and the Normandy Breakout* (Boulder, CO: Lynne Rienner Publishers, 2000), 89.

[107] Blumenson, *Breakout and Pursuit*, 216-17.

[108] AAF Evaluation Board, *Effectiveness*, 85-86.

1st, 2nd, and 3rd Heavy Bombardment divisions.[109] The 1st and 3rd divisions flew the battle-proven B-17 Flying Fortress, while the 2nd flew the newer and larger B-24 Liberator.[110] As for the other flight units in Eighth Air Force, 8th Fighter Command provided fighter escort duty to the bombers, while the 325th Photo Reconnaissance Wing supported Allied intelligence collection and served as an aerial forward observer function to the artillery.[111] Ninth Tactical Air Command would provide 396 medium bombers and close to 700 fighter-bombers to round out the air effort.[112] The RAF was excluded from Cobra, however, due to the inability of British aircraft to load one hundred-pound demolition and smaller fragmentation bombs.

Operation Cobra combined extreme levels of firepower with large-scale maneuver and was laden with risk. Bradley and his planners took active steps to identify these risks and implement necessary controls to minimize those to both force and to mission. Informed by the lessons learned from previous tactical employments of heavy bombers, such as at Cassino and Normandy, they implemented doctrinal and unique controls into Cobra's plans.

The most obvious risk to force was the potential for fratricide during the aerial bombardment. On July 19th Bradley met with senior AAF officials at Air Chief Marshal Leigh-Mallory's Allied Expeditionary Air Force (AEAF) headquarters in Stanmore England. He and the AEAF air planners worked out a number of details for Cobra, including risk mitigation controls. In particular, Bradley specifically chose the St-Lô-Périers road for use as a safe bomb line: "The bombers, I reasoned, could fly parallel to it without danger of mistaking our front line."[113] Bradley initially intended to pull VII Corps' units back 800 yards from the safe bomb line during

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[109] US Air Force Historical Division, *Tactical Operations of the Eighth Air Force: 6 June 1944-8 May 1945*, Air Force Historical Studies No. 70. Box 18, Series I – USAF Historical Studies, Dwight D. Eisenhower Presidential Library, Organization Chart.

[110] AFHD, *Tactical Operations*, Organization Chart.

[111] Ibid.

[112] AAF Evaluation Board, *Effectiveness*, 85-86.

[113] Bradley, *A Soldier's Story*, 330.

the bombardment, but air planners insisted on 3000 yards. They eventually compromised and settled on 1200 yards.[114]

Bradley also wanted the bombers to make their runs parallel to the St-Lô-Périers road to further protect the ground forces from friendly fire. However, AEAF planners, counter to Bradley's intent, settled on a perpendicular approach to the Cobra carpet area for two primary reasons.[115] First, they sought to ensure the completion of the aerial bombardment within one hour, as initially requested by Bradley. He wished to disorient the Germans in all sectors of the carpet area simultaneously to ensure pockets of resistance did not form during the ground offensive. To spread the bombs over a longer time period would have given the Germans a chance to regroup in sectors bombed during the initial waves. Planners calculated that to funnel more than fifteen hundred aircraft through the target area on a parallel course would take nearly two and a half hours.[116] Second, a perpendicular approach would reduce the amount of time bombers were over enemy territory and exposed to anti-aircraft fire.[117] Thus, the decision was made to execute the bomb run perpendicular to the St-Lô-Périers road. However, according to Bradley, he was not informed of this decision.[118] He believed the bombing direction issue had been settled at Stanmore, but air planners claim no such decision was ever fully agreed upon.[119]

VII Corps also planned to establish visual markings of both the target area and friendly positions. In accordance with *FM 31-35,* Corps artillery would fire white smoke rounds into the carpet area to mark its boundary, and red smoke to mark individual target locations.[120] First Army

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[114] Blumenson, *Breakout and Pursuit,* 221. 9th ID reports verify the twelve hundred-yard withdrawal distance.

[115] There remains confusion as to whether Bradley was informed of this change, but he claimed, well into retirement, that AEAF planners changed the direction without his consent.

[116] Davis, *Spaatz,* 471.

[117] Carafano, *After D-Day,* 110.

[118] Bradley, *A Soldier's Story,* 346-47.

[119] Carafano, *After D-Day,* 109-10.

