

**Selling Schweinfurt: Targeting, Assessment, and Marketing
in the Air Campaign against Germany**

by

Brian Vlaun

A Dissertation submitted to the faculty of Air University in partial fulfillment of the
requirements for the degree of Doctor of Philosophy

Maxwell Air Force Base, Alabama

2017

Dr. Stephen Chiabotti, Chair

Dr. Mark Conversino

Dr. Paul Gelpi

Colonel Timothy M. Cullen, PhD
Commandant and Dean
School of Advanced Air and Space Studies

Disclaimer

The conclusions and opinions expressed in this document are those of the author. They do not reflect the official position of the US Government, Department of Defense, the United States Air Force or Air University.



About the Author

Lt Col Brian Vlaun is currently assigned as a Stephen R. Lorenz Fellow, completing research and composition requirements for the Air University PhD program. Lt Col Vlaun is a command pilot in the B-1 with various combat deployments in support of Operations Enduring Freedom and Iraqi Freedom, and he has previously served as a USAF Weapons School Instructor and as Commander of the B-1 Formal Training Unit.

Lt Col Vlaun received a Bachelor of Science in Computer Science from the USAF Academy in 1998, a Master of Aeronautical Science from Embry Riddle Aeronautical University in 2007, and a Master of Military Operational Art and Science in 2010, as a distinguished graduate of Air University's Air Command and Staff College. Lt Col Vlaun graduated from the School of Advanced Air and Space Studies in 2011, earning a Master of Philosophy in Military Strategy.



Acknowledgements

I wish to extend my sincere gratitude to my committee: Dr. Stephen Chiabotti, committee chairman and Director of Air University's PhD program at the School of Advanced Air and Space Studies (SAASS), who lit the intellectual path along which I endeavored to grow as this project took its form; Dr. Mark Conversino, Professor and Deputy Commandant at SAASS; and Dr. Paul Gelpi, Professor of Military History at Marine Corps University. Their thoughtful feedback and encouragement propelled me through this project.

For this project's core research, I owe wholehearted thanks to Ms. Tammy Horton and Ms. Maranda Gilmore of the Air Force Historical Research Agency (AFHRA) at Maxwell Air Force Base. Without their extraordinary responsiveness, resourcefulness, and generosity, this project would have stalled in the idea phase or plummeted haplessly into research gaps. They provided me with copies of 110 digitized reels of microfilm encompassing nearly 175,000 frames that informed my work on this project. They are improving student access to the USAF's research gems in ways previously unthinkable.

Thank you to Ms. Terry Kiss and Ms. Yvonne Kincaid of the Air Force Historical Support Office (AFHSO) at Joint Base Anacostia-Bolling. They admitted me into their research trove, often on short notice, and offered resources I did not know existed.

Additional archivists and research professionals helped me as well. Thanks to Ms. Melissa Robohn and Dr. Mary Ruwell of the Special Collections Branch at the USAF Academy's McDermott Library, Simon Fowler of The National Archives (TNA) of the United Kingdom at Kew, and Steve Clark of the Imperial War Museums in London.

Thank you to Dr. Mark Clodfelter, who gave of his time to help refine my analysis.

My parents deserve my sincere appreciation for their constant support throughout this project, as always—even when that meant *not* asking “so how's the research going?” They are exemplary and loving grandparents to my kids, who have patiently endured yet another episode of limited time with me.

Without my wife, I would not have reached this opportunity at all, much less obtained any reasonable chance of success with it. In addition to picking up household responsibilities while I was seemingly deployed to archives or our basement office, she offered numerous readability suggestions—often in ways only the most endearing spouse would advise: “Sweetheart, this makes no sense.”

Lastly, as with all works of history—especially those that examine human or organizational behavior—this study is unavoidably influenced by the author's perspectives and inclinations. Though I have made a conscious effort to guard against such biases, any remaining errors of fact, omission, or interpretation are entirely my own.

Abstract

Limitations of America's military-industrial complex during World War II necessarily constrained President Franklin D. Roosevelt's strategic and military options. Airpower proponents boasted of a quick-victory option, but they lacked an apparatus with the industrial information and analytical power for selecting targets and assessing results, so they conjured a hurried air-intelligence enterprise, which leaned upon the British, to accompany their untested strategic-bombing doctrine. Right or wrong, the underlying subtext governing American military decision-making and bureaucratic rivalry was resource efficiency.

Under the backdrop of the Combined Bomber Offensive, several bureaucratic battles ensued: The Army Air Forces leveraged the air campaign against Germany as a platform to fight for its own independence. A second fight involved an emerging national intelligence community as it struggled for influence both through and in lieu of the War Department through its committees of analysts, economists, lawyers, mathematicians, engineers, and industrialists. A third fight enveloped the AAF's internal Air-Intelligence enterprise (A-2) and the War Department's Military Intelligence Division (G-2). The A-2's burgeoning community of air-intelligence experts, led initially by pilots in temporary assignments, sought to prove that air intelligence demanded unique specialization and information requirements. The A-2 fought not only for independent responsibilities from the G-2, but also for recognition as a worthy and separate enterprise from the pilot corps within the AAF.

This study seeks to determine whether an air campaign is an organizational or technology-driven phenomenon. This study's approach is to evaluate this relationship within contextual factors both external and internal to the air component and to trace them across the period from pre-war planning and doctrine development through Eighth Air Force's independent air campaign against Germany, culminating with the pre-invasion preparations at the start of 1944. This study concludes that the air campaign against Germany proved an interaction between both organizational and technological mechanisms, though neither mechanism received necessary pre-war development. Charged to discern ambiguous bombing results and determine enemy responses, the few air-intelligence analysts reported information that reflected their organizational tendencies and preferences.

Left unchecked, organizations may adopt symbols and exaggerate claims to justify their own preferences and market their ideas in ways that mask their optimistic assumptions. In the case of the air campaign against Germany, both the B-17 and Schweinfurt served as symbols and powerful marketing tools for the AAF and air intelligence, but both organizations clung to their respective symbols in ways that stifled their objectivity and creativity.

Contents

Introduction	1
Literature Review	12
Chapter Summary	32
Chapter One: The Clausewitzian Air Campaign	38
Chapter Two: The AAF at War for a Bomber	60
ACTS Shapes the Air Campaign	60
Air Intelligence Born into Neglect	71
Custody Dispute: The A-2 / G-2 Debate	78
From Pearl Harbor to Ploesti	87
Air Intelligence Growth Spurt	96
Chapter Three: Forming the Air Informers	103
British Air Intelligence—"Through the Looking Glass"	103
Americans Under British Tutelage	125
American Air Intelligence Training: A School of Apprehension	137
Chapter Four: Picking Up the Slack	158
Donovan's OSS Branches Out	158
Spaatz's Team: Under-resourced and overstretched	168
Targeting by Economists—A Micro- and a Macro-enterprise	179
A Calculating Bunch of "Quiz Kids"	197
Chapter Five: Targeting and Assessing from Washington	214
A Committee of Lawyers and Industrialists	214
ACTS of Air Intolerance	227
A Tale of Bombs and Fuses	236
The Sheen of Success at Vegesack	245
Eaker Saves Casablanca	250
Operations Analysts Feed the Eaker Plan	261
Chapter Six: Eaker's Imperfect Pitch	275
Eaker Faces Feedback	284
The Devil and the Deep Blue Sea	294
Gunships and Negative Aims	314
A Firestorm of Post-Mission Assessments	321
Chapter Seven: "The Appearance of the Bottom of the Barrel"	331
The Campaign for Air Assessment	341
Tapping Ploesti and Synthetic Oil Assessments	355
Schweinfurt-Regensburg and the Risk-Reward Calculus	365
Hitler's Vengeance and The Blue Hour	381

Chapter Eight: Quadrant to Sextant	397
Quadrant Shifts to the Ground	397
The Blind, the Weary, and the Wishful	404
Bombing Blind and the Emden Do-over	425
Spinning Wheels Over Ball Bearings	436
Sextant: A New Course and a Falling Star	450
Conclusion and Epilogue	466
Conclusion	466
Epilogue	492
Bibliography.....	521



Introduction

You know, we live in a country where if you want to go bomb somebody, there's remarkably little discussion about how much it might cost, even though the costs almost inevitably end up being orders of magnitude larger than anybody projected at the [outset].¹

—Dr. Andrew Bacevich, 20 June 2014

What we all want is results. I am certain that neither you nor anybody else in Washington wants it better than we in the field, and I am certain also that nobody is trying harder to accomplish a high level of bombing accuracy than we are. Let us continue, therefore, to report our bombing as we see it here...

...It is impossible, unless you could go and walk over the target, to tell where all the bombs hit. We would have to have a lot of cooperation from the enemy or wait until the war was over to report accurately by the system you suggest.²

—Maj Gen Ira Eaker to Maj Gen Barney Giles, 15 September 1943

War is expensive. World War II (adjusted by the Congressional Research Service into FY11 dollars) cost American taxpayers the equivalent of \$4.1 trillion, peaking in 1945 at 37.5 percent of GDP in defense spending.³ These weren't just fiscal costs; they were human. Of nearly 18 million American men and women who mobilized for war—over 12 percent of the U.S. population, 61.2 percent were male draftees with an average tour of duty of 33 months.⁴

¹ Dr. Andrew J Bacevich, interview by Bill Moyers, 20 June 2014.

² Maj Gen Ira C. Eaker, *Letter, Eaker to Giles*, War Department, (Washington, DC: NA, 15 September 1943), AAG 312.1, Operations Letters, RG 18.

³ Stephen Daggett, *Costs of Major U.S Wars*, Congressional Research Service, (Washington, DC: 29 June 2010), RS22926, 2.

⁴ 50th Anniversary of World War II Commemoration Committee, *World War II Informational Fact Sheets*, United States Army, (Washington, D.C: HQ Department of the Army, 1995), SO027050, 3; Total U.S. population in 1945 was 139,928,165. See: U.S. Census Bureau, "Historical National Population Estimates: July 1, 1900 to July 1, 1999," Population Division,

More than 963,000 Americans were killed or wounded, but they were not the only ones who sacrificed. Every American felt the impact of tough choices. Trade-offs were made at all levels between the war effort and other national or individual priorities with consequential disruptions to public life. These included politically controversial and seemingly un-American policies such as wage limits, price ceilings, goods rationing, and “ballooning tax bills for the millions of Americans of average income previously exempt from income tax.”⁵ These fiscal limitations and personal sacrifices are the opportunity costs of war. Those responsible for war’s conduct share an obligation to minimize these costs not only to the combatants but also to the civilians who pay its price.

How do we fight and win efficiently? Airpower, as just one element of military power, offers a means to fight at a lower cost in American lives.⁶ A common airpower narrative suggests bombing represents a symbol of superior technology, training, and innovation, even offering a shortcut to victory “over not through” the enemy.⁷ However, airpower may not be efficient, even toward

Accessed 22 December 2016,

<https://www.census.gov/population/estimates/nation/popclockest.txt>.

⁵ Mark H. Leff, “The Politics of Sacrifice on the American Home Front in World War II,” *The Journal of American History* 77, no. 4 (1991): 1299-1304; Gropman argues rationing included such goods as tires and gasoline, but “people were generally fed better than they had been before the war, and they consumed more meat, shoes, clothing and energy.” In any case, sacrifices tended to hit laborers harder than the big corporate bosses, whose profits skyrocketed by lucrative contracts. See: Alan L. Gropman, *Mobilizing U.S. Industry in World War II: Myth and Reality*, ed. National Defense University. Institute for National Strategic Studies., McNair Paper (Washington, DC: U.S. G.P.O., 1996), 6, 107.

⁶ For example, Frank Weigley claims strategic bombing greatly extended the costs of war onto the Germans, including civilian casualties, in the process of reducing ground losses to the Allies. See: Russell Frank Weigley, *The American Way of War: A History of United States Military Strategy and Policy* (Bloomington, IN: Indiana University Press, 1977), 359.

⁷ Paula G. Thornhill, *“Over Not Through”: The Search for a Strong, Unified Culture for America's Airmen*, ed. Project Air Force, Occasional Paper (Santa Monica, CA: Rand Corporation., 2012),

goals for which it is well-suited, if decision-makers are not informed with the requisite information. Uninformed use of airpower risks squandering resources (i.e. time, money, human capital, and materiel). Launched on inadequate information or flawed decision-making, an air campaign may waste weaponry, increase expenses, and inhibit success as political will fades. The outcome may induce unintended consequences, demand an unnecessary and expensive ground campaign, or even invite disaster. Further, the promise of airpower brings with it a comparatively high information burden—one that begins well before bombs are dropped and does not cease when hostilities end.

So what is the information burden of airpower? This burden is air intelligence, which informs us as to what we need to strike (targeting) and how well what we are doing is working (assessment). These terms and others will be unpacked in detail later. In short, we need to know a lot about the enemy and we need to know a lot about ourselves including the organizations nominating targets and performing analysis.⁸ Air intelligence should be timely, accurate, thorough, and synthesized with other sources of information about the enemy and the efficacy of our own attack. Air intelligence guides best courses for further air action, identifies operational limitations, stimulates innovative

3,8-11. Builder argues airmen possess a “reverence for technology” in addition to a blindness induced by strategic bombing doctrine. See: Carl H. Builder, *The Masks of War: American Military Styles in Strategy and Analysis*, A Rand Corporation Research Study (Baltimore, MD: Johns Hopkins University Press, 1989), 69-73.

⁸ On this subject, Stephen Rosen adds, “Although it is hard to understand others, it is harder to understand ourselves... Organizational self-assessments have rarely displayed a realistic understanding of the strengths and weaknesses of the organization.” See: Stephen Peter Rosen, “Competitive Strategies: Theoretical Foundations, Limits, and Extensions,” in *Competitive Strategies for the 21st Century: Theory, History, and Practice*, ed. Thomas G. Mahnken (Stanford, CA: Stanford University Press, 2012), 25.

solutions, or even appraises decision-makers whether kinetic attack is the right mechanism for victory at all.⁹

Air Intelligence Investment. How much does airpower's information burden cost? The answer isn't simple, but it is important if airpower is to include efficient and effective military options. A large standing intelligence enterprise has tradeoffs, and intelligence activity cannot start effectively after war begins. Unfortunately, organizational complexities, overlapping responsibilities, and classification sensitivity obfuscate dissection of the Intelligence Community (IC) budget. This challenge is especially pronounced where the lines between organic functions of military services and national-level support blur. In fact, what may seem an exorbitant national intelligence budget commits only a very small share to air-campaign targeting and assessment. For example, the combined U.S. budget for both National and Military Intelligence appropriations hovered at a lofty \$70 billion in 2016 after peaking at \$80.1 billion in 2010—an amount roughly equivalent to the combined salary of every high school teacher in the United States or the annual cost to operate the entire American prison system.¹⁰

⁹ The term non-kinetic appears in May of 2000 as the preferred nomenclature to differentiate defense programs that may have lethal effects while providing “additional options to handle non-conventional threats.” The term “kinetic” was retroactively applied to traditional conventional weapons. See: Sandra Erwin, “Joint-Service War Games Aim to Shape Pentagon Programs,” *National Defense* 84, no. 558 (2000): 35.

¹⁰ Office of Director of National Intelligence, “U.S. Intelligence Community Budget,” DNI, Accessed 8 August 2016, <https://www.dni.gov/index.php/intelligence-community/ic-policies-reports/ic-policies-2>. For comparative value to \$80 Billion in 2015 dollars, see: The White House, “Remarks by the President at the NAACP Conference,” news release, 14 July 2015, <https://www.whitehouse.gov/the-press-office/2015/07/14/remarks-president-naacp-conference>.

However, only a slice of this massive Intelligence budget goes to what the Intelligence Community (IC) calls Support to Military Operations (SMO), of which targeting and battle-damage assessment are an even smaller part. Since 1961, the Defense Intelligence Agency (DIA) has been the DoD organization responsible for providing intelligence support to targeting and battle-damage assessment—just one of its six missions—which it divides among its 7,000 employees and its meager \$1-billion portion of the IC budget.¹¹ If targeting and bombing assessment are important priorities to the Intelligence Community, their proportion of the budget does not reflect it.

Matters of detangling the IC budget aside, the essential question for airpower is how best to ensure that an air-combat organization learns as it fights. Air-campaign learning is not merely a challenge for remote instances of global war. In the 21st century, the shrinking technology gap between the United States and potential adversaries and the proliferation of smart weapons has bequeathed parity of long-range-strike capability to smaller countries.¹² While the United States still retains the edge in global-power-projection capability and capacity, that edge is shrinking. Intelligence activities related to targeting and assessment may hedge against this parity by providing an information advantage, but such activities must be performed in a cost-

¹¹ Gordon Adams, *Buying National Security: How America Plans and Pays for Its Global Role and Safety at Home*, ed. Cindy Williams (New York, NY: Routledge, 2010), 124.

¹² For example, North Korea, Iran, and Syria all possess ballistic-missile programs of varying degrees and engage in technology sharing. See: Paul K. Kerr, Mary Beth D. Nikitin, and Steven A. Hildreth, "Iran-North Korea-Syria Ballistic Missile and Nuclear Cooperation," *Current Politics and Economics of the Middle East* 5, no. 1 (2014).

effective manner.

American resources are obviously not infinite, nor are those of potential adversaries. A competitive strategies approach—the one that helped ensure an advantageous military-industrial dominance over the Soviet Union—assumed that “both sides operated in a resource-constrained environment.”¹³ This logic suggests that political goals should be informed by the efficiency with which they can be attained, not merely by the expectations of effectiveness levied onto the organizations tasked to attain these goals, even under short-term circumstances. As Stephen Rosen offers, “actors may be blind to the fact that they are damaging themselves by adopting a course of action.”¹⁴ This may be especially true if short-term political goals slip into unexpected long-term military quagmires. In other words, a successful long-term strategy includes political goals informed by an interaction between efficiency and effectiveness considerations, not by the inexorable subordination of the former to the later.

A total-war context, such as in World War II, included similar imperatives for efficient military employment. Limitations of America’s military-industrial complex necessarily constrained President Franklin D. Roosevelt’s strategic options and forced difficult choices between alternative military capabilities and capacity. Proponents of an airpower option—one that could mobilize sooner than ground forces and ensure more immediate and direct effects than

¹³ Daniel I. Gouré, "Overview of the Competitive Strategies Initiative," in *Competitive Strategies for the 21st Century: Theory, History, and Practice*, ed. Thomas G. Mahnken (Stanford, CA: Stanford University Press, 2012), 95.

¹⁴ Rosen, "Competitive Strategies: Theoretical Foundations, Limits, and Extensions," 13.

the ongoing Allied blockade—boasted of securing cheaper and quicker victory.¹⁵ Airpower experts, lacking an apparatus with the industrial information and analytical power for selecting targets, conjured a hurried air-intelligence enterprise to accompany their untested strategic-bombing doctrine. Right or wrong, the underlying subtext governing American military decision-making was efficiency.