[120] US AAF, *FM 31-35,* 11, 17-18.

also ordered its front-line units to mark their locations using high visibility ground panels and individual vehicles using both painted white stars and luminous panels.[121] Air planners had divided the carpet area into target sections to ensure the even distribution of bombs. This division also increased safety as the highly accurate fighter-bombers could focus on the sections immediately south of the road. This added an additonal two hundred fifty yards of buffer between the ground forces and the heavy bomber targets.[122]

Other controls First Army implemented included a weather delay plan. The ground assault could operate under heavy cloud cover, but the bombers from Eighth Air Force could not. Bradley felt so strongly about the necessity for the bombing he was willing to delay Cobra as long as necessary to reap its benefits. He recognized its potential to both decrease the risk to VII Corps as they advanced south, and to increase the probability of penetrating the German defenses enough to break though. The Allies postponed Cobra from July 21st to July 24th due to inclement weather, freeing up aircraft for strategic bombing missions in Germany.[123] Subsequent weather decisions were left to Air Marshal Leigh-Mallory, despite his lack of experience in heavy bomber operations.[124]

One important lesson learned from Cassino was the need for a swift assault to take full advantage of the disorientation of the Germans in the carpet area.[125] Any delay could allow the Germans to recover from the effects of the bombings and reorganize. To enhance speed, Bradley streamlined the command structure of both First Army and VII Corps. By consolidating six divisions under MG Collins' VII Corps, Bradley ensured unity of command and unity of effort

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[121] Headquarters, 745th Tank Battalion, "Report After Action Against Enemy 19-20 July, 1944 (D+43)," World War II Operational Documents, Combined Arms Research Library, 12-13, accessed August 27, 2018, http://cgsc.contentdm.oclc.org/cdm/singleitem/collection/ p4013coll8/id/3479/rec/3.

[122] Blumenson, *Breakout and Pursuit*, 221.

[123] Davis, *Spaatz*, 469.

[124] Ibid., 469-70.

[125] AFHD, *Employment*, 63.

among the entire assault and exploitation force. This would enhance synchronization among the divisions and prevent delays during execution.

This sampling of First Army's controls highlights the opposing tensions affecting LTG Bradley's decision making, particularly his desire to preserve the lives of Allied forces and simultaneously ensure Cobra's success. Both Bradley and Eisenhower had made it well known they would assume large amounts of risk if it led to a breakout.[126] However, Bradley's insistence on protecting his forces from the risks inherent in the use of heavy bombers alludes to the limit of his risk tolerance.[127]

Execution

Operation Goodwood (July 18th-20th) resulted in little tactical success due to limited bombing effectiveness and the German anticipation of the offensive.[128] Dempsey's armored thrust only captured thirty-two square miles of land south of Caen, at a cost of nearly four hundred tanks.[129] Operationally, however, Second British Army succeeded in capturing the Germans' attention. "We had forced the enemy to commit his reserves on a wide front;" wrote Montgomery in the memoirs he set down by his own hand in 1958, "we were now ready to commit ours on a narrow front, and so win the battle."[130] The narrow front of which he spoke lay between St-Lô and Périers, and the German Panzer Lehr Division was waiting.

Operation Cobra got off to a poor start the morning on July 24th, due to heavy cloud cover over the intended carpet area south of the St-Lô-Périers road. The latest weather forecast had the clouds breaking by 1300 hours, so Leigh-Mallory delayed the bombing from 1000 to 1200 hours

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[126] Carafano, *After D-Day*, 110; Tedder, *With Prejudice*, 559.

[127] Carafano, *After D-Day*, 107.

[128] D'Este, *Decision in Normandy*, 377-78.

[129] Carafano, *After D-Day*, 99; D'Este, *Decision in Normandy*, 385-86.

[130] Bernard Law Montgomery, *The Memoirs of Field-Marshal The Viscount Montgomery of Alamein, K.G.* (Cleveland, OH: The World Publishing Company, 1958), 232.

in the hopes it would clear in time.[131] When it did not, he attempted to recall all aircraft, but by then many were out of radio range. Most of the bombing groups turned around when they encountered heavy cloud cover over the target area. Some groups however, felt they had enough visibility, and executed their drop. Of the 944.5 tons of bombs dropped, only 15 percent fell within the carpet area.[132] Most crews cautiously delayed their release and dropped long of the target area, similar to the Neptune assault bombings. However, two groups of heavies and five medium bombers deployed their bombs north of the road and short of the bomb line.[133] This proved especially harmful for the 30th Infantry Division on VII Corps' left flank, which suffered 25 killed in action and 131 wounded in action.[134] Confusion spread through the Allied line as official notification of Cobra's delay passed slowly through First Army and VII Corps. Eventually, 30thID, 4th ID and 9th ID on the front line were ordered to advance back to the St-Lô-Périers road. However, German forward defenders had quickly occupied the ground. The fight back to the road, under heavy German artillery fire, proved extremely difficult for all three divisions, and especially for 30th ID. It took the more than an hour to sort out their fratricide casualties and reorganize before the division was ready to move.[135] By nightfall, the Allied line along the north side of the St-Lô-Périers road was reestablished, but at a significant effort.