Although victory in Europe headlined the main event for the War Department to garner public support, for the Army Air Forces (AAF), there were several other bouts on the card. The AAF fought for its own independence. It rose rapidly in size and global presence in the heat of wartime mobilization, though its leader, General Henry H. “Hap” Arnold, ensured its Air Corps Tactical School (ACTS) graduates remained purposefully sprinkled across the top to guide its fight in his direction. In a second fight, an emerging national intelligence community struggled for influence both through and in lieu of the War Department. Committees of analysts, economists, lawyers, mathematicians, engineers, and industrialists assisted the AAF with targeting as they sought to earn prestige from their British counterparts and credibility from the President.

Finally, a third fight, less visible but no less important to its respective combatants, involved the AAF’s A-2 (titles were dynamic, but essentially an Air-Intelligence Division) and the War Department’s G-2 (Military Intelligence Division). A burgeoning community of air-intelligence experts, led initially by

¹⁵ Phillip S. Meilinger, "Air Strategy: Targeting for Effect," 13, no. 4 (1999): 49-50.

pilots in temporary assignments, sought to prove that air intelligence demanded unique specialization and information requirements. The A-2 fought not only for independent responsibilities from the G-2, but also for recognition as a worthy and separate enterprise from the pilot corps within the AAF. While the A-2's fight might have seemed the featherweight bout, it was the one that owned the air-campaign assessments and the narrative upon which all of the other fights depended for the AAF. These organizational interests were firmly established by fall of 1942. However, the extent to which they would shape the conduct of air campaign, if at all, remained to be seen.

This study seeks to determine whether an air campaign is an organizational or technology-driven phenomenon. Do air-intelligence organizations use targeting and assessment processes to market their own ideas about airpower and pursue their own interests? Do airpower leaders employ air intelligence and air-campaign assessments to their own purposes? Or do technological solutions help to guard against inevitable human bias? The implications of these answers are significant, because if the costs imposed on the enemy and the costs incurred by the air campaign depend upon organizational learning, and air-campaign learning depends upon the quality and objectivity of targeting and assessment intelligence, then organizational biases might drive adverse outcomes.

This study's approach is to evaluate this relationship within a context of factors both external and internal to the air component, including the security environment, physical environment, alliance politics, enemy strategy, civilian

oversight, inter-service rivalry, fiscal constraints, doctrine, training practices, and leadership preferences. This study explores interrelationships among these factors and traces them across the period from pre-war planning and doctrine development, through Eighth Air Force's independent air campaign, culminating with the formation of the United States Strategic Air Forces and the pre-invasion preparations at the start of 1944. This period of the air campaign against Germany is selected because it is perhaps the least studied in air-intelligence history, and it serves as a prequel to the exhaustively researched debate between the proponents of the Oil and Transportation Plans in 1944.

By January 1944, according to Robert Ehlers, "the intellectual infrastructure for Allied air intelligence was mature."¹⁶ Thus, this period offers rich, unexplored depth into the organizations responsible for this first test of AAF strategic bombing. The air-intelligence angle provides an additional facet to a period during which Mark Clodfelter aptly declares, "Eaker refused to allow paltry numbers, German defenses, and poor weather to halt the American experiment in daylight bombing that he had fought so hard to preserve, but he could do little to improve the accuracy of his bomber force."¹⁷ How those responsible for providing the target intelligence, assessments, and even the accuracy numbers helped and hindered this experimental period forms the

¹⁶ Robert Ehlers, *Targeting the Third Reich: Air Intelligence and the Allied Bombing Campaigns*, Modern war studies (Lawrence, KS: University Press of Kansas, 2009), 181.

¹⁷ Mark Clodfelter, *Beneficial Bombing: The Progressive Foundations of American Air Power, 1917-1945* (Lincoln, NE: University of Nebraska Press, 2010), 131.

substance of this study's purpose.

This study's aim is not to prescribe a particular path for air-intelligence investment, but to inform our view of alternatives with an open eye as to possible implications. The aim is likewise not an attempt to prove that Eighth Air Force might have secured victory independently in 1943, but rather to explore how we might best conduct targeting and assessment in future air campaigns through a better understanding of these functions and the ways that the organizations that perform them might pursue their own interests.

This study's approach asks particular questions of air intelligence in an air campaign's historical context: What was the published air doctrine at the time and how did published doctrine drive targeting and assessment? In what ways did technological elements enable or inhibit targeting and assessment? Which were the influential intelligence organizations? Why and how were they formed? Who (if anyone) was the dominant personality? How was the organization structured? Who comprised the organization, and how were they trained? What did they seek to provide and how did they provide it? What were their predominant methods (in terms of inputs, processes, and outputs)? Who was the primary customer and how were organizational outputs viewed by the customer (and by the organizations themselves)? What was the organization's identity and how did it view itself? What questions did the organization attempt to answer and how did its process cope with any unanswerable questions? To what extent was the organization successful at guiding the targeting process and internal and external learning, and ultimately the success of the air

campaign? What were the potential sources and outcomes of organizational bias? (e.g. individual or organizational incentives) What was the campaign after-action-report or lessons-learned process? The study that follows will attempt to answer these questions.



Literature Review

Many aspects of this study's subject matter are not new. As examined later, there is no shortage of studies that intend the following: to dissect the air offensive against Germany in World War II based on post-war revelations or declassified documents; to recount the history and role of air intelligence; to evaluate the inter-related roles of technology, doctrine, training, leadership, politics, or the gnashing of opposing strategies in shaping air-campaign outcomes; or to assess the drivers of competition and cooperation between similarly charged organizations. This study aims to complement the existing body of work by offering a fresh approach to understanding the ways air intelligence informed how Eighth Air Force fought—and even more importantly—how it learned during the experimental period of the air campaign against Germany. This study renders its perspective through the organizations and individuals charged to collect, analyze, and disseminate the intelligence that helped and hindered the air campaign by peering into the motivations, inclinations, and patterns of behavior of the organizations themselves. The aim is to identify why they selected the targets they did, why they assessed effectiveness as they did, and what drove the arguments they made to key decision-makers using a blend of all of the aspects above.

A new approach is necessary and worthwhile because it seeks to answer questions often left unanswered, if asked at all, by other studies. Most airpower studies that address intelligence, if they incorporate an organizational level of analysis, focus only on inputs and outputs. In other words, what information

did organizations obtain and what did they produce with it? Did they apply a predictable process or did they simply conjure assessments oriented to their masters' wishes, as many studies conclude?

Deeper organizational questions, especially *why* questions, are challenging to answer in a definitive sense. These deeper questions are important if we are to differentiate aspects of air intelligence where human judgment may be indispensable versus those where that judgment may be detrimental to air-campaign outcomes. To accomplish this, we need to understand the mechanisms of organizational and individual biases. Unfortunately, even if important organizational questions are addressed in unit histories, oral interviews, personal letters, or official reports, the authors' perspectives are inevitably colored by their own experiences, which may well be part of the relevant question under analysis. Taken in context or in aggregate, however, patterns of individual or organizational motives and interests often do emerge. These potential motives, set in their context and traced through their demonstrated outcomes, comprise the focus of this study.

Studies that incorporate air intelligence often wrestle with outcomes of the Combined Bomber Offensive: some reinforce arguments for or against airpower's decisiveness while others circumscribe airpower's limited, supporting role in joint warfare. Some hail airpower's prowess as a short-cut to victory. Many advocate ways strategic bombing may have been more effective, more ethical, or not attempted at all.¹⁸ Despite this varied range of conclusions,

¹⁸ Brauer and Van Tuyll notably conclude that bombing had diminishing returns "...and the

most—if not all—comprehensive studies conclude that air intelligence emerged as an enterprise out of wartime necessity, that more intelligence fusion and greater cooperation among intelligence organizations is desirable, and that effective air operations depend upon reliable air intelligence. The following literature review will relate prominent studies to this research and assemble relevant questions as guideposts for the research that follows.

In *Targeting the Third Reich*, Dr. Robert Ehlers, a career Air Force intelligence officer and military historian, traces air intelligence from its historical foundation in World War I through the conclusion of the air war over Germany in 1945.¹⁹ Through an exhaustive methodological if unconventional approach, he breaks the Combined Bomber Offensive into several distinct air campaigns, from which he draws comparisons of American and British experiences as skewed by the preferences of each side's leaders.²⁰ Ehlers' work emphasizes the under-appreciated role air intelligence has played in the study and analysis of airpower history and highlights "the degree to which bombing

resources might well have been used to help prosecute the war in other areas." See: Jurgen Brauer and Hubert P. Van Tuyll, *Castles, Battles, & Bombs: How Economics Explains Military History* (Chicago, IL: University of Chicago Press, 2008), 235. Levine offers a counter-factual that bombing of transportation and electrical systems early in the campaign would have "reduced Germany to helplessness" even without a land campaign. See: Alan J. Levine, *The Strategic Bombing of Germany, 1940-1945* (Westport, CT: Praeger, 1992), 202. Ehlers takes an opposing view: neither bombing nor intelligence present a "war-winning capability," and bombing must be evaluated in a "larger combined-arms and combined-operations context." See: Ehlers, *Targeting the Third Reich: Air Intelligence and the Allied Bombing Campaigns*, 2, 13, 347.

¹⁹ For Ehlers' dissertation, see: Robert S. Ehlers, "BDA: Anglo-American Air Intelligence, Bomb Damage Assessment, and the Bombing Campaigns Against Germany, 1914-1945" (Dissertation, The Ohio State University, 2005).

²⁰ Ehlers explains his rationale for sub-dividing the CBO at: Ehlers, *Targeting the Third Reich: Air Intelligence and the Allied Bombing Campaigns*, 2-3.

succeeded or failed in its stated aims based on the relative efficacy of air intelligence inputs.”²¹ Air intelligence was responsible for air-campaign outcomes insofar as leaders took the advice of the analysts.

Along the path of his detailed analysis, Ehlers explores an air-intelligence enterprise largely responsible for achieving its own growth and potential. He praises the wartime emergence of “superb reconnaissance and photo-interpretation capabilities” along with “comprehensive damage assessments,” and concludes: “if used properly, [air intelligence] can hasten victory.”²² Ehlers contributes an American perspective on British archival sources to show air intelligence, while imperfect, was essential to the air campaign and that the many organizations of Allied air intelligence were unavoidably intertwined.

Ehlers encounters a number of intelligence shortcomings. In various cases, he shows analysts lacked necessary information, produced assessments ignorant of their own limitations, or aligned immodestly to their operational bosses’ views. Organizational squabbles are common occurrences throughout Ehlers’ narrative, although they do not alter air-campaign outcomes. Sources of “bureaucratic infighting,” his research suggests, are externally driven, either by their “operational masters” or service-level “institutional preference,” as evidenced in arguments between oil and transportation offensives in 1944.²³

Operational and intelligence failures do not, however, derive from internal organizational or individual interests on the part of the intelligence enterprise.

²¹ Ibid., ix.

²² Ibid., 4, 13, 129.

²³ Ibid., 297.

Where such failures occur, Ehlers finds them attributable to “frequent and outright misuse of intelligence as policymakers and senior commanders pushed their various strategic and operational preferences,” while well-intentioned “intelligence personnel engaged in an iterative learning process.”²⁴ In other specific cases, such as analysts’ failures to detect German industrial dispersal or ongoing production in bombed-out buildings, Ehlers’ leaves an investigation of internal organizational root causes for intelligence failures outside the scope of his argument, or such factors were otherwise not present.²⁵

What might a close investigation into internal organizational root causes show? Did these organizations pursue their own interests, if any existed? If they felt compelled to align with their bosses’ or broader institutional preferences, were contrarian viewpoints suppressed? If they were truly blind to their own limitations, was it out of ignorance or were there other reasons? Finally, were there other strains of external influence? For example, did graduates of the Air Corps Tactical School (ACTS) continue their practice of “utter lack of attention to air intelligence” as Ehlers suggests prior to the United States entering World War II, or might ACTS graduates have maintained personal relationships and steered air intelligence throughout the war?²⁶ These are threads worthy of further inquiry.

Another study dove deeper into the Air Intelligence organizations

²⁴ Ibid., 2, 340, 348.

²⁵ Ibid., 145-146.

²⁶ Ibid., 78.

themselves. In 1996, the Air Force Historical Studies Office published a monograph entitled *Piercing the Fog: Intelligence and Army Air Force Operations in World War II*. The study zeroes in on several critical fault lines for early air intelligence. First among these was bureaucratic tension over information sources and analytical responsibilities between the Army's G-2 Military Intelligence Division—the organization with nominal control over all of the Army's intelligence matters—and the Army Air Force's burgeoning and subordinate A-2.²⁷ The study concludes that analysis of similar topics by the Army's Military Intelligence Service and the AAF's A-2 resulted in “unnecessary duplication and the danger of expressing dangerous divergences,” that ULTRA information—the highly sensitive Allied decryption of German messages—was suppressed from A-2 “for good reason,” and that AAF officers' perception of the G-2 as “a malevolent force intent on suppressing the air arm... was unfair.”²⁸ Were the Army's senior intelligence officers simply defending Army regulations as published and maintaining appropriate security measures, or were other intentions at play? Why did AAF leadership and intelligence officers respond as they did?

Another key fault line traversed the foundation of air-intelligence training with its epicenter at the AAF's Air Intelligence School (AAFAIS). For better or worse, AAFAIS channeled the energies of the AAF's new intelligence profession. The Air Force study acknowledges the school's darkest period between the fall

²⁷ John F. Kreis, *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II* (Bolling AFB, Washington, DC: Air Force History and Museums Program, 1996), 7.

²⁸ *Ibid.*, 7, 118.

of 1942 and the spring of 1944 at its Harrisburg, Pennsylvania, campus but leaves many stones unturned. The school's challenges, euphemistically downplayed by the study as "organizational and administrative bugs," are attributed to large shifts in quality and quantity of student accessions, limited faculty experience, and disinterested oversight by Technical Training Command prior to the school's realignment underneath the Air Staff.²⁹ In what ways did the school's early leadership shape its graduates? A deeper visit into the school's texts, histories, and Inspector General investigation reports may reveal ways the school shaped enduring organizational culture for the services' air intelligence officers. Their work may have reflected cultural tendencies, especially in performing Group-level S-2 (intelligence officer) duties.

Finally, as with Ehlers' book, the Air Force study surveys challenges and contributions of photo-interpretation, although some sources of underlying friction are unexplored. The study notes, for example, "a tendency to overestimate the actual impact of damage on a target's productive capability, even when evaluations of structural damage were correct."³⁰ If this tendency of photo-interpreters proved true, was there an underlying cause other than the photographs themselves? Photo-interpretation, in the study's words, "was an art that demanded great skill in assessing photographs and an ability to reason and deduce facts from images."³¹ Did senior intelligence and operational officers appreciate photo-interpretation as an art? Or might published accounts

²⁹ Ibid., 127-130.

³⁰ Ibid., 203.

³¹ Ibid., 83.

and oral histories show that analysts were consistently pressured by their air-intelligence leadership to rely on scientific approaches and objective analysis at the expense of subjective inferences?

In its final analysis, the study concludes that civilian experts populating the Committee of Operations Analysts and the Enemy Objectives Unit “generally matched the demands that war placed on them,” despite “unforeseen technical difficulties” the service experienced with strategic bombing.³² The study leaves responsibility for exposing such limitations outside the air intelligence purview. Could AAF leadership have better understood the perspectives these civilians brought with them? Might these civilians have better understood bombing limitations? What did their presence do to the AAF’s air intelligence enterprise as well as for it?

In *Beneficial Bombing: The Progressive Foundations of American Air Power, 1917-1945*, Dr. Mark Clodfelter unwinds the threads of “progressive bombing,” from their “just, rational, positive, and efficient” progressivist origins, through the Army Air Force’s wartime struggle to carve “cheap victory” with an untested blade of industrial-web theory, which left Eaker short on “the time and equipment to create an aerial razor.”³³ Clodfelter’s narrative follows the course of an impatient air campaign: swept by currents of optimistic pre-war doctrine along with a concomitant public (and presidential) fascination with the promise

³² Ibid., 6, 398.

³³ Clodfelter, *Beneficial Bombing: The Progressive Foundations of American Air Power, 1917-1945*, 2, 8, 60-73, 131.

of air power; propelled by plans that forecasted Allied bombing production against Axis industrial destruction; and steered vainly by air leaders who sought victory through independent air power.³⁴ By the time Eighth Air Force merged into USSTAF to prepare for the Allied cross-Channel invasion in 1944, Eaker's efforts to "produce quick, inexpensive results had morphed into an air campaign that placed a higher priority on rapid success than it did on producing inexpensive gains."³⁵ Complicating matters, Eaker's available intelligence sources failed to demonstrate "if the actual destruction had produced the desired effect on Germany's capability and will to keep fighting."³⁶ Perhaps an investigation into the assessments and interactions behind the air campaign's results may offer complementary contributions to Clodfelter's argument.

What role, if any, did the air-intelligence organizations play in bridging information gaps with their own assumptions? Might the intelligence organizations have intensified pressure to achieve quick victory by adding their own preferences into Roosevelt's stated goal for "unconditional surrender", as they fed their targeting recommendations and post-raid assessments to Eaker and to Arnold in Washington?³⁷ Further, who developed Eaker's method for assessing bombing accuracy, and how well did it reflect actual bombing performance and guide decision-makers' perceptions? Further still, might

³⁴ Ibid., 127.

³⁵ Ibid., 147.

³⁶ Ibid., 141.

³⁷ Ibid., 119.

aircrew have been motivated not only by survival, but also by pressing the intelligence reports to show that their often-pyrrhic raids had been worth the costs?³⁸ Did Group-level intelligence officers hold aircrew accountable for their claims or did they share in the aircrews' optimism and military esprit de corps? Finally, was Eaker's "public relations background" a catalyst for marketing behavior by the air-intelligence organizations, or did the latter also seek to market their own ideas?³⁹ The air-intelligence assessments may contain the threads of hidden biases, which might add to the fabric of Clodfelter's rich narrative of the quest for cheap victory.

In his brief but penetrating 28-page "a History of Effects-Based Air Operations," Dr. Phillip Meilinger argues that measures of effectiveness drive air-campaign targeting and assessment, much of which he recounted in his 2012 Air Force Research Institute monograph, *Bomber: The Formation and Early Years of Strategic Air Command*. Meilinger's insights reflect his rare depth of airpower thought and his gift for tying the threads of early Airmen's challenges to the limits and successes of modern-era application. He concludes from his treatment of the air campaign over Germany: "Targeting was the key to everything, and intelligence was essential to conduct that function; analysis was then needed to ensure the targets were indeed the correct ones, which in

³⁸ Although, as Clodfelter suggests, aircrew may have been more interested in their chances of returning home alive than "whether their actions contributed to Germany's demise," but they may have also experienced an intense desire to feel that the lives of their fellow aviators were worth the price. See: *ibid.*, 138.

³⁹ *Ibid.*, 126.

turn required more intelligence. It was an iterative and complex process.”⁴⁰ This early manifestation of Effects-Based Operations was an information-hungry infant, and no amount of analysis could satiate its appetite for data. Meilinger traces the accomplishments and inevitable shortcomings of then-newly formed, competitive, and under-equipped intelligence organizations as they aided the judgment of Allied commanders and planners.⁴¹ These intelligence organizations, he noted, were prone to “counting things, mistaking that practice for evaluation and measurement,” “mirror-imaging” American industry, and building analyses on a foundation deficient of “the requisite experience and methodologies.”⁴² If these organizations preferred quantitative methods, why was that so, and what was the source of their methodologies? Why were some organizations prone to mirror-imaging?

Further, Meilinger analyzes air-intelligence organizations broadly and focuses on their common traits. He finds “the objective of these [both American and British] economic analysis groups was similar” and they “suffered from similar problems,” even if they didn’t always get along.⁴³ He splits their inclinations roughly along the national clefts separating their senior commanders. In preparation for Operation Overlord, Spaatz and the Americans, along with the Committee of Operations Analysts (COA) and the

⁴⁰ Phillip S. Meilinger, *Bomber: The Formation and Early Years of Strategic Air Command* (Maxwell Air Force Base, AL: Air University Press, 2012), 62.

⁴¹ Ibid., 61.

⁴² Phillip S. Meilinger, "A History of Effects-Based Air Operations," *The Journal of Military History* 71, no. 1 (2007): 141-142.

⁴³ Ibid., 145.

Enemy Objectives Unit (EOU), sought to drain the German economy of its oil with daylight precision, while Air Marshall Arthur Tedder and the British, especially Solly Zuckerman and the British Ministry of Economic Warfare (MEW), fought to deny rail transportation through the area bombing of marshalling yards.⁴⁴ Both Allies stiffened their core arguments using different desired measures of effectiveness “to determine if their chosen targeting strategies were working and achieving the political goals established.”⁴⁵ General Dwight Eisenhower ultimately directed all bombers under his combined command toward the rail plan, versus oil, because of the former’s higher probability of delivering short-term aid to his cross-Channel invasion—the measurement most important to the Supreme Allied Commander.⁴⁶ The oil-rail debates have been exhaustively studied, as have the two nations’ different approaches to bombing, but the roots of their various intelligence organizations’ preferences are not.

Further, did conclusions drawn by the COA subcommittee on probabilities and force match those of the rest of the civilian-heavy organization or was it chaired by a disgruntled and obstinate ACTS graduate? Did the mix of professions incorporated into these organizations add balance, diversity, and objectivity? Or were the top posts often taken by “inside lawyers” who, similar to corporate attorneys, felt “pressures to conform to the wishes and objectives

⁴⁴ Ibid., 148-156.

⁴⁵ Ibid., 149.

⁴⁶ Ibid.

of managers who have the authority to hire and fire them”?⁴⁷ The ways these analysts contributed to target selection is an important line of inquiry. If, as Meilinger offers, “a skeptic could argue that a history of air strategy is a history of the search for the single, perfect target,” then this study may be one such history.⁴⁸

Other authors have linked military learning, especially in wartime, to measures of effectiveness.⁴⁹ Prominent among them are Stephen Rosen and Scott Gartner. In *Winning the Next War: Innovation and the Modern Military*, Rosen argued that military innovation in wartime is internally-driven and dependent upon well-defined measures of effectiveness. Rosen defined his notion of *measures of effectiveness* as a combination of “the definition of the strategic goal, the relationship of military operations to that goal, and indicators of how well operations are proceeding.”⁵⁰ Because these three components are necessary, political masters, military commanders, and those responsible for conducting assessments must share a clear understanding of the goal. In his words, “When military innovation is required in wartime, it is because an inappropriate strategic goal is being pursued, or because the relationship between military operations and that goal has been

⁴⁷ Susanna M. Kim, “Dual Identities and Dueling Obligations: Preserving Independence in Corporate Representation,” *Tennessee Law Review* 68, no. 2 (Winter 2001): 204.

⁴⁸ Phillip S. Meilinger, *Ten Propositions Regarding Air Power*, 1995, Air Force History and Museums Program, 22.

⁴⁹ Gartner uses measures of merit vice effectiveness, but the terms are interchangeable. For consistency, measures of effectiveness is used here.

⁵⁰ Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military*, Cornell Studies in Security Affairs (Ithaca: Cornell University Press, 1991), 35.

misunderstood.”⁵¹

In his examination of intelligence performance in the air campaign against Germany, Rosen found measures of effectiveness were not considered prior to the war, but this was a less significant driver than the challenges of building new air-intelligence functions in wartime, especially given the dearth of information from which to build targeting plans and to assess the economic effects of bombing.⁵² As result, he found targeting was not successful until the final year of the air campaign, but “the errors of the men and women doing the work of target selection in World War II cannot be attributed to any gross bureaucratic or intellectual failures.”⁵³ Might a deeper look show that AAF leadership had, in fact, considered measures of effectiveness for strategic bombing? Were there intense bureaucratic challenges and intellectual biases at play?

Scott Gartner’s interpretation varies slightly from Rosen’s. He adds an additional stipulation that different organizations may interpret information differently or choose to interpret different information from available sources, which may drive their assessments out of sync with each other.⁵⁴ Although he does not look specifically at bombing in World War II, he concludes that military organizations do incorporate new information into their strategic preferences. “Organizations update their beliefs about the efficiency and

⁵¹ Ibid.

⁵² Ibid., 180-181.

⁵³ Ibid., 170.

⁵⁴ Scott Sigmund Gartner, *Strategic Assessment in War* (New Haven, CT: Yale University Press, 1997), 2-3, 8.

likelihood of success of their strategies,” Gartner concludes, “both during and after conflicts.”⁵⁵ In what ways did air intelligence organizations select from available information and did they voice concerns about information they lacked? Did they tend to update their perspectives as they discovered new or conflicting information, or did they tend to seek information that confirmed existing beliefs? Barbara Spellman, in a book produced by the aptly yet verbosely-named *Committee on Behavioral and Social Science Research to Improve Intelligence Analysis for National Security*, cautions against sources of confirmation bias: “They include (1) only searching for information that is consistent with one’s favored hypothesis; and (2) devaluing, ignoring, or explaining information that is not consistent with one’s favored hypothesis.”⁵⁶ Might a close evaluation of air intelligence show a tendency toward confirmation bias, or were early air intelligence organizations aware of such a possibility?

The Collapse of the German War Economy, 1944-1945, by Alfred C. Mierzejewski, presents another brilliant facet related to this study. He argues that coal, among all potential targets, was the one indispensable resource for the German economy. Mined in abundance from Germany’s Ruhr and Upper Silesia regions, coal heated the iron-smelting furnaces and supplied the synthetic fuel plants, yet it had to be transported across the vast arteries of the

⁵⁵ Ibid., 164.

⁵⁶ Barbara A. Spellman, “Individual Reasoning,” in *Intelligence Analysis: Behavioral and Social Scientific Foundations*, ed. Baruch Fischhoff and Cherie Chauvin (Washington, DC: National Academies Press, 2011), 129.

Deutsche Reichsbahn.⁵⁷ As the air offensive progressed into its final stages, attacks on marshalling yards, he contends, finally succeeded in dislocating the German economy from its precious energy source.⁵⁸

Mierzejewski finds that competition and discord among intelligence organizations stymied air-campaign effectiveness. For example, “the Americans, EOU in particular,” he argues, “were guilty of mirror-imaging and bureaucratic egotism of unusual dimensions,” as they aligned unquestioningly to their leaders’ unsupported faith in bombing.⁵⁹ Because of their failure to cooperate, Allied Intelligence organizations overlooked available information and perpetuated poor assumptions.⁶⁰ As a result, they failed to overcome Harris’ and Spaatz’s misguided predilections. Only Sir Arthur Tedder’s serendipitous leadership and political savvy, backed by Solly Zuckerman’s bombastic personality and organismic views of German industry, could combine to surmount “the prevailing atmosphere of interservice, interoffice, and inter-Allied conflict” prevalent among intelligence organizations.⁶¹ Indeed, Mierzejewski’s appraisal of air intelligence was remarkably harsh.

Mierzejewski’s study carves an edge between air-campaign success and air-intelligence rivalry, but there are informative matters beyond his scope and fundamental questions he left unanswered. Might a deeper look into the

⁵⁷ Alfred C. Mierzejewski, *The Collapse of the German War Economy, 1944-1945: Allied Air Power and the German National Railway* (Chapel Hill, NC: University of North Carolina Press, 1988), xii, 22, 29, 34.

⁵⁸ *Ibid.*, 184.

⁵⁹ *Ibid.*, 180-181.

⁶⁰ *Ibid.*, 76, 102, 180.

⁶¹ *Ibid.*, 180.

organizations strengthen his argument or refine its applicability? With respect to bombing, his study trains its gaze on events after spring of 1944 with only the occasional backward glance to pre-1944 events to compare industrial production and transportation throughput. If the COA's civilian experts had, in fact, recognized coal as "perhaps the most important single item" at a meeting in 1942, why had it not received commensurate priority?⁶² Were there factors shaping air intelligence rivalry that Allied leaders might have identified and alleviated earlier?

William Odom, a former Army 3-star general and Director of the National Security Agency, published a candid exposé of the U.S. intelligence enterprise, *Fixing Intelligence*, in 2003. His discussion centered on intelligence-doctrine inadequacies, structural challenges, and complex relationships among civilian and DoD agencies, for which he recommends a number of broad reaching changes. However, the logic underlying his observations most contributes to the study of Intelligence. Odom teases out a logic explaining the tension and tendencies that shape behavior of intelligence organizations depending on the degree of autonomy provided to them.⁶³ Odom's take acknowledges, yet extends beyond, conventional arguments that peacetime military organizations reject assessments contrary to their preferred doctrine, while in wartime they are more open to contrary feedback because lives are on the line.⁶⁴ In his view,

⁶² *Meeting Minutes*, War Department, (Maxwell AFB, AL: AFHRA, 15 December 1942), #118.151-1, IRIS 110545.

⁶³ William E. Odom, *Fixing Intelligence: For a More Secure America* (New Haven, CT: Yale University Press, 2003), 37-44.

⁶⁴ *Ibid.*, 38. As a case to Odom's point, Posen suggests militaries prefer to cast their

intelligence organizations subordinated to their user's operational missions tend to provide biased analyses favoring their user's desires. Alternatively, intelligence organizations afforded a high degree of autonomy tend to take on their own biases. To what extent does this argument hold true for air intelligence as it formed in World War II?

Odom does not offer granularity as to the drivers of external or internal biases, but he does posit two corrective tendencies. According to Odom, corrections occur to intelligence bias when enemy action exposes invalid assessments or when analysts independently buck the system with contrarian discoveries.⁶⁵ Among these two corrective agents, enemy interaction is the stronger factor; whether or not objective assessments are rewarded by an autonomous hierarchical intelligence organization depends largely upon its culture.⁶⁶ Odom finds little value in "competitive analysis"—a method of pitting intelligence organizations against each other—which he argues leads to greater parochialism without improving intelligence.⁶⁷ The right balance of competition and cooperation remains elusive. In his final analysis, intelligence

environment in terms that increase their budgets, reduce uncertainty, and extend their autonomy, all of which depend on control over information with respect to their civilian masters. Because intelligence organizations necessarily play a role in describing the external environment, they are incentivized to produce analyses consistent with doctrinal preferences since such analyses are more likely to be selected. See: Barry Posen, *The Sources of Military Doctrine: France, Britain, and Germany Between the World Wars*, Cornell Studies in Security Affairs (Ithaca: Cornell University Press, 1984), 45-46; Rosen elucidates wartime innovation similar to Odom's take. For example, Rosen argues military wartime innovation may be stimulated because "the organization is suffering casualties in battle, and the morale and composition of the leadership is effected by that reality." See: Rosen, *Winning the Next War: Innovation and the Modern Military*, 22.

⁶⁵ Odom, *Fixing Intelligence: For a More Secure America*, 39.

⁶⁶ Ibid.

⁶⁷ Ibid.

organizations *should* be subordinated to a civil or military command authority, but their behavior must be influenced by rewarding intellectually honest assessments—"the unvarnished truth."⁶⁸

Finally, Jurgen Brauer and Hubert Van Tuyll, in *Castles, Battles, & Bombs*, combine Brauer's background as a peacetime economist and Van Tuyll's military-history acumen to explain military history using economic theory.⁶⁹ Among their several cases and explanatory concepts, they argue from a self-described "skeptical look at the promise of strategic bombing" that the air offensive over Germany in World War II exemplified the principle of diminishing marginal returns.⁷⁰ In other words, more resources applied to bombing led to proportionally fewer gains toward achieving its objectives. Did air-intelligence assessments support the authors' conclusions about diminishing returns, or might bombing under some circumstances instead show economies of scale—that more bombing actually achieved proportionally greater results at reduced marginal cost?

To make their case, the authors rely heavily on United States Strategic Bombing Survey (USSBS) data, which they scope to 1944—the period after Eisenhower had steered air-campaign priorities toward invasion preparation.

⁶⁸ Ibid., 40.

⁶⁹ See: Danielle Harris, "GRU professor inducted into Morehouse College's Collegium of Scholars," Augusta University, Accessed 10 January 2017, <https://jagwire.augusta.edu/archives/15381>; Hubert Van Tuyll, "Augusta University Faculty and Staff," Augusta University, Accessed 11 January 2017, <http://www.augusta.edu/pamplin/hist-anth-phil/faculty/hvantuyll.php>.

⁷⁰ Brauer and Van Tuyll, *Castles, Battles, & Bombs: How Economics Explains Military History*, 213.

During this period, aircraft-production targets and other industries ranked below transportation targets in hopes of dislocating German reinforcements. Awkwardly, Brauer and Van Tuyll hold bombing results accountable to AWPDP-1, the plan produced before America entered the war rather than the plan in effect at the time.⁷¹ But what of the period before 1944? What did intelligence analysts suggest with respect to targeting the Luftwaffe and was it accurate?

The preceding literary review is neither comprehensive nor definitive, but serves as a representative sample of the important works directly relating to this study's aims. Many other relevant works are further discussed, woven into notes, or informative to this study as it unfolds. In addition, many of the foregoing questions and a multitude of others have answers that may appear a bit different after an objective examination under the often-icy surface of air-intelligence organizational relationships.

⁷¹ Ibid., 213-215.

Chapter Summary

Chapter One breaks down the elements of an air campaign from a Clausewitzian model. Its purpose is to provide a framework for the historical narrative that follows by defining terms and showing how the pieces of air intelligence fit into an air campaign in the overall context of war. This study argues that the logic of war applies to air campaigns as well as to air intelligence. Effective air intelligence might increase an air campaign's efficiency and decrease the cost of war.

Chapter Two follows the emergence of independent airpower doctrine out of the “thoughts and dreams” of “birdmen” who believed in “modern bombers” and inter-service rivalry.⁷² Their efforts to prove the independent value of airpower intensified along with inter-war budgetary constraints and war preparations. Nearly every key decision-maker during the ensuing era of wartime officer promotions was an Air Corps Tactical School graduate—indeed, most had been instructors there together. The notable exception was General Henry H. “Hap” Arnold, an airpower pioneer in his own right and the sometimes-revered leader of them all.⁷³ The chosen few aviators, too under-

⁷² Henry Harley Arnold and Ira Eaker, *This Flying Game*, Reprinted, January 1940 ed. (New York and London: Funk & Wagnalls, 1936), xvii, 3, 131.

⁷³ ACTS graduates are noted as such throughout the text. As for Arnold, his path was shaped as one of the Army Signal Corps' first two pilots. With the possible exception of his rivalry with Frank Andrews (until Andrews' untimely death), Arnold's political savvy served to place him atop the Air Corps. See: Henry Harley Arnold, *American Airpower Comes of Age*, ed. John W. Huston, vol. 2, General Henry H. “Hap” Arnold's World War II diaries (Maxwell AFB, AL: Air University Press, 2001), 4. Also: James Parton, *Air Force Spoken Here: General Ira Eaker and the Command of the Air*, ed. Air Force Historical Foundation, Reprint ed. (Maxwell Air Force Base, AL: Air University Press, 2000), 254-255.

resourced to evaluate thoroughly their inter-war assumptions, honored old relationships as they attempted to guide every aspect of AAF expansion including their burgeoning air-intelligence apparatus. Chapter two closes with the birth of the AAF's internal air-intelligence program as it squirmed between the weight of a dogmatic War Department and AAF leadership who were more interested in owning it than nourishing it. Army control over intelligence sources and priorities left the AAF hamstrung from producing independent war plans.

Chapter Three explores the British experience with inter-war air intelligence, which evolved of two distinct phases: one of dashing ingenuity and another of structured science. The British leaned heavily on photographic evidence while the AAF leaned heavily on the British. Both were hampered as much as they were aided by the photograph as well as the mind behind the camera's eye.

Chapter three continues by diving into the AAF's effort to train its own intelligence cadre to meet wartime demands. Plagued with challenges of a hastily assembled, disconnected, and poorly-led school, the AAF was left with a false choice between quantity and quality of students. Meanwhile, its graduates often failed to garner credibility with aircrew or with allied counterparts. Where expertise, education, and commitment of its trained air intelligence personnel fell short, the AAF outsourced its needs with two methods: wholesale adoption of external agencies and piecemeal incorporation of civilians into chartered committees. Both methods are addressed by the following two chapters, in

turn.

Chapter Four examines air intelligence augmented by agencies external to the AAF. The Office of Strategic Services (OSS) forms the core of a partnership between its London-based Enemy Objectives Unit (EOU), Spaatz's (then Eaker's) Eighth Air Force, and the prodigious British Ministry of Economic Warfare (MEW). Offering its economic brainpower along with inroads to other American intelligence organizations, the EOU expanded the Office of Strategic Services' influence and secured connections to British intelligence. New partnerships emerged with new rivalries and competing interests—both organizational and personal.

Chapter Four continues with the advent of the Operations Research Section (ORS) in Eighth Air Force, as another blended civilian-military organization lends its effort into an ill-defined space between intelligence and operations. Its lawyers, architects, mathematicians, and engineers formed various staff sections and added their hands into the grist of CBO analysis and decision-making. Eaker's planners and subordinate commanders rely on their inputs, for better or worse, as the researchers focus on improving bombing accuracy in an effort to keep the costs of the air campaign from exceeding the gains.

Chapter Five returns to Washington as AAF leadership leveraged civilian outsiders within its midst. In forming the Committee of Operations Analysts (COA), General Arnold sought ready-made expertise for target planning and credibility for his bombing doctrine. The COA maneuvered to ensure its survival then brought unintended consequences as it became another actor

vying for influence.⁷⁴ A task from General Arnold pits various air-intelligence entities into the throws of developing Major General Ira Eaker's air-campaign plan in a context of political, allied, inter-service, and organizational preferences over targeting priorities. These aspects along with operational limitations—some understood, others then imperceptible—combine to frustrate bombing efficiency as Eighth Air Force and British Bomber Command couple a slow start for bombing with a slow start for learning.

Meanwhile, Operations Research in Eighth Air Force spins off a Bombs and Fuzes subsection to aid in bomb selection. A close look at Eighth Air Force's raids on submarine shipyards sheds light on the challenges, successes, and organizational interests at play. Finally, Eaker receives unrequested assistance from Washington, and he begins assembling his plan for the Combined Bomber Offensive.