Bradley was furious when he received news of the short bombings, and especially over the perpendicular approach.[136] Leigh-Mallory confirmed new perpendicular air routes would take days to recalculate and would still not provide the short, decisive strike First Army desired.[137] Bradley faced a difficult decision: To delay Cobra indefinitely and re-plan the air routes, or

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[131] Davis, *Spaatz*, 469.

[132] AFHD, *Employment*, 84.

[133] AAF Evaluation Board, *Effectiveness*, 86.

[134] Blumenson, *Breakout and Pursuit*¸ 229.

[135] Ibid., 231.

[136] Bradley, *A Soldier's Story*, 347.

[137] Ibid.

execute Cobra as planned when the weather cleared. Existing controls had obviously failed to prevent fratricide, and without additional ones, the probability of more short bombings would remain high.[138] However, for Cobra to have a chance of succeeding they would have to try again immediately. With the element of surprise lost, and the weight of the Allied operational situation on his shoulders, Bradley chose to re-execute Cobra with no changes to the plan.

The weather had cleared enough by the following day to launch Operation Cobra in earnest. The bombings, in full measure this time, began just before 1000 hours. In an unprecedented display of firepower, 550 fighter bombers, 380 medium bombers and 1,579 heavy bombers dropped 3,700 tons of ordnance to pave the way for VII Corps' assault.[139] Army Air Force calculations showed 51 percent of the bombs dropped on July 25th landed within the carpet area.[140] But short bombings had again occurred, ravaging the VII Corps front. The 9th and 4th IDs suffered ninety and twenty-two casualties, respectively, but once again the 30th Infantry Division took the bulk of the short bombing: sixty-four killed and 374 wounded.[141] Between the two days, VII Corps casualties from the heavy bombings totaled 111 killed in action and 490 wounded.[142]

The Panzer Lehr Division commander, Fritz Bayerlein, believed the aborted attack on the 24th had contained the full power of the Allied assault.[143] Pleased with his unit's performance, he began consolidating his forward outposts south of the St-Lô-Périers road in anticipation of a renewed Allied attack the following day.[144] He also moved two hundred replacements from his reserve north into the carpet area to reinforce casualty-stricken units.[145] However, when the full

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[138] Carafano, *After D-Day*, 111.

[139] Craven and Cate, *The Army Air Forces*, 232.

[140] AAF Evaluation Board, *Effectiveness*, 91.

[141] Carafano, After *D-Day*, 113-14; Headquarters, 30th Infantry Division, G-3 Section, "After Battle Report, 1 July 1944 – 31 July 1944," R-12422, Combined Arms Research Library, 20.

[142] Blumenson, *Breakout and Pursuit*, 236.

[143] Ibid., 238.

[144] Ibid.

[145] Ibid.

force of the Cobra attack came the next day, Bayerlein and the Panzer Lehr Division were caught off guard. The heavy bombing shattered his division, killing an estimated one thousand soldiers and devastating their equipment.[146] Allied bombs knocked out communications, destroyed three battalions' command posts, and effectively wiped out an attached parachute regiment.[147] German prisoners of war captured on the 25th described the bombings as unbearable and demoralizing.[148] Many others actively sought to surrender, as they feared their own officers would shoot them as cowards if they retreated.[149]

Following close on the heels of the heavy bombings, the 30th ID's advance encountered dug-in tanks and heavy enemy artillery and mortar fire, while lead elements of 4th and 9th IDs encountered sporadic pockets of stiff enemy resistance.[150] Bradley, however, was optimistic the pace would pick up speed the following day. His instincts were proved correct. The German ranks, thinned from the rigorous defensive efforts of the preceding weeks, lacked depth. With Bayerlein's division destroyed, and VII Corp's exploitation force in the open, little stood between the Allies and their objectives to the south (see Figure 3.)