Chapter Six follows intelligence support to Eaker's plan as he develops and defends its phases and assumptions to the Joint Chiefs then the Combined Chiefs in Washington in May 1943. Between April and July, Eaker's attempts to increase intensity and depth of his raids, which are met with increased resistance from the Luftwaffe. EOU tries to steer the bombing effort toward

⁷⁴ As a new organization functioning in a "highly elaborated institutional environment" such as the War Department, the COA's near-term survival would depend upon establishing its conformity and legitimacy with respect other institutions in its environment. This means that, at least in the near term, an imperative to function collaboratively with other intelligence organizations would be more important than internal controls such as "productive efficiency." Playing well with others would trump perfecting its reports. Also, to the teams detriment, the primacy of pilots in the Air Corps transferred as a behavioral norm into committee dynamics. This would give Sorensen an unnecessary degree of authority even in ad hoc discussions. See: John W. Meyer and Brian Rowan, "Institutionalized Organizations: Formal Structure as Myth and Ceremony," *American Journal of Sociology* 83, no. 2 (1977): 352.

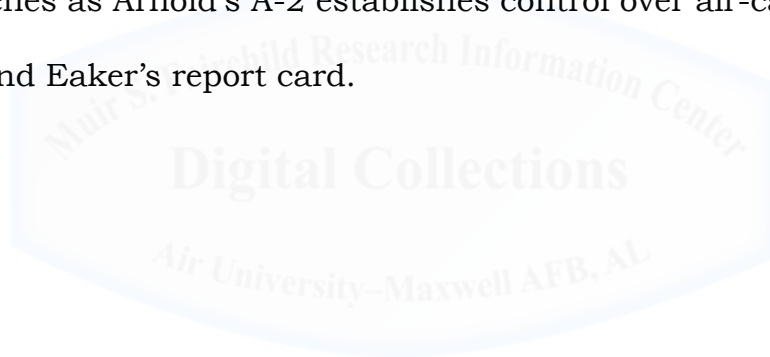
aircraft-assembly plants while Eaker tries to minimize his losses. Raids on Kiel, Hls, and Hamburg show the dynamics and frustrations of aircrew, Group-level intelligence officers (S-2s), and photo-interpreters as they aim to improve and report on bombing effectiveness.

Chapter Seven explores the fight to control assessments as the limits of America's industrial capacity and the demands of the War Department's invasion plan begin to reflect in the bottom of the available manpower pool. The Washington-based intelligence staff is called upon to assess CBO progress and to project its outcome on German war-making potential. In the context of a series of meetings with the Allied Combined Chiefs of Staff to determine future strategy, the various faces of air intelligence offer competing campaign-level assessments.

Chapter Seven then brings the second phase of the CBO and all of the various intelligence organizations into a broader spotlight. A series of raids on German industry including Ploesti and the Schweinfurt-Regensburg mission add nuance to targeting and assessment preferences from aircrew and Group S-2s through their higher headquarters as well as the differing perspectives among those responsible for bomb-damage assessment. Finally, various British intelligence entities vie for influence and prestige over an unexpected and frightening new set of targets.

Chapter Eight culminates Eaker's command of Eighth Air Force through the late summer and fall of 1943. A series of raids unpacks additional nuance to air-intelligence interests as Eaker's bomber slip away from Pointblank's

primary objectives. Attacks on a V-weapon site fail to impress British intelligence entities as crews struggle with poor environmental conditions and poor planning. The following week, reconnaissance and BDA priorities falter in support Eaker's airdrome attack on Brussels/Evere in occupied Belgium. Later, his bomber crews experiment with blind bombing techniques with two raids on the port of Emden, as both the crews and the intelligence officers learn the limits of bombing and assessing through the weather. Finally, under pressure from Washington to prove results to Arnold and his analysts, Eaker returns his force to Schweinfurt. On the heels of this devastating raid, Eighth Air Force flinches as Arnold's A-2 establishes control over air-campaign assessment and Eaker's report card.



Chapter One: The Clausewitzian Air Campaign

*The aim of a nation in war is, therefore, to subdue the enemy's will to resist with the least possible human and economic loss to itself.*⁷⁵

—Sir Basil Henry Liddell Hart, 1925

*The formulation of bombing policy is a fairly complex subject. It demands the combination of a massive flow of intelligence, with a feeling for changing bombing capabilities, and the changing sequence of war strategy and timing, in its broadest sense. The fact that this intellectual process related directly to violent acts of war gave to it, at the time, extraordinary point and vitality.*⁷⁶

—Economist Walt Rostow, Enemy Objectives Unit, Sep 42 – Apr 45

This chapter aims to deconstruct an air campaign into a useful analytical framework. It begins by introducing the range of targeting theories. It then defines and breaks down an air campaign into three qualities derived from Prussian-military theorist Carl von Clausewitz's views on the unchanging nature and mutable character of war.⁷⁷ Clausewitz's views of war also guide the thoughtful study and conduct of air campaigns. This proposed framework argues for the importance of assessment and concludes by further unpacking assessment with an emphasis on its definition, scope, and challenges relevant

⁷⁵ Basil Henry Liddell Hart, *Paris or The Future of War*, ed. Oliver Wendell Holmes, Today and Tomorrow Series (New York, NY: E.P. Dutton, 1925), 19.

⁷⁶ W. W. Rostow, *OSS War Diary Vol. 5, 13 September 1942 - 30 April 1945*, in *Economic Outpost With Economic Warfare Division R&A Branch*, 5, (Maxwell AFB, AL: AFHRA, ca. 30 April 1945), #520.056-167, IRIS 1075566, 10.

⁷⁷ Although the origins of manned flight, often associated with Jean de Rosier's 1783 ascent in a Montgolfier hot-air balloon, coincided with Clausewitz' lifetime, the author accepts that the aerial dimension of combat did not appear with meaningful influence on the battlefield until the American Civil War. Nonetheless, Clausewitz' theory applies to any medium of conflict. For a brief history of the origins of aerial reconnaissance, see: Air Ministry, *Photographic Reconnaissance, Vol. 1, to April 1941*, Air Historical Branch, (Kew, London: UK National Archives, 1945), AIR 41/6, 1-5.

to this study.

Targeting matters. As war continues to be “an act of violence,”⁷⁸ the question of *what should we strike?* remains a central concern and a well-plowed acreage of study related to the application of airpower. This is the question of targeting, which is as old as the idea of hurling a projectile through the air. Across the gamut of airpower theorists, targeting for independent airpower objectives is of variable importance, with differing linkages to victory. Three examples are representative of this range of targeting perspectives:

Giulio Douhet’s 1921 theory bookended one extreme, in which he postulated, “the complete destruction of the objective has moral and material effects, the repercussions of which may be tremendous.”⁷⁹ For Douhet, selection and destruction of objectives, including not only “industrial and commercial establishments,” but also “designated areas of the civilian population as well,” led to certain victory—all facilitated by command of the air.⁸⁰ An air force with control over enemy skies could also sever the vital supply lines of the opposing army and navy on its way to achieving an independent victory.⁸¹ Command of the air is everything for Douhet. Destroy the enemy air force first, not only in the air, but also on its airfields, in maintenance, and in production.⁸² In short, own the sky above the enemy,

⁷⁸ Carl von Clausewitz, *On War*, ed. and trans. by Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1984), 90.

⁷⁹ Giulio Douhet, *The Command of the Air*, ed. Joseph P. Harahan and Richard H. Kohn, trans. Dino Ferrari (1942; repr., Tuscaloosa, AL: The University of Alabama, 1998), 20, 25.

⁸⁰ Ibid.

⁸¹ Ibid., 192.

⁸² Ibid., 24, 103-106; David R. Mets, *The Air Campaign: John Warden and the Classical*

destroy what the enemy values, and victory would be assured.

Colonel John A. Warden III extended Douhet's theory with a more prescriptive approach to targeting, and he guided its operational planning debut as the Instant Thunder air-campaign portion of Operation Desert Storm.⁸³ Warden developed his targeting construct around simultaneous attacks on enemy centers of gravity. These he organized into concentric rings of increasing importance with enemy leadership at the center.⁸⁴ Warden deemphasized direct attacks on civilian population centers, instead seeking to complement his main effort to "isolate and incapacitate the national leadership" with psychological operations aimed toward both enemy troops and civilians.⁸⁵ With an eye toward war termination and casualty mitigation for both sides, Warden sought to influence the enemy mind with both leaflets and bombs.

Warden also broke traditional ideas about *interdiction* into three categories—close, intermediate, and distant. This last category sought "decisive outcomes affecting the whole theater" by disrupting enemy industry and "the

Airpower Theorists, Rev. ed. (Maxwell, AL: Air University Press, 1999), 13.

⁸³ John Olsen offers an in-depth history of Warden's role in campaign planning for Instant Thunder and its subsequent incorporation into Desert Storm in January 1991. See: John Andreas Olsen, *John Warden and the Renaissance of American Air Power* (Washington, DC: Potomac Books, 2007), 140-246.

⁸⁴ John A. Warden, *The Air Campaign: Planning for Combat*, National Defense University Press, (Washington, DC: National Defense University Press, 1990), 10, 138-139; Warden's use of centers of gravity is borrowed from Clausewitz. Warden easily accepts that an enemy has multiple centers of gravity, but suggests they must each be targeted if they are accessible. Clausewitz, on the other hand, suggests multiple centers of gravity should be traced "back to a single one." See: Clausewitz, *On War*, 595-596, 619.

⁸⁵ Olsen, *John Warden and the Renaissance of American Air Power*, 109, 149, 164, 191.

source of men and materiel.”⁸⁶ Distant interdiction also required the most patience and skill to assess. In its totality, Warden’s schema for concentration and precision pushed the boundaries of 1990’s Air Force doctrine and technology to the limit by relying on an as-yet-undemonstrated combination of stealth, precision weapons, aerial refueling, and forward-basing.⁸⁷

Warden pushed boundaries for joint collaboration through his emphasis on air superiority and battle-damage assessment. As to the air-superiority mission, Warden was unequivocal. All appropriate force should be applied to gain air superiority first—it was the primary mission, and it wasn’t just an Air Force challenge. Both land and sea forces, as Warden saw it, should contribute to establishing requisite control of the air.⁸⁸ Further, “no other operation should be commenced if it is going to jeopardize the primary mission,” Warden declared, “or is going to use forces that should be used to attain air superiority.”⁸⁹

The way Warden related air superiority to air-campaign targeting is an important concept. In Clausewitz’s theory, only offensive operations are positive aims in war. “The aggressor has a positive aim, while the defender’s aim is merely negative,” Clausewitz argued, adding, “positive action is therefore proper to the former since it is the only means by which he can achieve his ends.”⁹⁰ The crux is whether offensive action to disarm an enemy’s ability to defend air

⁸⁶ Warden, *The Air Campaign: Planning for Combat*, 1990, 94-95.

⁸⁷ Olsen, *John Warden and the Renaissance of American Air Power*, 157, 189.

⁸⁸ Warden, *The Air Campaign: Planning for Combat*, 1990, 18, 38.

⁸⁹ *Ibid.*, 36.

⁹⁰ Clausewitz, *On War*, 216.

attack is inherently a positive or a negative aim. Warden interpreted such offensive action as a positive aim, which forced an enemy “to devote more of his resources to defense.”⁹¹ Air-superiority targets were inherently offensive because they were necessary to secure the aims of an air campaign, even though air superiority was not necessarily “an end in itself.”⁹²

Finally, Warden’s emphasis on simultaneity and targeting for strategic effect stirred controversy with the Defense Intelligence Agency (DIA), whose analysts preferred to focus on visible damage and “straight-forward mathematical analysis.”⁹³ As Warden saw it, old analysis methods tended to underestimate second-order and inter-related effects. Airpower need not always be the primary force, however. While targeting and air superiority were the keys to Warden’s idea of victory, he also allowed for airpower to assume a supporting role, depending on the context of a conflict.⁹⁴

On the other end of the shelf are examples of modern theorists whose thoughtful study spanning more than a century of airpower leads to more muted conclusions. For example, Colin Gray cautions that “airpower may well be judged the decisive enabler of overall victory in a war, but rarely will it be able to deliver that success by conclusive strategic virtue of its own unaided

⁹¹ Warden, *The Air Campaign: Planning for Combat*, 1990, 13-14, quote on 25.

⁹² Ibid.

⁹³ Olsen, *John Warden and the Renaissance of American Air Power*, 235.

⁹⁴ Mets generously characterizes Warden's theory as "less vitriolic on the subject of the role of the other armed services than were the other classical theorists." Mets nevertheless recognizes Wardens emphasis on air superiority and cases when airpower might win alone. See: Mets, *The Air Campaign: John Warden and the Classical Airpower Theorists*, 59-62. Also: Clayton K. S. Chun, *Aerospace Power in the Twenty-First Century: A Basic Primer*, ed. Air University (2001; repr., Maxwell Air Force Base, AL: U.S. Air Force Academy in cooperation with Air University Press, 2010), 66-67.

kinetic effort directed by a brilliant, or even just good enough, targeting strategy.”⁹⁵ Gray was concerned that targeting, as a central element of airpower strategy, gives its kinetic role unwarranted prominence, thus leaving other roles “shortchanged in appreciation.”⁹⁶ To the extent that war has a violent component (or at least a credible threat thereof), targeting—the dissection of enemy capability into vulnerable air objectives—remains fundamental.⁹⁷ How closely its objectives might lead to victory depends upon all of the factors discussed below as they influence the conduct of air campaigns.

Before unpacking the air campaign, it is important to highlight a couple of terms and concepts: *strategic bombing* and *interdiction* have enjoyed dynamic and inconsistent denotation as airpower doctrine has evolved, and they have further done so since David Mets published *The Air Campaign* nearly two decades ago.⁹⁸ For practical purposes, *strategic bombing* refers to independent air attacks against enemy war-making capability, except for *interdiction*, which specifies attacks intended to interfere with transportation of enemy military capabilities before they can be used against friendly forces.⁹⁹ The distinction is important academically because the two missions may involve different types of

⁹⁵ Colin S. Gray, *Airpower for Strategic Effect*, Air University Series on Airpower and National Security (Maxwell Air Force Base, AL: Air University Press, February 2012), 294-295.

⁹⁶ Ibid.

⁹⁷ The scope and focus of this study on the role of air intelligence in kinetic air campaigns is in no way intended to cheapen the contributions of other airpower missions or the millions of Airmen who have participated in them.

⁹⁸ Mets, *The Air Campaign: John Warden and the Classical Airpower Theorists*, 7.

⁹⁹ This definition is simplified from current joint doctrine. The joint definition is muddled with jargon whose only purpose is to delineate programmatics, rules of engagement, and bureaucratic responsibilities without adding useful academic clarity. See: Department of Defense, *Joint Publication 3-03: Joint Interdiction*, 9 September 2016).

targets and desired objectives; the distinction is important operationally because attacks on the different types of targets often require different capabilities (especially if the targets are moving). Air campaigns comprise both missions, while interdiction targets increasingly come into play with ongoing or impending ground operations. Ground operations tend to drive airpower objectives into a supporting role, with Close Air Support (CAS) at the other end of the spectrum from strategic bombing. Close Air Support missions are not considered part of an air campaign for the purpose of this study.

In their purest form, air campaigns may be independent or supported by other military operations. In either case, they are disconnected from direct results on the battlefield, wherein both the choice of targets and post-strike assessment are determined by (borrowing from J.C. Wylie) “the man on the scene with the gun.”¹⁰⁰ In an independent air campaign, air planners determine objectives and link targets to national security goals. Air intelligence informs target selection and conducts assessments. This definition is not intended as a dogmatic or service-centric viewpoint, except to acknowledge that supported-supporting relationships drive warfighting approaches even if these relationships tend to blur increasingly with truly joint operations. Nevertheless, the color of uniform of the person in charge matters more than it should and the background and experience of the commander informs assessment and decision-making in any use of military power.

¹⁰⁰ J. C. Wylie, *Military strategy: A General Theory of Power Control* (Annapolis, MD: Naval Institute Press, 1989), 72.

Air campaigns are a clash of wills. Aircraft and weapons are the tools of air campaigns, but they determine outcomes only insofar as they facilitate the clash of wills. Clausewitz proposed that victory depends upon each side's influence through force to "overcome the enemy's will."¹⁰¹ To this end, human nature limits how well we can know ourselves and the enemy at the onset of hostilities. The air campaign is an experience through which both belligerents learn of themselves and of each other in order to maximize their own advantages, and nullify their own weaknesses, all while negating the opponent's strengths and exploiting his weaknesses. The air campaign unfolds as a struggle for knowledge, so striking the right targets the first time may not be a realistic expectation or as important as learning and adapting to the enemy during an air campaign.

If an air campaign is a series of attacks waged against *an enemy's will to resist*, should we not target the enemy's war-making capability? Can an enemy offer resistance without the ability to fight? If resistance lies in the mind, then do war-making capabilities matter if they only reinforce the enemy's will with military options? To strip an opponent of war-making capability may sap his will, but methods of doing so may be costly and the aims of war must be considered.¹⁰²

¹⁰¹ Clausewitz, *On War*, 94.

¹⁰² In other words, the desired ends inform the selection of efficient ways and means. An air campaign is a means applied in particular ways and not an end in itself. Clausewitz' idea that "effectiveness relates not to the means but to the end," extended to Liddell Hart and carries into modern works. See: *ibid.*, 97. Basil Henry Liddell Hart, *Strategy*, 2nd rev. ed. (New York, NY: Meridian, 1991), 325, 335. Note Yarger's concern that "Strategy must reflect a preference for effectiveness... Objectives determine effectiveness; concepts and resources are measured in

As to this relationship between the aims of war, military objectives, and political will, Clausewitz offered:

*“The political object—the original motive for the war—will thus determine both the military objective to be reached and the amount of effort it requires. The political object cannot, however, in itself, provide the standard of measurement... [except] if we think of the influence it can exert upon the forces it is meant to move.”*¹⁰³

So a military force responds as it is ordered and aligns its objectives to a nation's political goals. But this isn't always possible regardless of the scale of political will and the resources a nation is willing to move. Military forces evolve, but they offer near-term capabilities based on existing doctrine, training, and technology. “In other cases the political object will not provide a suitable military objective,” Clausewitz suggests. “In that event, another military objective must be adopted that will serve the political purpose and symbolize it in the peace negotiations.”¹⁰⁴ The implication is a give-and-take between political goals and military reality. For what political purposes is an air campaign suited? When can it symbolize other purposes? When must another military objective replace an air campaign? Are there consequences of committing a military to pursue political objectives for which it is ill-designed?

Clausewitz addressed questions of war aims as he employed his dialectic to

efficiency.” See: Harry R. Yarger, *Strategy and the National Security Professional: Strategic Thinking and Strategy Formulation in the 21st Century* (Westport, CT: Praeger Security International, 2008), 136. A problem with Yarger's concern for clear objectives and end-states with efficiency subordinated to effectiveness, is that this view inclines military advice away from broader considerations of war's total costs in the continuum of strategic decision-making.

¹⁰³ Clausewitz, *On War*, 81.