[146] Blumenson, *Breakout and Pursuit*, 240.

[147] Ibid.

[148] VII Corps Headquarters, "History of the VII Corps for the Period of 1-31 July, 1944 including Report After Action Against the Enemy," Combined Arms Research Library, 30, accessed September 04, 2018, http://cgsc.contentdm.oclc.org/cdm/singleitem/collection/ p4013coll8/id/4580/rec/3.

[149] VII Corps Headquarters, "History," 30.

[150] 30th ID, "After Battle Report," 19-20.

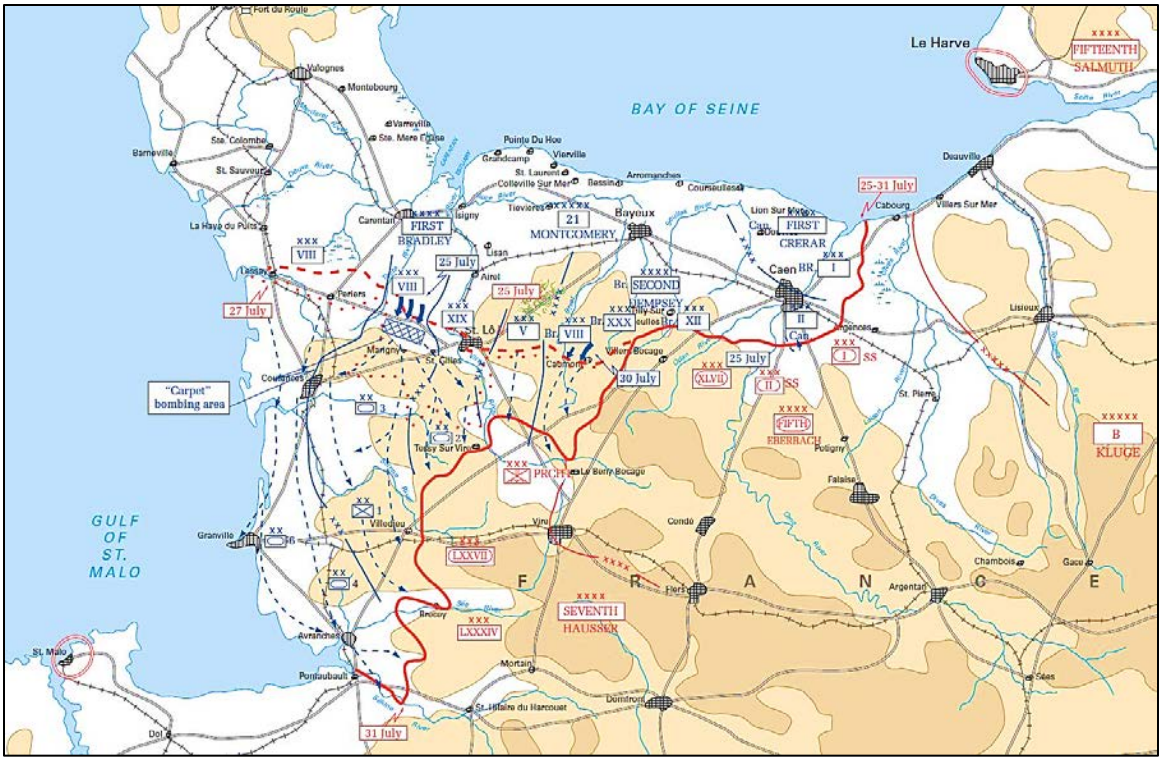

Figure 3. St. Lô, The Breakthrough, 25-31 July 1944. "Atlases, World War II European Theater," Department of History, US Military Academy, accessed January 01, 2019, https://westpoint.edu/sites/default/files/inline-images/academics/academic_departments/history/WWII%20Europe/WWIIEurope63.pdf.

Assessment

The primary deficiency of the Allied controls came from an overreliance on visual markings of friendly forces, the safe bomb line, and enemy targets, which were highly ineffective. Red smoke from the artillery marking rounds mixed with dust generated from the bomb impact, and winds from the south blew the mixture north over the safe bomb line and the St-Lô-Périers road.[151] Air crews had difficulty distinguishing red smoke from the red muzzle flashes of friendly artillery. Dust and winds also obscured, and then dissipated, smoke used to identify bomb lines and enemy targets.[152] Florescent panels and other tactical markings were not visible to heavy bomber crews flying at fifteen thousand feet and above, and would have been ineffective even at

[151] AAF Evaluation Board, *Effectiveness*, 91.