¹⁰⁴ Ibid.

differentiate his theory of total war from reality. Not every war has total aims, he cautioned, but “if we wish to gain total victory, then the destruction of [an enemy’s] armed forces is the most appropriate action and the occupation of his territory only a consequence.”¹⁰⁵ Clausewitz, who penned the parts of his magnum opus, *On War*, before the advent of offensive airpower, envisaged total victory only as the result of a ground campaign. In theory, although battle was the “bloodiest solution,” its importance was “rather a killing of the enemy’s spirit than of his men.”¹⁰⁶ In total war, it was necessary to disarm the enemy and to destroy his regenerative capacity. Enemy resistance would inevitably diminish as the opposition claimed his land and resources. In reality, however, war might have lesser political aims or a protracted conclusion since it was human nature to elude the decisive battle.¹⁰⁷ Wars tend to drag out while the enemy still had options.

The advent of airpower begged a new interpretation. Perhaps the air campaign ushered in a new character of war. B.H. Liddell Hart, who later critiqued Clausewitz for leading his “less profound disciples to confuse the means with the end,” offered such an interpretation.¹⁰⁸ Victory over the enemy mind came from insurmountable advantage not from a contrived necessity for decisive battle, arguing that “dislocation is the aim of strategy.”¹⁰⁹ Liddell Hart observed, in 1925, that Germany had surrendered in World War I “when her

¹⁰⁵ Ibid., 92.

¹⁰⁶ Ibid., 259.

¹⁰⁷ Ibid., 90, 250, 259.

¹⁰⁸ Liddell Hart, *Strategy*, 319.

¹⁰⁹ Ibid., 325.

armies were still powerful and her borders were still intact”—a pleasant prospect to the minds of the lead planners for an air campaign against the same country two decades later.¹¹⁰ German political will had been broken, but neither total annihilation nor occupation was necessary. Exhausted of manpower, food, and materiel, Germany sued for peace due more to economic dislocation and political turmoil than military decision.¹¹¹ To the entrenched land armies, airpower had have seemed an entertaining sideshow, but air-minded visionaries portended of bombers that could bypass the defensive stalemates in this new era of warfare and strike directly at an adversary's economy.

In the ensuing inter-war years, societies and their economies became increasingly dependent upon modernizing and expanding industry, and airpower seemed uniquely suited to exploit the vulnerabilities of an industrialized nation. As one air-campaign planner saw it, strategic bombers could simultaneously target a nation's military capability and her will by toppling her industry, while the loss of either would lead to defeat—all without setting foot on enemy soil.¹¹² Viewed through either theory of victory,

¹¹⁰ Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington, DC: Office of Air Force History, 1986), 3.

¹¹¹ John Horne, *State, Society, and Mobilization in Europe During the First World War*, Studies in the Social and Cultural History of Modern Warfare (Cambridge: University Press, 1997), 2-5; Avner Offer, *The First World War: An Agrarian Interpretation* (New York: Oxford University Press, 1989), 23, 77; Richard Wall and J. M. Winter, *The Upheaval of War: Family, Work, and Welfare in Europe, 1914-1918*, 1st pbk. ed. (Cambridge: Cambridge University Press, 2005), 37-40; Ian Cawood and David McKinnon-Bell, *The First World War*, (London, UK: Routledge, 2001). 137-141; Michael Howard, *War in European History*, Updated ed. (New York, NY: Oxford University Press, 2009), 113-115.

¹¹² Hansell, *The Strategic Air War Against Germany and Japan: A Memoir*, 11, 19.

Clausewitz's decisive battle or Liddell Hart's strategic advantage, airpower brought with it the possibility of victory by imposing a higher cost on the receiving end of the bombs.¹¹³ The possibility then, untested but irrefutable in the minds of the Air Corps Tactical School's instructors, was that airpower offered victory at a much reduced cost—even in total war.

Air campaigns are iterative. Clausewitz also opined that “war is an act of human intercourse.”¹¹⁴ By this he incorporated two ideas: first, we are to understand that war comprises iterative transactions; and second, that it is subject to human nature. Air campaigns are iterative in that they are cyclical. The cycle repeats throughout the campaign with the issuance of commander's guidance, intelligence collected—analyzed—disseminated, operational plans developed, targets selected, units tasked, aircraft readied, sorties flown and debriefed (or interrogated), assessments accomplished, commanders briefed. Military doctrine divides this basic framework into a multitude of steps, delegated through varied lines of authority, and parsed into diverse functional organizations.¹¹⁵ Many steps can be accomplished concurrently or even dynamically, changing while aircraft are airborne to destroy emerging targets, re-prioritizing objectives, or reattacking a failed bomb run. This cycle might repeat in minutes for airborne aircraft, hours between strike packages, daily for

¹¹³ Clausewitz notes, it is always necessary “to influence the enemy's expenditure or effort...to make the war more costly to him.” See: Clausewitz, *On War*, 93.

Similarly, Liddell Hart argued that decision in battle should be sought “under the most advantageous circumstances in order to produce the most profitable result.” Liddell Hart, *Strategy*, 325.

¹¹⁴ Clausewitz, *On War*, 149.

¹¹⁵ Detailed doctrine examples are provided later in this section.

formal planning and tasking, or weeks (even years) as phases of a large-scale operation unfold.

Air campaigns are interactive. Air campaigns are interactive because they are a human endeavor subject to influences both external and internal to the actors waging the campaign. Externally, air campaigns interact with the security environment, physical environment, alliance politics, fiscal constraints, enemy behavior, and available technology. Air campaigns are also subject to internal influences such as civilian oversight, inter-service rivalry, doctrine, training practices, organizational behavior, and leadership personalities. Each step of an air-campaign cycle and each external and internal interaction is also subject to human nature.

Outcomes of human nature are especially pronounced as opposing military strategies clash. As Clausewitz said, “in war, the will is directed at an animate object that reacts.”¹¹⁶ In an air campaign, this means both sides learn as they interact and their context changes. Martin Van Creveld describes this paradoxical logic of strategy: “an action that has succeeded once will likely fail when it is tried for the second time,” and conversely, “an operation having failed once, the opponent may conclude that it will not be repeated.”¹¹⁷ As air

¹¹⁶ For an additional discussion of Clausewitz and paradoxical logic see: Edward Luttwak, *Strategy: The Logic of War and Peace*, Rev. and enl. ed. (Cambridge, MA: Belknap Press of Harvard University Press, 2001), 13-14. Clausewitz, *On War*, 149.

¹¹⁷ Martin Van Creveld, *The transformation of war* (New York: Free Press, 1991), 120. Luttwak proposes “the entire realm of strategy is pervaded by paradoxical logic,” a central theme of his important monograph. The idea is that strategy should not be viewed as linear cause and effect. See: Luttwak, *Strategy: The Logic of War and Peace*, 2. Beyerchen discusses a non-linear interpretation of Clausewitz in depth, see especially: Alan Beyerchen, “Clausewitz, Nonlinearity, and the Unpredictability of War,” *International Security* 17, no. 3 (1992-1993): 61-63.

forces tangle, they size each other up, seek advantages, minimize their own weaknesses, and exploit opportunities. Myriad examples obtain. Eighth Air Force successfully employed diversionary maneuvers during the Combined Bomber Offensive (CBO) by feinting toward previous targets such as submarine bases along the French coast. False routing drew a defensive response from German fighters, whose limited range and flight time ran out while bombers attacked their primary targets elsewhere.¹¹⁸

In other cases, responses stem from fear and lack of understanding an opponent's strategy. The Germans added three more meters of concrete to the already-impervious seven meters protecting their submarine pens at Lorient and St. Nazaire, despite the Allies having low expectations of penetrating.¹¹⁹ The Allies used the easily reachable targets more or less as practice. The back-and-forth response led to a competition of thicker concrete versus bigger bombs, though the Allies lacked the accuracy to achieve the necessary series of direct hits anyway. Another example of such interaction occurred with the Allied targeting of the Focke-Wulf aircraft factory at Bremen. The Germans had surreptitiously relocated equipment for FW190 production to Marienburg, which was further east and thus conducive to Luftwaffe protection. A British photo-interpreter argued post-war that the Germans continued to defend the

¹¹⁸ Wesley Frank Craven and James Lea Cate, eds., *The Army Air Forces in World War II*, vol. 2, *Europe: Torch to Pointblank, August 1942 to December 1943* (Washington, DC: Office of Air Force History, 1983), 330, 336.

¹¹⁹ Major Frederick Haas, *Factors in Germany's Defeat*, Prisoner of War Intelligence Section Headquarters Mediterranean Allied Air Forces, (Maxwell AFB, AL: AFHRA, 11 July 1945), #168.7026-7, IRIS 126465, 2; Col Richard D'Oyly Hughes, *Memoirs: Chapter VIII, 1941-1945*, USAF, (Maxwell AFB, AL: AFHRA, 1957), #520.056-234, IRIS 01075633, 25.

defunct plant at Bremen, giving the Allies a false sense that the location was still of strategic value, and resulting in considerable bomber attrition.¹²⁰

However, there was also value in the fact that Allied bombing forced the Germans to disperse aircraft production because of the resultant cost to German aircraft-production efficiency in addition to the aerial-combat losses to Luftwaffe fighters.¹²¹ The problem was that Eighth Air Force had intended to use its self-defending bombers to achieve air superiority by bombing aircraft production on its way to winning the war through destruction of German vital centers—not to fight a costly airborne-attrition campaign. Allied targeting plans also lacked actionable information about German dispersal plans and expeditious debris-cleaning at other Focke-Wulf plants, so re-attack timelines were haphazard.¹²²

Early recognition of enemy responses can help to optimize target selection with respect to the interaction of air-campaign strategies; this means assessments about poorly selected, excessively defended, or easily recuperated targets can be as useful as high-quality intelligence on alternative enemy vulnerabilities. The Focke-Wulf plant at Bremen was inside of 400 miles from London, so it was within P-47 escort range and Eaker considered it “accessible” (due more so to B-17 combat loading) even before Pointblank began, though he focused only upon Bremen’s potential productive capacity.¹²³ Had Eaker’s

¹²⁰ Ursula Powys-Lybbe, *The Eye of Intelligence* (London, England: W. Kimber, 1983), 140.

¹²¹ United States Strategic Bombing Survey, *Focke Wulf Aircraft Plant, Bremen, Germany*, ed. Aircraft Division, 2nd ed., No. 10 (Washington, DC: USSBS, 1947), 12.

¹²² *Ibid.*, 16.

¹²³ Maj Gen Ira C. Eaker, *Suggested Commentary... for The Combined Bomber Offensive From*

analysts helped to identify Bremen as a site for deliberate attrition battles, the Allies might have engaged with bombing feints, heavier escort, and a better-informed plan to avoid anti-aircraft artillery.¹²⁴

Air campaigns depend upon assessment. If these Clausewitzian dicta hold true, then it is the assessments, not the initial targeting plan, that matters most. In other words, to determine how best to amend a targeting plan—and no plan should be considered perfect at the outset, it is necessary to anticipate, observe, and respond to enemy reaction.¹²⁵ Thus, the corollary of the targeting question: *how can we strike better?* demands similar focus. A discussion on assessment to follow includes its definition, its purpose and scope, and its challenges. The current Joint lexicon defines assessment as: “a continuous process that measures the overall effectiveness of employing joint force

the United Kingdom, in *Personal Collection of Gen Henry H. Arnold part 3 of 6*, (Maxwell AFB, AL: AFHRA, ca. 16 April 1943), MICFILM 28253, IRIS 2053776, 1. Committee of Operations Analysts, *Report of Committee of Operations Analysts with Respect to Economic Targets Within the Western Axis*, War Department, (Maxwell AFB, AL: AFHRA, 8 March 1943), #118.04A-1, IRIS 110423, foldout 1; Maj Gen Ira C. Eaker, *Presentation: Plan for Combined Bomber Offensive From the United Kingdom*, in *Personal Collection of Gen Henry H. Arnold part 3 of 6*, Joint Chiefs of Staff (277), (Maxwell AFB, AL: AFHRA, 29 April 1943), MICFILM 28253, IRIS 2053776, v.

¹²⁴ Eighth Air Force' Operations Researchers produced an insightful yet untimely (far too late to help Eaker) report on 12 February 1944 summarizing approaches to minimize losses. For example, the report lamented bomber losses on the 8 October 1943 attack on Bremen: “213 of the 357 [aircraft] which returned after attacking were found to be damaged by flak, and a considerable number of the 30 [aircraft] lost that day may likewise be ascribed to flak.” See: Headquarters Eighth Air Force, *Reduction of Losses and Battle Damage: A Summary and Analysis of the Defensive Experience of VIII Bomber Command 17 August 1942 - 31 December 1943*, Operational Research Section, (Maxwell AFB, AL: AFHRA, 12 February 1944), #520.310-6, IRIS 220160, 24.

¹²⁵ Recall Moltke's famous quip: “Therefore no plan of operations extends with any certainty beyond the first contact with the main hostile force. Only the layman thinks that he can see in the course of the campaign the consequent execution of an original idea with all details thought out in advance and adhered to until the very end.” See: Helmuth Graf von Moltke, *Moltke on the Art of War: Selected Writings* (Novato, CA: Presidio Press, 1993), 92.

capabilities during military operations.”¹²⁶ The jargon is abstruse, but the important components are present. Assessment is an *ongoing evaluation of performance*, which may be both objective and subjective. Air Force doctrine adds additional specificity:

Assessment measures whether desired effects are being created, objectives are achieved, and next steps are evaluated. Effective planning and execution require continuing evaluation of the effectiveness of friendly and enemy action...

*...Planning for it begins prior to commencement of operations, takes place throughout planning and execution, and continues after the conflict is over.*¹²⁷

A further review of official Joint terminology reveals a slew of inter-related definitions that would offer little clarity here except to suggest that the nomenclature follows rather than leads organizational responsibilities. For example, *Combat Assessment* is broken into “(a) battle damage assessment [an intelligence responsibility]; (b) munitions effectiveness assessment [an operations responsibility]; and (c) reattack recommendation [both operations and intelligence, although nominally a planning function.]”¹²⁸ Stove-piped organizations espouse processes that separate their responsibilities rather than integrate them; this method avoids bureaucratic conflict. Finally, the term *Battle Damage Assessment* (BDA) refers only to the post-strike portion of

¹²⁶ Department of Defense, *Joint Publication 2-01: Joint and National Intelligence Support to Military Operations*, 05 January 2012), xx.

¹²⁷ United States Air Force, *Annex 3-60 Targeting*, (Maxwell AFB, AL: Curtis E. LeMay Center for Doctrine Development and Education., 2014).

¹²⁸ Joint Chiefs of Staff, *Joint Publication (JP) 1-02, Department of Defense Dictionary of Military and Associated Terms*, Department of Defense 8 November 2010 (amended 15 February 2016)), 16-17, 23, 38, 59, 159-160, 196, 198, 237.

assessment. In the broader sense intended by this study, assessment has matured to integrate all three into a coherent reporting process and to do so via its own joint doctrine, detailed cycle, phases, and cells with their own designated responsibilities.¹²⁹ As described in later chapters, these processes and the organizations that performed them developed separately.

With a sense of what assessment is, we move on to the scope of what it does. Assessment begins with an appraisal of the enemy, informs planning and target selection, relates objectives based upon gathered intelligence, monitors progress, and renders all aspects of post-strike analysis. The process includes the responsible organizations (who does it), their methods and outputs (how they do it and to whom they provide their analysis), as well as the technology and tools in place to support their tasks (what they use). Air Force and Joint doctrine incorporate assessment into procedures throughout their organizational hierarchy from the squadron level up through operational and Joint Force headquarters as well as the Air Staff level. Put otherwise, assessment starts before the beginning, never concludes, includes people, processes, and tools, and incorporates roles at all levels. It is a ubiquitous

¹²⁹ The term Bomb Damage Assessment (BDA) was used consistently during World War II among both British and US government agencies. Battle Damage Assessment subsumed the BDA acronym in US Joint Force lexicon in 1992 after the Defense Intelligence Agency formed a Battle Damage Assessment Working Group and published approved Joint terminology. See more at: Daniel Z. Sui, *Geospatial Technologies and Homeland Security: Research Frontiers and Future Challenges*, The GeoJournal Library (Dordrecht, Netherlands: Springer, 2008), 151. BDA doctrine can be found at: Joint Warfighting Center, *Commander's Handbook for Joint Battle Damage Assessment*, Office of the Secretary of Defense Joint Battle Damage Assessment Joint Test and Evaluation, (Suffolk, VA: United States Joint Forces Command, 1 June 2004); See also, John T. Rouch, "Assessing Airpower's Effects: Capabilities and Limitations of Real-Time Battle Damage Assessment" (2002), 20.

aspect of modern warfighting.

Assessment may inform not only progress toward objectives, but also the objectives themselves as an air campaign unfolds. Previous assumptions may become facts or be invalidated. Changing context can also alter the range of options available. Former Under Secretary of Defense for Policy Fred Iklé opined pithily, “new information leads to new (or reaffirmed) choices.”¹³⁰ Assessments may offer new opportunities for war termination, but that is not the time to initiate assessment. The idea captured in Air Force doctrine that assessment must be incorporated into planning before conflict is paramount—a lesson paid for with the lives of many airmen.

The work of assessment is not without its challenges. Such challenges may include: obtaining relevant information, selecting meaningful measures, and drawing valid conclusions, whether they hinge on objective or subjective methods. However, it is the subjective aspects of assessment that present the greatest risk. In fact, nowhere is human nature’s influence on an air campaign more evident than in assessing human actions. Deductions and inferences are necessarily subjective and thereby shaded by the assessor’s biases and imperfect knowledge. “To estimate others’ intentions, to predict the consequences of one’s own actions, to draw inferences from ambiguous information, one must employ less certain intellectual tools,” warns Robert Jervis.¹³¹ New information must compete with *a priori* expectations and past

¹³⁰ Fred Charles Iklé, *Every war must end*, 2nd rev. ed. (New York: Columbia University Press, 2005), 16.

¹³¹ Robert Jervis, *Perception and Misperception in International Politics* (Princeton, NJ: Princeton

experience. As assessments attempt to draw connections from bombs dropped to visible damage or other intelligence sources... to actual damage... to the effect on a specific target... to the effect on the class of target or industry... to an effect on enemy warfighting potential... to the enemy's will to fight, assessments become increasingly subjective and prone to bias. The deeper the assessments extend—and closer to the enemy mind—the more valuable they become if they are correct and more dangerous when they are wrong.

In air-campaign assessment, these perceptions, intuitions, assumptions, experiences, interactions, and decisions by actors on all sides (magnified further by coalition warfare) are ever-present. “The interactive nature of war makes assessment difficult,” wrote Scott Gartner in his monograph, *Strategic Assessment in War*, “because it adds many players, and actors need to formulate expectations on how they expect their adversaries to react.”¹³² This means effective air-campaign assessment is at least as much about understanding the minds of the various (friendly and enemy) actors as it is about capturing data on airstrikes.

Learning during an air campaign is largely an exercise in framing and reframing expectations. This is true not only for the commanding generals, but for all participants, especially those involved in planning and intelligence activities. Since all participants are subject to biases, which shade how they recognize their environment and develop expectations, there is advantage in

University Press, 1976), 119.

¹³² Gartner, *Strategic Assessment in War*, 5.

understanding one's own biases just as there is in evaluating those of the opponent. "Difficulty of accurate recognition constitutes one of the most serious forms of friction in war," proposed Clausewitz, "by making things appear entirely different from what one had expected."¹³³ At best, assessments quickly discern such discrepancies, reorient the appropriate actors, determine plausible causes, and recommend the most informed steps forward. At their worst, they reinforce incorrect perceptions and obfuscate reality. Since sources of bias are not only cognitive, but also "cultural bias, organizational bias, or bias that results from one's own self-interest," the potential for misleading assessments is significant.¹³⁴

In conclusion, air campaigns are iterative and interactive acts of violence using airpower to compel an enemy. Air-campaign effectiveness rests on air intelligence, which informs targeting objectives and offers continuous assessment. Assessment, despite its challenges, is especially pertinent in a context of war with slow, expensive, and unresponsive government acquisitions systems and insufficient military manpower to meet challenging and dynamic mission requirements. Unless the full industrial might and political will of a state are aligned behind a prolonged war effort, most militaries expect to fight with what they have when hostilities start and probably fall short of the manpower and materiel requirements they factor into their plans. Alternatively, the peacetime price tag to train, equip, and maintain large standing forces can

¹³³ Clausewitz, *On War*, 117.

¹³⁴ Richards J. Heuer, Jr., *Psychology of Intelligence Analysis*, Center for the Study of Intelligence (Washington, DC: Central Intelligence Agency, 1999), 111.

consume gross domestic product (GDP) in excess of political will. Whether an air campaign precedes an actual or credible threat of a ground invasion, or achieves some limited independent objective, success might be measured in terms of quicker victory with more lives preserved, fewer forces mobilized, and less economic disruption. Such would be American hopes for the Combined Bomber Offensive against Germany.



Chapter Two: The AAF at War for a Bomber

This world in arms is not spending money alone. It is spending the sweat of its laborers, the genius of its scientists, the hopes of its children.

The cost of one modern heavy bomber is this: a modern brick school in more than 30 cities.

It is two electric power plants, each serving a town of 60,000 population.

It is two fine, fully equipped hospitals. It is some 50 miles of concrete highway.¹³⁵

—President Dwight D. Eisenhower, 16 April 1953

One thing was apparent: whoever was running the Air Corps at that time, it wasn't the Chief of the Air Corps.¹³⁶

—Maj Gen Laurence S. Kuter

ACTS Shapes the Air Campaign

The American experience in the closing days of World War I had featured promising aerial attacks on troop concentrations including rear-echelon forces, rail yards, and other lines of communication, while the British had even managed some disruption of German industry—though mostly from workers' "lost sleep" and never with enough consistency to achieve "cumulative

¹³⁵ Dwight D. Eisenhower, "Address 'The Chance for Peace' Delivered Before the American Society of Newspaper Editors," *The American Presidency Project* (16 April 1953), <http://www.presidency.ucsb.edu/ws/index.php?pid=9819>.

¹³⁶ Kuter spoke in this quote of the period around mid-1939, shortly after "Hap" Arnold first assumed the position of Chief of the Air Corps. At 36 years old, Kuter served as 1st Bombardment Wing Commander in the European Theater and later commanded Air University. See: Laurence S. Kuter, *Address to Air War College: Organization of Top Echelons in World War II*, in MS 18, *Kuter Papers*, (USAF Academy, CO: Clark Special Collections Branch, 28 February 1949), 4.

results.”¹³⁷ Early airmen who’d advocated most strongly for the independent role of air power focused on evolving this offensive potential. For these early airmen, the locus of many important debates was the Air Corps Tactical School (ACTS). ACTS was borne out of a concession by the War Department General Staff (at the time meaning only Army), when the Army adopted the Air Service as one of its combatant arms in 1920.¹³⁸ The official purpose of ACTS was to standardize education for air service officers, who were initially only field-grade pilots with at least a year of aviation service, to prepare them for command and staff positions; its spirited cadre also developed “the tactics and techniques of the Air Service.”¹³⁹ As the Air Corps’ premier training institution, ACTS took on the unofficial role of professing airpower thought among its enthusiasts and inculcating those who would listen. Its instructors and students were competitively selected and predominantly pilots. Token numbers of faculty and students from other branches and services joined after 1925, adding to the school’s credibility and its collective knowledge base.¹⁴⁰

ACTS instructors were intrepid, air-minded, and strong-willed. There was an air at the school of innovation, of quasi-intellectualism, and of empirical experimentation via their twice-per-week training flights.¹⁴¹ These were not career scientists, engineers, or economists. They were capturing and teaching

¹³⁷ Maurer Maurer, *The U.S. Air Service in World War I*, 4 vols. (Maxwell AFB, AL: AFHRA, 1978), IV: 367, 501.

¹³⁸ Robert T. Finney, *History of the Air Corps Tactical School, 1920-1940*, USAF historical studies (Washington, DC: Center for Air Force History, 1992), 7.

¹³⁹ Ibid., 8. *ibid.*

¹⁴⁰ Ibid., 19-20.

¹⁴¹ Ibid., 12.

air doctrine and tactics; some were proven but most were forward-thinking. Their conclusions-turned-dogma often derived from excessive extrapolation or downright speculation unconfirmed by the rigorous application of scientific method. Most cadre were locked in a steady struggle to break from Army service culture, though their steps were necessarily incremental since the school still had to meet the War Department's purposes. For example, cadre succeeded in purging the stable management course from the curriculum in 1923, but courses on infantry and field artillery remained until the school closed.¹⁴² The school's motto, adopted in 1929, was *Proficimus More Irritenti*—"We make Progress Unhindered by Custom."¹⁴³ In some ways, the motto was more of a desire than a reality, because Army customs died hard.

With a fervor that would later draw much scholarly criticism, inter-war Air Corps Tactical School instructors also developed doctrine to support their expectations for the B-17 and an independent air campaign.¹⁴⁴ ACTS instructors pushed away from Army conceptions of offensive airpower as aerial extensions of artillery. It was an uphill battle. Army Field Regulations issued in 1923 limited the scope of bombing objectives to "those vital to the functioning of the enemy's line of communications and supply," until called upon "to

¹⁴² Ibid., 12,81.

¹⁴³ Charles Griffith, *The Quest: Haywood Hansell and American Strategic Bombing in World War II* (Maxwell Air Force Base, AL: Air University Press, 1999), 40.

¹⁴⁴ Dr. Hal Winton defined doctrine as "the conceptual core around which decisions must be made concerning how the force should be organized, trained, and equipped to win the next war," which must be then incrementally tested and rigorously evaluated. See: Harold R. Winton and David R. Mets, *The Challenge of Change: Military Institutions and New Realities, 1918-1941*, Studies in War, Society, and the Military (Lincoln, NE: University of Nebraska, 2000), xii.

render the greatest assistance possible to the main attack” of decisive ground operations.¹⁴⁵ Also during this period, the RAF’s J.C. Slessor pushed a similar viewpoint espousing interdiction and the tactical role of bombardment. He opined that airpower objectives should be oriented toward “fighting troops and supply,” by which he emphasized cutting off ground troops from their lifelines.¹⁴⁶ Both interwar Army doctrine and Slessor’s theory assumed the following: (1) The primary role of airpower was to support ground operations; and (2) Only ground operations could be decisive in war.

ACTS refuted those assumptions. Opportunity to influence Army policy came in connection to the General Staff’s War Plans Division, which used ACTS (via the Office of the Chief of Air Corps) as a coordinating office. ACTS members had no direct authority with regard to War Department policy, so only through professional credibility and skilled argument would their inputs be accepted. A 1935 update to Army Training Regulation 440-15 provided such an opportunity. In this new framework, an air force could conduct “independent operations,” but its objectives were still subordinated to the “territorial or tactical command.”¹⁴⁷ This meant a theater ground commander, if assigned,

¹⁴⁵ War Department General Staff, *Field Service Regulations, United States Army, 1923* (Washington, DC: War Department, 1924), 23; David E. Johnson, *Modern U.S. Civil-Military Relations Wielding the Terrible Swift Sword* (Washington, DC: Institute for National Strategic Studies, National Defense University, 1997), 6.

¹⁴⁶ John Cotesworth Slessor, *Air Power and Armies* (Tuscaloosa, AL: University of Alabama Press, 2009), 63-64.

¹⁴⁷ David R. Mets, *Master of Airpower: General Carl A. Spaatz* (Novato, CA: Presidio Press, 1988), 97-98; John F. Shiner, *Foulois and the U.S. Army Air Corps, 1931-1935* (Washington, DC: AFHSO, 1984), 228-229; Thomas H. Greer, *The Development of Air Doctrine in the Army Air Arm, 1917-1941*, Special studies (Washington, DC: Office of Air Force History, U.S. Air Force, 1985), 73-74.

would have sole authority for an air force's target selection.¹⁴⁸ For ACTS instructors, this compromise was still problematic. They thought the best use of airpower was "to select targets whose destruction would disrupt the entire fabric of an enemy's economy"—to collapse the enemy's "industrial web"—a concept that by 1939 had controversially surpassed even the primacy of air superiority within the school walls.¹⁴⁹

An assumption, dating back to 1932, that "the bombers will always get through" had diminished an earlier emphasis on fighter escort.¹⁵⁰ Despite this unfounded premise, one ACTS instructor later argued that the school foresaw the potential need for detailed air intelligence in order to "defeat the enemy air defense force," yet controversy about bomber invincibility seemed to stall the impetus.¹⁵¹ Their confidence in the potential for the heavy bomber was remarkable given the limitations of their experience, especially because they didn't even have a B-17 while they were writing doctrine for it. As Brigadier General Haywood "Possum" Hansell later reflected of his time teaching at ACTS, "because we lacked the airplanes themselves, we had a tendency to build our doctrine around the drawing board designs and the expected performance of aircraft still in the design stage."¹⁵²

¹⁴⁸ Mets, *Master of Airpower: General Carl A. Spaatz*, 97-98.

¹⁴⁹ Finney, *History of the Air Corps Tactical School, 1920-1940*, 65,74. Barry D. Watts, *The Foundations of US Air Doctrine: The Problem of Friction in War* (Maxwell AFB, AL: Air University Press, 1985), 18.

¹⁵⁰ Hansell, *The Strategic Air War Against Germany and Japan: A Memoir*, 7,10.

¹⁵¹ *Ibid.*, 13.

¹⁵² Brig Gen Haywood S. Hansell, *Lecture to Air War College: "The Development of the United States Concept of Bombardment Operations"*, in MS 6, *Hansell Papers*, (USAFA, CO: Clark Special Collections Branch, 16 February 1951), Series 3, Box 4, Folder 1, 2.

ACTS cadre sparred outside of the War Department as well. In fact, they fueled a rivalry with the Navy by developing tactics and formalizing training for intercepts at sea during the interwar period. Along the way, the school produced exercise bombardment tables that assumed a 50:50 chance of sinking any ship up to 500 feet by 90 feet by dropping four 300-pound bombs from an altitude of 8,000 feet; and with even greater optimism, “one hit on a carrier will put it OUT for airplane operations” (emphasis in original).¹⁵³ These were bold assertions, untested in combat (or even in peacetime), and undoubtedly provocative to the sea service.¹⁵⁴

ACTS instructors were not only challenged to obtain realistic data about potential air threats and bombing performance, but also about intelligence requirements to match their targeting doctrine. Without support from the Army staff, this fell to one of their instructors, Major Muir S. “Santy” Fairchild, who’d gained credibility flying night bombing missions in World War I and was among the first Distinguished Flying Cross recipients for his Pan-American flight with Ira Eaker.¹⁵⁵ What he lacked in information and support, he compensated with brains and ingenuity. He has been credited with pulling together the conceptual pieces necessary for strategic bombing, ultimately justifying both

¹⁵³ Air Corps Tactical School, *Rules for Umpires*, War Department, (Maxwell Field, AL: AFHRA, May 1936), #248.101-17, IRIS 157297, 5.

¹⁵⁴ For more examples of Air Corps’ bombing “at the expense of the Navy,” see: Stephen Lee McFarland, *America’s Pursuit of Precision Bombing, 1910-1945*, Smithsonian History of Aviation Series (Washington: Smithsonian Institution Press, 1995), 99-100.

¹⁵⁵ Jeffrey C. Benton, *They Served Here: Thirty-Three Maxwell Men* (Maxwell Air Force Base, AL: Air University Press, 1999), 59-60. Griffith, *The Quest: Haywood Hansell and American Strategic Bombing in World War II*, 43. Vicki J. Rast, *The Air University Pantheon of Air, Space, and Cyberspace Power Thinkers* (Maxwell AFB, AL: Air University Press, 2009), 58-62.

expanded B-17 procurement as well as AAF use of the Norden bombsight, as he argued:

*If it could be established that the destruction of a reasonable number of industrial targets might have disastrous consequences, it might be then possible to design and construct the required aircraft, bomb-sights, bombs, navigational aids and air armament, conduct the necessary training, and, finally, calculate the force required based on expected accuracy on the strength of enemy opposition.*¹⁵⁶

To support his claims, Major Fairchild recognized the need for intelligence data but wasn't able to obtain information about foreign industry. As ACTS Director of the Department of Air Tactics and Strategy, he initiated a vulnerability study based upon American industry, from which he concluded—not so profoundly—the American “economy is highly specialized.”¹⁵⁷ But he didn't stop there. High specialization meant less redundancy, interdependence among industries, and geographic concentration; all of this amounted to vulnerability and the possibility of bottlenecks that could collapse the economy—not unlike the “economic dominoes” that had toppled America and its western industrialized partners into the Great Depression.¹⁵⁸

Because interwar Army doctrine pigeon-holed heavy bombers into coastal defense missions, ACTS instructors were prohibited from conducting “independent school examination of the economies of foreign countries,” which was to be the exclusive domain of the War Department's Military Intelligence

¹⁵⁶ Col Guido R. Perera, *Memoirs: Washington and War Years*, (Maxwell AFB, AL: AFHRA, 1973), #168.7042, IRIS 127110, 77.

¹⁵⁷ Finney, *History of the Air Corps Tactical School, 1920-1940*, 111.

¹⁵⁸ Brauer and Van Tuyl, *Castles, Battles, & Bombs: How Economics Explains Military History*, 207.

Division.¹⁵⁹ Fairchild's findings would later be applied to targeting assumptions about Germany, many of which were untrue, but in no way held up doctrine development. By August of 1941, Air War Planners (several of whom were ACTS graduates) made their case to Gen Arnold: "If the air offensive is successful, a land offensive probably will not be necessary."¹⁶⁰

ACTS of intelligence. Emerging bombing doctrine would require more than industrial intelligence for target selection, but also an enterprise for pre- and post-strike reconnaissance. Toward this endeavor, ACTS instructors took incremental steps away from Army tradition, and the school's curriculum guided the air service's future leaders' views. From an instructional standpoint, significant curriculum emphasis fell to map-reading and chart-creation. While advanced application of these skills would be fruitful to both observation and bomber pilots, long-standing Army traditions imparted ground-centric viewpoints into the course material. For example, many of the exercises in their 1935 *Maps and Photographs* course surveyed topography of Gettysburg and Fort Leavenworth.¹⁶¹ In other cases, aerial photography appeared as an adjunct to ground-centric methods rather than as a deliberate and systematic tool for

¹⁵⁹ Kreis, *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II*, 26-27. Kreis also highlights a student exercise led by Majors Byron Gates and Robert Webster in 1936 for examining American industry. Kreis concludes that the G-2 would not have had the depth of information required to support ACTS doctrine. This is discussed in a later chapter. Many historians fault ACTS for "mirror-imaging" American industry onto Germany; in truth, they had little choice.

¹⁶⁰ Memorandum, Hansell to Arnold, 11 August 1941, cited in: Michael E. Weaver, "International Cooperation and Bureaucratic In-fighting: American and British Economic Intelligence Sharing and the Strategic Bombing of Germany, 1939-41," *Intelligence and National Security* 23, no. 2 (April 2008): 168.

¹⁶¹ Air Corps Tactical School, *Maps and Photographs Course*, Conference 1-12, (Maxwell Field, AL: AFHRA, 1935-1936), #248.101-17A, IRIS 157288, 1-49.

airpower assessment. The aerial photograph was “nothing more than a machine-made, but man-interpreted, substitute for maps or for visual reconnaissance,” one course text declared.¹⁶² Of eight reasons listed in course material for employment of aerial photography, the top two were “substitute for maps,” and “furnish details on existing maps,” while “allow detailed study of projected bombardment subject,” and “confirm efficacy of artillery or bombardment operations” graced the very bottom of the list.¹⁶³ Aerial photography had entered into the ACTS curriculum as a short cut or an improvement to old methods but fell short of promulgating new intelligence requirements necessary to support strategic bombing theory.

As ACTS instructors saw it, photographic interpretation duties pertained to a select few trained intelligence personnel either at the Corps level or at higher headquarters, far from the theater of operations. “We should find such personnel in the GHQ Air Force G-2 Section,” the text suggested.¹⁶⁴ Otherwise, anyone who could get their hands on a photo—even without training—might put it to their use, including commanders who desired to back their claims with “irrefutable evidence.”¹⁶⁵ “The Bombardment Group Commander is certainly able and willing to interpret photos of destruction wreaked by his bombers,” the text added.¹⁶⁶ In its infancy, the course left awkward

¹⁶² Air Corps Tactical School, *Course: Maps and Photographs, Tactical Employment of Aerial Photography*, Conference No. 14, (Maxwell Field, AL: AFHRA, 10 January 1937), #248.101-17A, IRIS 157289, 80.

¹⁶³ *Ibid.*, 6.

¹⁶⁴ *Ibid.*, 2.

¹⁶⁵ *Ibid.*, 7.

¹⁶⁶ *Ibid.*, 2.

contradictions of photo-interpretation as a highly technical skill yet with appeal and purpose to anyone with access to a decent reconnaissance photo. ACTS instructors seemed to grasp that BDA might serve more than one purpose, but given their broader doctrinal pursuits, they shaped their course material more toward ways post-strike images might prove an attack's success to an external audience than stimulate objective analysis for an internal one.

Both ACTS and the Army's Command and General Staff School played an inter-war role in evaluating bomb effectiveness. While testing was somewhat narrow in scope, courses at both schools contributed to a general sense that the limited sizes and types of bombs available would be adequate for strategic bombing missions, perhaps because dual-advocacy for both bombers and bombs might have made the whole endeavor seem too expensive to pursue. The ACTS curriculum pushed the idea that small well-aimed bombs were superior to large bombs that narrowly missed. After comparing tests with 100-lb and 300-lb bombs against brick and stone structures, one report concluded "a direct hit with even a small bomb is immeasurably superior to near hits with considerably larger bombs."¹⁶⁷

A similar theme of emphasizing accuracy and trusting in the destructive power of small bombs consistently permeated ACTS doctrine. A class taught in the 1938-1939 academic year by then-Capt Laurence Kuter argued as a "principle of Bombardment Tactics: Never use a larger bomb than required.