[152] Ibid.

lower altitudes because of the smoke and dust blowing north from the carpet area.[153] The St-Lô-Périers road was also difficult for aircrews to identify from high altitude.

Another mitigation that contributed to the short bombings, and which has historically received the most criticism, is the perpendicular approach used by the bombers. It gave air crews little time to identify targets before dropping their payloads, which contributed to the bombing errors. Had the bombing run been parallel to the road, crews would have had more time to distinguish the correct target area. Bradley's claim that a parallel approach would have prevented the fratricide during Cobra is only speculative at best, as it ignores other risks inherent with that technique. Errors in accuracy caused by lateral bomb deflection were greater a greater risk than those caused by range errors: unguided bombs dropped from high altitudes tended to drift laterally depending on their make and model, wind speed, and aircraft movement during deployment.[154] If bombers on a parallel approach dropped their payloads near the safe bomb line, the bombs could drift north of the line and strike friendly units, but on a much larger scale. A bomb's range and forward momentum were far easier to predict, making a perpendicular approach the safer option.

The withdrawal distance of twelve hundred yards proved insufficient to fully protect VII Corps ground forces from short bombings. Five to ten percent of all bombs dropped on July 25th fell north of the St-Lô-Périers road, and three percent fell behind friendly lines.[155] This number would have decreased had the withdrawal distance been set at three thousand yards, as air planners originally requested.[156] However, preventing fratricide was not the only consideration during Operation Cobra. It was necessary to follow the preparatory bombing with a quick,

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[153] Carafano, *After D-Day*, 119.

[154] US Army Air Corps, *Field Manual (FM) 1-10, Tactics and Technique of Air Attack* (Washington, DC: Government Printing Office, 1940), 50.

[155] AFHD, *Employment*, 85-86.

[156] Carafano, *After D-Day*, 120.

decisive ground assault. The greater the withdrawal distance, the longer it would take the ground assault to close with the enemy, potentially squandering the opportunity produced by the bombings. The twelve hundred yard distance was a compromise, and First Army commander knowingly accepted the increased risk.[157] During the meeting at Stanmore on the 19th, Bradley told the air planners he understood the risks of the shorter distance and he accepted the possibility of casualties.[158] He had to keep the overall objective of Cobra in mind and not let risk mitigation compromise operational effectiveness.

Overall, Allied controls during Operation Cobra were marginally effective at preventing fratricide during the preparatory bombing. When considered individually, it is easy to demonstrate a correlation between the ineffectiveness of each control and occurance of the short bombings. However, when considering the enormity of the bombing operation, and the potential for fratricide on a much larger scale, some credit must be given to their effectiveness in the aggregate. Unanticipated mechanical failures and simple human error were the root causes for most of the incidents.[159] However, First Army and the AEAF did not take such failures into consideration when designing controls. They focused on ensuring bombs were dropped in the proper location, not on the prevention of an accidental release, or the minimizing of negative effects if such an error occurred.

Despite the tragic incidents of friendly fire, Operation Cobra's preparatory bombing was a resounding success. In one bold stroke First Army, aided by the Eighth AF and Ninth TAC, had broken out of Normandy. By August the Allies were in Brittany, and by September they had taken Paris and were advancing toward Germany. By ensuring the success of Operation Cobra, Bradley helped the Allies regain tempo at the operational level and had seized the initiative from the Germans.

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[157] AAF Evaluation Board, *Effectiveness*, 91.

[158] Carafano, *After D-Day*, 120.

[159] AFHD, *Employment*, 83-85.

Shortly after the breakout, General Eisenhower directed Air Chief Marshal Tedder to convene a meeting with the senior Army commanders involved with Goodwood and Cobra to capture lessons learned surrounding the use of heavy bombers in their operations.[160] Later in the war, Eisenhower's headquarters published a "Theater Lesson" capturing the insights from previous uses of heavy bombers in a tactical role for the immediate use in operations. Distribution included air and ground commanders throughout the ETO, other theaters, and AAF officials in back in Washington, DC.[161] Such a venture demonstrates the willingness of the Allies to continuously improve and find new ways to gain an advantage on the battlefield.