¹⁶⁷ Office of Chief of Ordnance, *Power of Demolition Bombs*, Air Corps Tactical School, (Maxwell AFB, AL: AFHRA, 18 August 1927), #248-6892-14, IRIS 166897, XXII-XXIII.

Attack more targets or get a better probability of hitting with a proper size bomb.”¹⁶⁸ The course went on to argue, again with confidence as if stating a proven maxim, “the use of too large a bomb is obviously bad practice, obviously uneconomical of force and obviously can accomplish the desired degree of destruction and unessential obliteration at the objective.”¹⁶⁹ Clearly this methodology did not consider the possibility that unseen or unstudied attributes of the target (such as underground pipes or electrical cables) might be worthy of adding a little extra destructive force—just in case.

Taken alone, these bombing principles may have seemed problematic, except that Kuter also taught with extremely confident appraisals of bombs dropped in earlier campaigns. He argued, for example, “we have seen proved conclusively that a 100-pound bomb has the necessary power and effect to destroy buildings,” including “the heavy factory type.”¹⁷⁰ Kuter’s observations were not isolated to ACTS. A chart produced at the Command and General Staff College during the same academic year claimed that 100-pound bombs were the preferred munition for buildings of “all types of construction except sky-scrapers.”¹⁷¹ It was clear from the start that Air Corps officers sought to find the right balance between bombs sizes and bomb loads to offer the best chance to secure hits and the desired damage. It was also clear that they erred

¹⁶⁸ Laurence S. Kuter, *Memorandum, Kuter to Arnold*, War Department, (Maxwell AFB, AL: AFHRA, 6 August 1943), #118.201-6, IRIS 110591, 4.

¹⁶⁹ *Ibid.*, 6.

¹⁷⁰ *Ibid.*, 11.

¹⁷¹ The Command and General Staff School, *Conference: Effectiveness of Demolition Bombs Against Specified Objectives*, War Department, (Maxwell AFB, AL: AFHRA, 14 September 1938), #118.201-6, IRIS 110591, Table 1, 2.

on the side of optimism since they'd picked instances where small bombs had landed in ideal placement, and they'd lacked a rigorous method for evaluating damage to building contents.

The school's speculative yet dogmatic views on strategic bombing coupled with its stagnated and myopic views of aerial photography and interpretation set the AAF up for stunted learning. Further, excess trust in the value of a photograph alone would inhibit the early development of an air-intelligence corps necessary to use photos for broader targeting purposes or to correlate photographic evidence with other forms of intelligence. Admittedly, the ACTS cadre were not responsible for determining intelligence requirements and personnel training for the Air Corps. However, if they were visionaries for the future of strategic bombing, they were colorblind to their service's needs for aerial photography and interpretation. As the war began, ACTS' full year-long course stood down, and it eventually returned in a different form as the AAF School of Applied Tactics in Orlando Florida (discussed later).¹⁷² It was no doubt a tough choice between reaping the annual crop of experts from a vital center of airpower excellence or distributing its seed corn to the world-wide staffs and airfields where they were desperately needed.

Air Intelligence Born into Neglect

Stated succinctly in a 1948 training text, Air Intelligence was "Military

¹⁷² Finney, *History of the Air Corps Tactical School, 1920-1940*, 83.

intelligence required for the employment of air power.”¹⁷³ That simple post-war definition is as revealing as it was reflective. Air Intelligence emerged as a field conjured by pilots who needed a library of information about their potential adversaries. Military intelligence, however, had long traditions of supporting ground warfare, and those traditions did not involve assessments of adversary industrial vulnerabilities. An Air Intelligence section was first established in the Army Signal Corps HQ staff in 1917, which the Air Service later employed as an Information Section in the American Expeditionary Force in France, in November of 1918. The section was then led by a captain with oversight of six branches comprised entirely of Lieutenants. Their purpose was to distribute bulletins, handbooks, and publications of allied countries and other “important secret matters” to appropriate air service offices, schools, and other services.¹⁷⁴ Upon return to a stateside presence, the section was reorganized into an Information Group comprised of “Collection, Library, Reproduction, and Dissemination Divisions,” and its work shifted toward liaison with the various assistant military attaches for aviation.¹⁷⁵ It was a meager start for an essential mission, then providing no analysis, but simply collecting and distributing data from domestic and foreign sources. In an environment inhabited by ostentatious pilots or an otherwise rigid military intelligence system, the group

¹⁷³ USAF Air Command and Staff School, *Air Intelligence*, AC&SS Pamphlet (Montgomery, AL: Air University, 1948), 1-1.

¹⁷⁴ *Chart of Liaison System, Information Section, 11 Nov 1918*, 14, (Maxwell Field, AL: AFHRA, ca. 1 January 1954), #106-87, IRIS 467833.

¹⁷⁵ Dr. Victor H. Cohen, *Air Intelligence*, in *USAFHS-87*, USAF, (Maxwell AFB, AL: AFHRA, ca. 1 January 1954), #106-87, IRIS 467820, IV: 2, 5.

was little recognized by leaders from either and its members took little pride in their work.

During this period, the small group of junior officers failed to impress Air Service leadership. "A good part of the work being undertaken is of little or no value to the service," counselled Colonel William E. Pearson, the Air Service Administrative Executive. "[They] frequently send out information which is not in line with the Director's ideas."¹⁷⁶ By 1926, air intelligence was relegated to a section within the Information Division, and it stayed there until it rose to its own Division of the Office of the Chief of Air Corps by December 1940. The struggle over Army control of air intelligence had come to a head by the 1935 creation of a GHQ Air Forces staff because the air arm needed information to support its interwar bombing doctrine. As Air Corps leadership sought to extract itself from the Army, GHQ Air Force (then the Air Corps' war-fighting HQ) "argued that its status demanded additional autonomy in air intelligence, both for following foreign technical developments and for planning air operations beyond the lines of, and before the employment of, Army surface forces."¹⁷⁷ The fight met with little success, which explains why not only ACTS, but also the air war planners, were left to fend for themselves.

Since Air Forces could attack on the European continent long before a ground-invasion force might cross the Channel, air planners required detailed

¹⁷⁶ Colonel William F. Pearson, *Memorandum for Colonel Westover*, Office of the Director of Air Service Administrative Executive, (Maxwell AFB, AL: AFHRA, 7 April 1920), #203-6v2, IRIS 142222.

¹⁷⁷ Kreis, *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II*, 23.

intelligence on potential targets. This meant that the War Department G-2, ostensibly responsible not only for collecting all information on potential threatening countries, but also for producing all comprehensive assessments necessary for the ground and air components, would have either to shift its focus toward analysis of industrial targets or yield manpower along with this responsibility to the A-2. The issue may not have been as serious if adequate military and industrial information on foreign governments was available to the War Department or if this challenging analytical work was being accomplished in one office or another. The problem was that American military intelligence writ large was neglected between the wars, which reflected the domestic preoccupation and isolationist perspective of the American public. Dwight D. Eisenhower revealed in his post-war memoir, *Crusade in Europe*, that the General Staff G-2 had been a “stepchild position,” overseeing a Military Intelligence Division (MID) that “could not even develop a clear plan for its own organization nor could it classify the type of information it deemed essential in determining the purposes and capabilities of our enemies.”¹⁷⁸ MID had a particularly glaring deficiency with industrial studies, which were exactly what the Air Staff needed most. If military intelligence was a stepchild, then air intelligence was an orphan, rejected by the War Department as an unfamiliar trade, and undernourished by the air service that needed it.

War Department intelligence bureaucracy did not cope well with the idea of its air arm getting out in front of the ground forces and driving new intelligence

¹⁷⁸ Dwight D. Eisenhower, *Crusade in Europe* (Garden City, NY: Doubleday, 1948), 32.

requirements, much less the underlying assumption that it might be appropriate for Air Staff planners to select military objectives for an independent air campaign. By extension, any steps to shift either human resources or office duties from War Department staff to Air Corps staff were unconscionable. Without cooperation from the G-2, initial efforts by General Oscar Westover (a former ACTS commandant, then Chief of the Air Corps) to grow the Air Corps' organic air-intelligence capability so saturated his nascent Information Division with collection requirements that they had no time for analysis. According to an unpublished study, "in April 1936, the Chief of the Information Division reported that his current Air Intelligence Section of one officer, one stenographer, one clerk, and one librarian working part time, could do little more than file intelligence reports."¹⁷⁹ Even a request to add five civilians was turned down. There weren't enough people to go around and many of those who were available weren't up to the task. When the plans division, typically loaded with hard-charging aircrew, couldn't get what they needed from the Information Division, they procured the information themselves, thereby marginalizing the intelligence section from one of its primary customers and creating redundant work for the comparably understaffed Plans Division. When the then-Chief of Plans, Maj W.R. Weaver, made a habit of complaining that the Air Corps staff "lacked a ready digest of air intelligence subjects and had failed to secure professionally qualified personnel to evaluate and properly disseminate the information," he was moved

¹⁷⁹ Cohen, *Air Intelligence*, ca. 1 January 1954, IV-13.

to Chief of Information, which forced him to inherit the problem himself.¹⁸⁰ The lack of air intelligence was a much bigger problem than one major could solve.

A series of air-arm reorganizations in the late 1930s, mostly driven from above, tended to intensify, rather than resolve, tensions within the Air Corps and between the Air Corps and the War Department. One source of such friction arose from a premature split of Air Corps' command structures as recommended by the 1934 War Department Special Committee on Army Air Corps (otherwise known as the Baker Board.) The board had been oriented against the Air Corps from its inception. It had comprised only one flier (Major General Benjamin Foulois) among its five general officers and was guided by a major from the War Department General Staff, who fought bitterly against flyer's accusations "of the inability of the General Staff to handle Aviation matters efficiently."¹⁸¹ The Baker Board recommended creation of a General Headquarters (GHQ) Air Force, which would retain warfighting functions of the of the Air Corps on a separate but equal footing with the Chief of the Air Corps—a move later implemented by the War Department Adjutant General on 1 March 1935.¹⁸² This arrangement left the Chief of the Air Corps with a disconnected mix of "procurement, supply, development of training doctrine, and Air Corps schools" and a fractured "unity of command" despite the report's

¹⁸⁰ Ibid., IV-38.

¹⁸¹ Shiner, *Foulois and the U.S. Army Air Corps, 1931-1935*, 195 ; Newton Diehl Baker, *Final Report of War Department Special Committee on Army Air Corps.*, United States Special Committee on Army Air Corps, (Washington, DC: U.S. GPO, 18 July 1934), 29.

¹⁸² USAF Historical Division, *Organization of the Army Air Arm, 1935-1945*, USAF Historical Studies: No. 10 (Maxwell AFB, AL: Air University, Research Studies Institute, 1956), 1.

reverence to the principle.¹⁸³ The result was excessive overhead and coordination required for the two geographically separated staffs and a newly cleaved rift between the officers assigned or subordinated to each.¹⁸⁴

After eventually assuming duties as Chief of Air Corps from Major General Oscar Westover in 1939, “Hap” Arnold led a successful effort that would temporarily consolidate control of both headquarters.¹⁸⁵ With the buildup of forces well under way, it was not until June of 1941 that Secretary of War Henry Stimson recognized the potential risk to wartime efficiency of the split arrangement, and directed the change implemented by regulation AR 95-5.¹⁸⁶ As though with an unceremonious wave of Stimson’s cane, he’d finally solidified the Army Air Forces (so-named in 1941) with its own staff under “one responsible head” in General Arnold, while proclaiming his dual intent:

*to develop an organization staffed and equipped to provide the ground forces with essential aircraft units for joint operation, while at the same time expanding and decentralizing our staff work to permit Air Force autonomy in the degree needed.*¹⁸⁷

There were still myriad unsolved challenges, and this act would give rise to many new ones. With the AAF still serving under the War Department, Arnold’s new authority coupled with Stimson’s mandate to expand and decentralize would set the stage for his AAF staff to compete for autonomy with their War Department counterparts.

¹⁸³ Shiner, *Foulois and the U.S. Army Air Corps, 1931-1935*, 198.

¹⁸⁴ USAF Historical Division, *Organization of the Army Air Arm, 1935-1945*, 3-4.

¹⁸⁵ *Ibid.*, 5.

¹⁸⁶ *Ibid.*, 5-6.

¹⁸⁷ Earl A. McClendon, *Autonomy of the Air Arm*, Air Force History Support Office, (Bolling AFB, Washington, DC1996), 83.

Custody Dispute: The A-2 / G-2 Debate

As the AAF built up its case for divorce from the Army, air intelligence was caught in the middle. Brigadier General Sherman Miles, the Army Assistant Chief of Staff G-2 (Intelligence), vehemently stiff-armed AAF attempts to mold its own intelligence service capable of collection and analysis adequate for strategic bombing.¹⁸⁸ The challenges for the subordinated A-2 either to steer G-2 toward a thorough acceptance of air intelligence requirements or to yield responsibility to the A-2 for all aspects of air intelligence reflected the same broader struggles of the newly-dubbed Army Air Force as a subordinate service to the Army. An Air Force capable of conducting independent planning and analysis might side-step the War Department to offer independent advice to their shared civilian masters, and that advice might seek to preclude a ground campaign.¹⁸⁹ Meanwhile, Arnold wasn't pleased with his A-2's progress or the quality of the intelligence products he received. Two years earlier, he'd credited a visit with Charles Lindbergh as "the most accurate picture of the Luftwaffe, its equipment, leaders, apparent plans, training methods, and present defects that I had so far received."¹⁹⁰ He knew his service had an intelligence problem, and it was going to take a battle within the War Department to fix it.

A bitter squabble between the War Department General Staff G-2 and AAF leadership played out on a national security stage as a melee of memoranda

¹⁸⁸ Weaver, "International Cooperation and Bureaucratic In-fighting: American and British Economic Intelligence Sharing and the Strategic Bombing of Germany, 1939-41," 159.

¹⁸⁹ Ibid., 162.

¹⁹⁰ Henry Harley Arnold, *Global Mission*, Military Classics Series (Blue Ridge Summit, PA: Tab Books, 1989), 188.

ensued between April and December of 1941. The controversy began when the Office of the Chief of Air Corps, Intelligence Division, produced a ten-page study on 31 March 1941. The report boldly suggested an air campaign had “certain lines of action, involving specific air tasks, as a framework for the compilation of air intelligence, upon which ultimate decision rests.”¹⁹¹ Beneath all of the jargon, the report was blasphemous and insubordinate to Army Intelligence. The study was ground-breaking in both its ingenuity as well as its departure from Army conventions with its exhaustive sketch of air-intelligence requirements necessary for an air campaign.

For example, the report sought collection of information such as: Basic elements necessary to sustain the German population; the sources, transportation, storage, and distribution of German imports and exports; “inter-connection between systems,” transmission, and effects of breakdown of the electrical power system; transportation vulnerabilities and mechanisms to “isolate vital industries, factories, or areas”; a comprehensive list information about “essential materials and commodities,” both strategic and “non-strategic but contributing to economic strength or weakness”; and studies of essential industries, including information such as sources, transportation and storage, manufacturing or processing plants, and “essential activities to which [each] industry and its products are necessary or valuable.”¹⁹² The report also walked

¹⁹¹ Brig Gen Sherman Miles, *Memorandum from Military Intelligence Division, G-2 to the Chief of Staff, War Department: "Responsibility of the Military Intelligence Division for Air Intelligence"*, (Maxwell AFB, AL: AFHRA, 18 April 1941), #203-6v.5 part 2, IRIS 142226.

¹⁹² A-2 Office Chief of Air Service (OCAS), *Basis for Air Intelligence for an Air Estimate of the Situation - Europe*, (Maxwell AFB, AL: AFHRA, March 22, 1941), #203-6v5 part 2, IRIS 142226,

a compelling, while subtle, argument to justify collecting intelligence for objectives required to neutralize an opponent's air force, whether or not plans called for a ground offensive, as well as requirements to defend and supply potential air bases.¹⁹³ Most disturbing to the Army was the not-so-subtle hint that seemed to link independent air assessments to decisive airpower.

Miles, in his capacity as the acting Army G-2, found this comprehensive review to be particularly insubordinate because the study omitted any references to the division of responsibility between the A-2 and its higher-echelon G-2.¹⁹⁴ Miles did acknowledge the basic framework as helpful, but felt it impermissible that the A-2 might go about pursuing independent collection or otherwise avoiding direct consultation with the War Plans Division. Miles also argued that the A-2 was officially charged to provide only "technical evaluation of information transmitted to them" by the G-2, whereas the Military Intelligence Division was "charged with the compilation of air intelligence, as well as that pertaining to other component parts of the Army, for the purpose of formulation of comprehensive military estimates."¹⁹⁵ If the A-2 needed something, it would have to get it from the G-2. In protest, Miles appealed directly to Gen Marshall 18 days later, advocating actions to put the A-2 back into its place. He cited an implied arrangement from a memo directed by the Secretary of War two years earlier as well as Army Regulation AR 10-15,

1-10.

¹⁹³ Ibid.

¹⁹⁴ Miles, *Memorandum, G-2 to the Chief of Staff*, 18 April 1941.

¹⁹⁵ Ibid.

(published in August 1936), which charged the Military Intelligence Division “with those duties of the War Department General Staff which relate to the collection, evaluation and dissemination of military information.”¹⁹⁶ Miles’ interpretation was that air intelligence was a subset of military intelligence, for which he was responsible. He’d managed to reject the AAF’s purpose by anchoring his argument back to published guidance that did not keep up with recent, although ambiguous, changes in warfighting doctrine.

For the G-2, an even deeper issue hinged on the authority to determine campaign objectives and whether it was appropriate for the Air Staff to evaluate targets at its own discretion. Offering a first rebuttal was an airman sitting serendipitously in the seat as acting Assistant Chief of Staff, War Plans Division, Brigadier General Joseph R. McNarney. He downplayed Miles’ concerns with a patronizing tone, suggesting the OCAS Intelligence Division was merely “determining the objectives for which objective folders should be prepared.”¹⁹⁷ Miles fumed back: “The selection of military objectives rests with the High Command, based on comprehensive estimates of the situation drawn from General Staff Intelligence,” he wrote, adding “the Air Corps’ ‘objective

¹⁹⁶ George V. Strong, *Memorandum by Direction of the Secretary of War to the Chief of the Air Corps: ‘Air Corps Intelligence’*, War Department, 5, (Maxwell AFB, AL: AFHRA, October 5, 1939), #203-6. Army Regulation AR 15-10 of the War Department, 18 August 1936, is published as exhibit No. 42 in United States Congress, *Hearings Before the United States Joint Committee on the Investigation of the Pearl Harbor Attack, Seventy-Ninth Congress, Second Session. Part 14*, Joint Committee on the Investigation of the Pearl Harbor Attack (1946), 1416-1421. See paragraph 9 for Military Intelligence Division.