The Allies would use heavy bombers in support of tactical operations eight more times in 1944.[162] Operation Queen, the most significant of these events, took place in November. In an attempt to break through the Siegfried Line defenses near Aachen, heavy bombers dropped more ordnance than any other previous operation, including Cobra.[163] During the bombing, First Army implemented newly developed controls and succeeded in preventing fratricide during the operation.[164] However, the bombings during Queen failed to help achieve Allied objectives. The focus on fratricide prevention, rather than mission effectiveness, reduced their benefit: bombing targets were too far behind the German front line of defense, and the follow-on tactical assault was unable to penetrate the front lines quickly enough to reach the bombed areas.[165] The Germans quickly reorganized their forces and committed their reserve to halt the Allied offensive.

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[160] Tedder, *With Prejudice*, 572.

[161] SHAEF, *Theater Lesson*, 2.

[162] AAF Evaluation Board, *Effectiveness*, viii.

[163] Davis, *Spaatz*, 516.

[164] AFHD, *Employment*, 93.

[165] US Army, *Combat Operations Data First Army: Europe 1944-1945* (Washington, DC: Government Printing Office, 1946), 15.

Conclusion

In LSCO, bold action at the operational level is often necessary to gain and maintain a relative advantage over an adversary. In order for that action to be successful, commanders at the tactical level must sufficiently balance risk mitigation and mission effectiveness. The previous analysis of Operations Dickens and Neptune demonstrated how an imbalance between risk and effectiveness at the tactical level resulted in negative operational level effects.

In contrast, Operation Cobra demonstrates how finding the right balance is essential to achieving objectives. Second only to the amphibious landings at Normandy, Cobra was the boldest action taken by the Allies in the ETO in 1944. It was successful because leaders, like LTG Bradley, were willing to assume risk. Its tactical success directly increased Allied tempo, mitigated operational risk, and seized the initiative from the Germans. These effects, enabled by bold action and balanced risk decisions, illustrate clear linkages between the operational and tactical levels of war.

Success on the modern battlefield requires commanders to expand their current level of risk tolerance. Eighteen years of counter insurgency and counter terrorism operations, within a zero-defect environment, have firmly established a culture of risk aversion. There is little doubt such qualities will be necessary during LSCO but relying on combat to act as a catalyst for change will prove costly. The increased lethality of modern weapons systems virtually guarantees failure for the commander that does not act boldly or accept risk from day one.

Moreover, US Army leaders must also develop similar levels of risk tolerance among their subordinates. Commanders at the operational level must continually communicate their priorities and risks to ensure subordinate units are aware of the bigger picture. Informed tactical commanders can then tailor their own tactical actions to help mitigate operational risk. Through a continual dialog commanders and staffs can better synchronize efforts and act as a cohesive force.

Risk should be viewed holistically and mitigated within the context of the situation. In contrast, a focus on individual hazards can lead to a mechanistic application of controls.

Moreover, an overreliance on standardized tools, like a risk management matrix, can undermine a commander's ability to effectively use judgement. *ADRP 6-0*, *Mission Command* states, "Commanders use judgment when identifying risk, deciding what risk to accept, and mitigating accepted risk."[166] Through the application of judgment, a commander maintains balance within an operation by managing risk levels and the application of controls.

Finally, the US Army must become proficient in conducting LSCO in an electromagnetically-degraded environment. Existing fratricide prevention methods rely heavily on digital systems, such as the Global Positioning System (GPS). However, recent events demonstrate the vulnerability of such systems to attack. In November 2018, NATO officials claimed GPS signals were jammed during the Trident Juncture exercise in Norway.[167] Peer adversaries are also working to harden their own digital navigation capabilities. Currently, Russia and China are taking steps to reduce their reliance on US-based GPS by continuing to expand and improve their own navigation networks.[168] To ensure it can continue to operate in a degraded environment, the US Army must increase individual and unit level proficiency with unguided munitions, analog battle tracking, and the visual marking of friendly positions.

[166] US Army, *ADRP 6-0*, 2-9.

[167] "Russia suspected of jamming GPS signal in Finland," *BBC News*, accessed March 01, 2019, https://www.bbc.com/news/world-europe-46178940; Brooks Tigner, "Russian GPS Jamming at NATO's Trident Juncture Exercise," *Real Clear Defense*, accessed March 01, 2019, https://www.realcleardefense.com/articles/2018/11/16/russian_gps_jamming_at_natos_trident_juncture_exercise_113960.html.

[168] "China Completes BeiDou-3 Constellation with Another Launch," *GPS World*, accessed March 01, 2019, https://www.gpsworld.com/china -completes-beidou-3-constellation-with-another-launch/; Yury Urlichich, "Directions 2019: High-orbit GLONASS and CDMA signal," *GPS World*, accessed March 01, 2019, https://www.gpsworld.com/directions-2019-high-orbit-glonass-and-cdma-signal/.

Bibliography

VII Corps Headquarters. "History of the VII Corps for the Period of 1-31 July, 1944 Including Report After Action Against the Enemy." Combined Arms Research Library. Accessed September 04, 2018. http://cgsc.contentdm.oclc.org/cdm/singleitem/collection/p4013coll8/id/4580/rec/3.

Ambrose, Stephen E. *Eisenhower: Soldier and President.* New York: Simon and Schuster, 1990.

———. *The Supreme Commander: The War Years of General Dwight D. Eisenhower.* Garden City, NY: Doubleday & Company, 1969.

Army Air Forces Evaluation Board in the European Theater of Operations. *The Effectiveness of Third Phase Tactical Air Operations in the European Theater: 5 May 1944 – 8 May 1945.* Browns Summit, NC: Etherington Conservation Services, 2008.

Atkinson, Rick. *The Day of Battle: The War in Sicily and Italy, 1943-1944.* New York: Henry Holt and Co., 2007.

———. *The Guns at Last Light: The War in Western Europe, 1944-1945.* New York: Henry Holt and Co., 2013.

Blumenson, Martin. *Breakout and Pursuit.* United States Army in World War II: The European Theater of Operations. Washington, DC: Center of Military History, 1984.

Bradley, Omar N. *A Soldier's Story.* New York: Henry Holt and Company, 1951.

———, and Clay Blair. *A General's Life.* New York: Simon and Schuster, 1983.

Calhoun, Mark T. "Close Air Support and Bombardment Theory: Operation Cobra." Edited by Thomas G. Bradbeer. *Lethal and Non-Lethal Fires: Historical Case Studies of Converging Cross-Domain Fires in Large-Scale Combat Operations."* Fort Leavenworth, KS: Army University Press, 2018.

Carafano, James Jay. *After D-Day: Operation Cobra and the Normandy Breakout.* Boulder, CO: Lynne Rienner Publishers, 2000.

Craven, Wesley, and James Cate, eds. *The Army Air Forces in World War II*. Vol. 3, *Europe: Argument to V-E Day, January 1944 to May 1945*. Chicago: University of Chicago Press, 1951.

D'Este, Carlo. *Decision in Normandy.* New York: Harper Perennial, 1994.

Davis, Richard G. *Carl A. Spaatz and the Air War in Europe.* Washington, DC: Center for Air Force History, 1993.

Doubler, Michael D. *Busting the Bocage: American Combined Arms Operations in France, 6 June – 31 July 1944*. Fort Leavenworth, KS: Combat Studies Institute, 1955.

Eisenhower, David. *Eisenhower at War, 1943-1945*. New York: Random House, 1986.

Eisenhower, Dwight D. *Crusade in Europe.* Garden City, NY: Double Day and Company Inc, 1948.

———. *The Papers of Dwight David Eisenhower*. Edited by Alfred Chandler. Vol 3, *The War Years.* Baltimore: Johns Hopkins Press, 1970.

———. *The Papers of Dwight David Eisenhower*. Edited by Alfred Chandler. Vol 4, *The War Years.* Baltimore: Johns Hopkins Press, 1970.

Gaddis, John Lewis. *On Grand Strategy.* New York: Penguin Press, 2018.

Gooderson, Ian. *Air Power at the Battlefront: Allied Close Air Support in Europe 1943-1945.* New York: Frank Cass Publishers, 1998.

Harrison, Gordon, A. *Cross-Channel Attack.* United States Army in World War II: The European Theater of Operations. Washington, DC: Center of Military History, 2004.

Headquarters, 30th Infantry Division, G-3 Section. "After Battle Report, 1 July 1944 – 31 July 1944." R-12422. Combined Arms Research Library.

Headquarters, 745th Tank Battalion. "Report After Action Against Enemy 19-20 July, 1944 (D+43)." World War II Operational Documents. Combined Arms Research Library. Accessed August 27, 2018. http://cgsc.contentdm.oclc.org/cdm/singleitem/collection/ p4013coll8/id/3479/rec/3.

Hughes, Thomas Alexander. *Overlord: General Pete Quesada and the Triumph of Tactical Air Power in World War II.* New York: The Free Press, 1995.

Isby, David C. *Fighting the Breakout: The German Army in Normandy from 'Cobra' to the Falaise Gap.* Mechanicsburg, PA: Stackpole Books, 2004.

Pogue, Forrest C. *The Supreme Command.* United States Army in World War II: The European Theater of Operations. Washington, DC: Center of Military History, 1996.

Mansoor, Peter R. *The GI Offensive in Europe: The Triumph of American Infantry Division, 1941-1945.* Lawrence, KS: University Press of Kansas, 1999.

Montgomery, Bernard Law. *The Memoirs of Field-Marshal The Viscount Montgomery of Alamein, K.G.* Cleveland, OH: The World Publishing Company, 1958.

Supreme Headquarters Allied Expeditionary Force. "Theater lesson: Use of Heavy Bombers in a Tactical Role." Combined Arms Research Library. 1945. Accessed September 03, 2018. http://cgsc.contentdm.oclc.org/cdm/singleitem/collection/ p4013coll8/id/4200/rec/6.

———. "Minutes of Meeting held in the ANFX Conference Room…, 2nd June, 1944." Dwight D. Eisenhower Presidential Library. Accessed September 04, 2018. https://www.eisenhower. archives.gov/research/online_documents/d_day/Minutes_of_the_SCAEF.pdf.

Tedder, Arthur W. *With Prejudice: The War Memoirs of Marshal of the Royal Air Force Lord Tedder.* Boston: Little, Brown and Company, 1966.

The US Strategic Bombing Survey. *Statistical Appendix to Over-All Report (European War).* Washington, DC: Government Printing Office, 1947.

———. *Summary Report (European War).* Washington, DC: Government Printing Office, 1945.

US Air Force Historical Division. *Tactical Operations of the Eighth Air Force: 6 June 1944-8 May 1945.* 1952. Air Force Historical Studies No. 70. Box 18, Series I – USAF Historical Studies. Dwight D. Eisenhower Presidential Library.

———. *The Employment of Strategic Bombers in a Tactical Role: 1941-1951*. April 1954. US Air Force Historical Study No. 88, Box 21, Series I – USAF Historical Studies. Dwight D. Eisenhower Presidential Library.

US Army. *Combat Operations Data First Army: Europe 1944-1945*. Washington, DC: Government Printing Office, 1946.

US Army Air Corps. *Field Manual (FM) 1-10, Tactics and Technique of Air Attack*. Washington, DC: Government Printing Office, 1940.

US Army Air Forces. *Field Manual (FM) 1-5, Employment of Aviation of the Army*. Washington, DC: Government Printing Office, 1943.

———. *Field Manual (FM) 31-35, Aviation in Support of Ground Forces*. Washington, DC: Government Printing Office, 1942.

———. *Field Manual (FM) 31-35, Air-Ground Operations*. Washington, DC: Government Printing Office, 1946.

———. *Field Manual (FM) 100-20, Command and Employment of Air Power*. Washington, DC: Government Printing Office, 1943.

US Department of the Army. *Army Doctrine Publication (ADP) 1-01, Doctrine Primer*. Washington, DC: Government Printing Office, 2014.

———. *Army Doctrine Reference Publication (ADRP) 3-0, Operations*. Washington, DC: Government Printing Office, 2017.

———. *Army Doctrine Reference Publication (ADRP) 5-0, The Operations Process*. Washington, DC: Government Printing Office, 2012.

———. *Army Doctrine Reference Publication (ADRP) 6-0, Mission Command*. Washington, DC: Government Printing Office, 2012.

———. *Field Manual (FM) 3-0, Operations*. Washington, DC: Government Printing Office, 2017.

———. *Army Techniques Publication (ATP) 5-19, Risk Management*. Washington, DC: Government Printing Office, 2014.

US Department of Defense, Joint Staff. *Joint Publication (JP) 3-0, Joint Operations.* Washington, DC: Government Printing Office, 2017.

US Military Academy. “World War II European Theater.” Department of History. Accessed March 18, 2019. https://westpoint.edu/academics/academic-departments/ history/world-war-two-europe.

Webster, Charles, and Noble Frankland. *History of the Second World War: United Kingdom Military Series.* Edited by James Butler. Vol. 3, *The Strategic Air Offensive Against Germany: 1939-1945.* London: Her Majesty’s Stationary Office, 1961.

Zaloga, Steven, J. *Operation Cobra 1944: Breakout from Normandy.* Praeger Illustrated Military History Series. Oxford: Osprey, 2004.