¹⁹⁷ Brigadier General Joseph T. McNarney, *Memorandum from Acting Assistant Chief of Staff, War Plans Division, to the Assistant Chief of Staff, G-2: ‘Responsibility of the Military Intelligence Division for Air Intelligence’*, War Department, 5, (Maxwell AFB, AL: AFHRA, 24 April 1941), #203-6.

folders' are really just compilations of technical information on targets which may or may not be designated as objectives."¹⁹⁸ The idea that compiling objective folders subdivided down to specific targets for pilot's use was an appropriate duty for the highest level of Air Corps headquarters went unchallenged by either side.¹⁹⁹ However, General Arnold himself knew that intelligence information such as "the size, location, general characteristics, special distinguishing marks, the type of construction, and other details necessary for bombing operations... did not exist in the United States."²⁰⁰ Advocacy had to come from the top.

With nothing to lose, Brigadier General George Brett, in one of his last acts as Chief of Air Corps (before Arnold assumed the position in his new consolidated role), retorted with a more congenial tone and subtle nuance:

There is no question that the selection of military objectives, including Air Force objectives, rests with the High Command. But estimates of the situation upon which the decisions of the High Command are based should include not only the M.I.D. estimate of the broad enemy situation resulting from a large accumulation of experience and records, but also the technical intelligence pertaining to air operations, including the evaluation thereof by Air Corps specialists. While it would be disastrous to have

¹⁹⁸ Brig Gen Sherman Miles, *Memorandum from Military Intelligence Division, G-2 to the Chief of Staff, War Department: "Delineation of responsibility for intelligence studies between the Air Corps and the Military Intelligence Division"*, 5, (Maxwell AFB, AL: AFHRA, May 14, 1941), #203-6v.5 part 2, IRIS 142226.

¹⁹⁹ The Intelligence Division was preoccupied with tactical-level work probably because the work was comfortably within the area of expertise of the assigned personnel, there wasn't yet a subordinate staff able to take on the work, and the G-2 preferred it that way. According to an Intelligence Division memo, 'each objective folder seeks to prepare all the intelligence needed by combat crews to conduct an air attack of te objectives located there. The objective folders are designated by the name of the country in which they are located and the name of the nearest town.' A-2 OCAC, *Memorandum from Intelligence Division, Office of the Chief of Air Corps to Assistant Chief of Staff, G-2: 'Digest of Information Received'*, War Department, 5, (Maxwell AFB, AL: AFHRA, February 13, 1941), #203-6.

²⁰⁰ Arnold, *Global Mission*, 534-535.

*divided responsibility in integrating the mass of intelligence on which decisions for the operations of the Army as a whole are to be based, it would also be disastrous to omit from that mass of intelligence detailed and technical air intelligence prepared by persons primarily responsible for air operations. Such air intelligence includes not only objective folders and target information but also a comprehensive and detailed analysis of the effects of air attack against military, industrial, and economic objectives...*²⁰¹

Brett introduced two facets of the argument previously either missed or otherwise unacknowledged by Miles. The first was the airman's view that air intelligence could only be accomplished by specialists who understood the application of airpower. The argument was a hard sell because Brett was trying to convince a confident expert that his entire staff (minus the airmen) lacked the acumen and aptitude for thinking about potential targets in a new way. Miles possessed neither the humility nor the self-reflection to accept that argument. The second of Brett's arguments foretold of challenges to come: that the assessment of air attacks was also an air-intelligence function and should be left to those who understand airpower. Only airmen could write the report card on the performance of other airmen.

The weight of Arnold's air branch with its rapid growth but slow maturity manifested itself through cracking and splintering within the functions of the War Department staff. Its highest leaders squabbled over individual words in the melee of memoranda in order to pursue their bureaucratic interests. Those at the top of the burgeoning air-intelligence community began to see

²⁰¹ General George Brett, *Memorandum from Chief of Air Corps to Military Intelligence Division, G-2: 'Non-Concurrence in G-2/271-A-ST'*, War Department, 5, (Maxwell AFB, AL: AFHRA, June 16, 1941), #203-6.

themselves as different than their War Department counterparts, with different perspectives, technical skills, and responsibilities to support independent air operations. War Department leadership, at this point, perceived no such distinction. To them, the air arm was comprised of army officers whose specialized training made them no different than officers of other Army branches.

The battle for control of air intelligence did not end there. The final two missives would set the future course for the A-2 and G-2 relationship and put the A-2 on a path for cultural identity that would outlast the war. Miles' final ploy was to portray A-2's efforts as exactly the type of disastrous duplication that should be avoided, in a similar vein that all redundancies in government were inherently wasteful. This line of reasoning was not unfounded. Miles leveraged contemporary issues much larger than the War Department that echoed conservative backlash prevalent in the late 1930s against unwieldy and uncoordinated growth of the Federal Government.

FDR's New Deal roll-out had included a multitude of new agencies, some of which performed redundant activities or operated outside of the normal cabinet structure, purportedly to side-step conservative influence.²⁰² The result was an insidious loss of executive-branch control over many of its own activities and a fragmentation of Presidential authority—a problem of which Roosevelt had become aware. Roosevelt acquiesced to chartering a committee led by Louis

²⁰² David E. Lewis, "Presidents and the Politics of Agency Design: Political Insulation in the United States Government Bureaucracy, 1946-1997," (2003): 7.

Brownlow, a champion of progressive reform and Director of the University of Chicago's Public Administration Clearing House (PACH), to recommend improvements.²⁰³ Unsurprisingly, the Brownlow Committee, formally recognized as the President's Committee on Administrative Management, found in its 1937 report that "there is waste, overlapping, and duplication, which may be eliminated through coordination, consolidation, and proper managerial control."²⁰⁴ Brownlow's report had unleashed a furor to seek and destroy duplication in executive-branch agencies. At the very least, Miles' accusation of duplication by A-2 would have to be addressed. Miles chose to take the argument even further with an intimation that duplication of intelligence effort "leads inevitably to divergent conclusions and the diffusion of counsel which results thereof."²⁰⁵ A subordinated air force had no such luxury of inefficient resources or of impudent dissent from its parent service.

Arnold, who was by then made an ex-officio member of the Joint Chiefs by the same Stimson order that had created the AAF, settled the matter for the current conglomeration of personalities. Arnold made it clear that timeliness

²⁰³ Barry D. Karl, "Louis Brownlow," *Public Administration Review* 39, no. 6 (1979): 512-514. PACH was funded by the Rockefeller Foundation and conducted public-administration research and consulting by linking universities, legislators, and private organizations "with perhaps 70,000 municipal officials in 5,000 cities and towns having a combined population of 50,000,000." Its purpose, in association with other Chicago agencies, was to "serve to promote the general acceptance of new devices or techniques of government." See: The Rockefeller Foundation, *Annual Report*, (New York, NY: The Rockefeller Foundation, 1935), 234-235.

²⁰⁴ United States, *Administrative Management: Report of the President's Committee*. (Washington, DC: U.S. GPO, 1937), 30.

²⁰⁵ Brig Gen Sherman Miles, *Memorandum from Military Intelligence Division, G-2 to the Chief of Staff, War Department: 'Delineation of Responsibility for Intelligence Studies Between the Air Corps and the Military Intelligence Division, W.D.G.S.'*, War Department, (Maxwell AFB, AL: AFHRA, 11 August 1941), #203-6v.5 part 2, IRIS 142226.

and adequacy were the overriding imperatives for air intelligence. In his view, A-2 reserved the right to obtain information from any source available *to* the G-2 not just *from* the G-2, and whenever “time is a determining factor,” the AAF would perform its own collection.²⁰⁶ To an airman, of course, time was *always* a determining factor. Arnold also knew that Miles didn’t think like an airman.

Further, Arnold insisted that air intelligence could be adequate only if “interpreted, evaluated, and disseminated by trained air force officers,” and duplication could be minimized by “the elimination of unnecessary steps.”²⁰⁷ To Arnold, the G-2’s hand in air intelligence *was* the most unnecessary step. Without waiting for Army Chief of Staff General George C. Marshall or the Secretary of War’s approval, he had just cut the G-2 out of the loop and set about the creation of his air-intelligence organization, which in his words, “had no recourse but to go to other sources for its information.”²⁰⁸ As the AAF set about slowly building up its air-intelligence enterprise, lack of cooperation from the highest levels of the Military Intelligence Division set back resources that might have been available to the A-2. Fears by the G-2 of duplication that bordered on pathological would cost not just the War Department’s planners but the most senior members of American government the value of alternative viewpoints along the way. Meanwhile, those who worked in A-2 were mostly pilots and civilian administrative staff. The former sought the info they needed

²⁰⁶ H. H. Arnold, *Memorandum from Military Intelligence Division, G-2 to the Chief of Staff, War Department: "Responsibility of the Military Intelligence Division for Air Intelligence"*, War Department, 5, (Maxwell AFB, AL: AFHRA, 18 April 1941), #203-6.

²⁰⁷ Ibid.

²⁰⁸ Arnold, *Global Mission*, 535.

to fly but had little interest or time to devote toward questions of assessment, while the latter had no professional training or interest in making their jobs more challenging. There was not yet a professional air intelligence enterprise.

From Pearl Harbor to Ploesti

Whether or not the Army Air Force was ready, the 7 December 1941 sunrise surprise by the Japanese on Pearl Harbor silenced the doves and finally pushed the U.S. into World War II. Over the next two days, Japan's follow-on attacks all but obliterated the offensive power of the Far East Air Force (FEAF) in the Philippines, leaving the remnants of US forces little choice but to withdraw to Australia.²⁰⁹ Americans were stunned by a catastrophe that later led to numerous conflicting reports, inquiries, and a congressional investigation into intelligence failures and allegations of dereliction of duty up to the highest levels of the Navy and Army.²¹⁰

²⁰⁹ The attacks would have been simultaneous with the raid on Pearl Harbor had weather not delayed the Japanese. As events transpired, the attack was only hours later since the Philippines are across the date line. According to the official Air Force account, half of the 35 B-17s and 55 P-40s were lost. See: Wesley Frank Craven and James Lea Cate, eds., *The Army Air Forces in World War II*, vol. 1, *Plans and Early Operations, January 1939 to August 1942* (Washington, DC: Office of Air Force History, 1983), 201-233.

²¹⁰ Failures of intelligence and military decision-making leading into Pearl Harbor shaped perceptions by American public and senior government officials that critical national and military intelligence lacked appropriate collection, analysis, dissemination, and especially coordination. Though senior military commanders were held accountable and relieved of duty after the attack, the extensive 70-day congressional investigation did not begin until after V-J day. Despite a variety of intelligence indicators of faltering diplomatic relations and Japanese interest in the detailed berthing plan for the Navy fleet at Pearl Harbor, the extent to which pieces of decoded messages and other available intelligence amounted to a definitive suggestion of imminent attack remain controversial. Nevertheless, Congress cited detrimental organizational rivalry factors among military intelligence offices and senior officers. For example, "The War Plans Division, particularly, appears to have had an overzealous disposition to preserve and enhance its prerogatives." See: United States Congress, *Report of the Joint*

Just 3 years earlier, America had been poised to spend its way out of recession with a \$2 billion Keynesian public works stimulus, while much of the rest of the industrialized world committed to rearmament.²¹¹ As a result of American domestic focus, military readiness for the U.S. Army and its air forces, as well as the Navy, was woefully lacking across all aspects of manpower, equipment, and training. To many, U.S. involvement in World War II was inevitable well prior to Pearl Harbor. The succession of events in summer of 1940—The Dunkirk evacuation, fall of France, and Battle of Britain—turned the tide of American isolationism with enough time and political will to wield its industrial might into the increasingly global conflagration.²¹² The Joint Chiefs recognized the impending predicament with alarm. On 24 June 1940, General George C. Marshall, Army Chief of Staff, and Admiral Harold C. Stark, Chief of Naval Operations, penned an urgent joint statement to President Roosevelt:

*The naval and military operations necessary to assure successful Hemisphere Defense call for a major effort which we are not now ready to accomplish. Time is of the essence in overcoming our unreadiness. To overcome our disadvantage in time, the concerted effort of our whole national life is required. The outstanding demands on this national effort are: – first, a radical speed-up of production, and second, the assembly and training of organized manpower.*²¹³

Committee on the Investigation of the Pearl Harbor Attack Including the Minority report, Joint Committee on the Investigation of the Pearl Harbor Attack, (New York: Da Capo Press, 1972), XIV, 251-266 (quote on 264). Pearl Harbor is exhaustively studied. For a sense of controversial conclusions, also see: David Kahn, "The Intelligence Failure of Pearl Harbor," *Foreign Affairs* 70, no. 5 (1991): 147-149; Roberta Wohlstetter, *Pearl Harbor: Warning and Decision* (Stanford, CA: Stanford University Press, 1962), 382-398.

²¹¹ Charles Poor Kindleberger, *The World in Depression, 1929-1939* (Berkeley, CA: University of California Press, 1986), 273-287.

²¹² Wayne S. Cole, *Roosevelt & The Isolationists, 1932-45* (Lincoln, NE: University of Nebraska Press, 1983), 11.

²¹³ George Catlett Marshall, "We Cannot Delay," *July 1, 1939-December 6, 1941*, ed. Larry I.

President Franklin D. Roosevelt and Congress, both aligned with a Democrat-party majority, acted swiftly. By the end of 1940, they had imposed the draft, quadrupled the defense budget, and passed legislation allowing the U.S. Government to buy corporate stock in order to drive production, acquire strategic materials, or even construct new plants.²¹⁴ By the time the Japanese attacked Pearl Harbor, the Army's total end strength had already swelled from 189,839 in 1939 to 1,462,315.²¹⁵ Congress had cleared the way for a massive buildup and Roosevelt was well-engaged in grand strategy. Meanwhile military leaders were embroiled in battle with each other over details surrounding the best ways forward.

As buildup planning ensued, inter-service debates raged unresolved over potential decisiveness of offensive air action, especially in roles other than direct support to ground forces. Serving as a grand aluminum pawn to these War Department bureaucratic tensions was the enormous, but comparably expensive, four-engined strategic bomber: the B-17 Flying Fortress. To Air Corps leadership and the Air Corps Tactical School (ACTS) instructors who busily promulgated interwar air doctrine, the B-17 was the long-awaited *sine qua non* for heavy bombardment aviation, capable of attack directly against

Bland and Sharon Ritenour Stevens, vol. 2, *The Papers of George Catlett Marshall* (Baltimore, MD: Johns Hopkins University Press, 1986), 262.

²¹⁴ Michael Warner, *The Rise and Fall of Intelligence: An International Security History* (Washington, DC: Georgetown University Press, 2014), 97-98. Gropman, *Mobilizing U.S. Industry in World War II: Myth and Reality*, 29.

²¹⁵ U.S. Census Bureau, *Historical Statistics of the United States, Colonial Times to 1957* (Washington, DC: U.S. GPO, 1960), 736.

enemy vital centers.²¹⁶ The B-17's longer range, bigger payload, and employment altitude higher than previous bombers, greater speed than contemporary enemy fighters, and defensive air-to-air firepower gave it the promise of lethality and invincibility.²¹⁷ To airmen, it was the manifestation of independent air power.

However, to the both the War Department and the Navy, B-17 procurement was an unnecessary and disruptive gamble. For the Army, the heavy bomber represented an opportunity cost worth a much larger force of smaller aircraft.²¹⁸ Two-engine attack aircraft (e.g. A-20) or medium bombers (e.g. B-25 or B-26) in larger numbers could prove more useful in direct support to ground campaigns. The B-17 also injected uncomfortable uncertainties into War Department plans. Even if clouds of B-17 formations could destroy enemy industrial targets far disconnected from the battlefield, it was impossible to accurately predict timelines for results. Further, gathering information and planning against such targets wasn't delineated in the War Department manuals that claimed precedence and watered down the Air Corps' "radical theory of air employment."²¹⁹ Every dollar spent on a B-17 rather than a tank or an infantry battalion would be trading away a relative known for an

²¹⁶ Kreis, *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II*, 25.

²¹⁷ The B-17s range was particularly sensitive to its bomb load. The B-17B boasted a maximum bomb load of 8,800 lbs and a range of 3,000 miles, but it could not accomplish either in combat conditions, in which it nominally carry only 2,400lbs up to 1,500 miles. The original armament load of five .30-caliber machine guns on the B model was eventually upgraded to twelve .50-caliber machine guns by 1945. See: Wesley Frank Craven and James Lea Cate, eds., *The Army Air Forces in World War II*, vol. 6, *Men and Planes* (Washington, DC: Office of Air Force History, 1983), 206-207.

²¹⁸ Ibid., 7, 197.

²¹⁹ Greer, *The Development of Air Doctrine in the Army Air Arm, 1917-1941*, 113.

unknown.

The Navy sided with the Army against the B-17 to protect its own turf. The sea service perceived an existential threat to both its land-based coastal defense and carrier-based aviation missions after the long-legged B-17 spotted the ocean liner *Rex* 600 miles offshore during an exercise in 1938.²²⁰ Despite challenges of weather, over-water navigation, and possible naval anti-aircraft artillery, the heavy bomber could patrol the vast American coast much more quickly than steaming ships—and with ample firepower to sink intruding vessels. Brigadier General William “Billy” Mitchell famously but controversially demonstrated that aerial bombs could sink ships 17 years earlier versus the cruiser *Frankfort* and battleship *Ostfriesland* at anchor; but the heavy bomber made it an operational reality.²²¹

Above the fray of service rivalry over the B-17 and its concomitant implications for war plans, President Roosevelt believed in both the air arm and the promise of a heavy bomber. In his January 6, 1941 State of the Union—11 months prior to Pearl Harbor—Roosevelt pled to the American public, “whatever stands in the way of speed and efficiency in defense preparations must give way to the national need.”²²² He framed a pre-emptive sense of crisis to the American public, and he did so effectively. American industry began to surge production of war materiel, including aircraft, in response to his

²²⁰ Craven and Cate, *Men and Planes*, 203.

²²¹ Robert Frank Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force* (Maxwell AFB, AL: Air University Press, 1989), 37.

²²² Deborah Kalb, Gerhard Peters, and John T. Woolley, *State of the Union: Presidential Rhetoric from Woodrow Wilson to George W. Bush* (Washington, DC: CQ Press, 2007), 303.

enthusiasm and his Lend-Lease program. The following year, with the gravity of congressional declaration of war on both Japan and Germany, he rallied support for a massive uptick in aircraft manufacturing:

*First, to increase our production rate of airplanes so rapidly that in this year, 1942, we shall produce 60,000 planes, 10,000 more than the goal that we set a year and a half ago. This includes 45,000 combat planes- bombers, dive bombers, pursuit planes. The rate of increase will be maintained and continued so that next year, 1943, we shall produce 125,000 airplanes, including 100,000 combat planes.*²²³

Internal War Department debates over doctrine or budgets couldn't change reality, but Roosevelt's enthusiasm helped. "The Army would require about two and a half years after Mobilization Day to create, equip, train ground forces," noted Major Haywood Hansell, then a member of the Air War Plans Division. "The Air Forces, on the other hand, could move much more quickly due to the fact that they were already well along in mobilization as a result of President Roosevelt's decision to expand American aviation" in addition to Lend-Lease.²²⁴ Since air forces could bed down overseas operations in a matter of several months, if the U.S. was to increase its forward role in Europe quickly, then it would have to untether at least some its air forces from ground maneuver.²²⁵

²²³ As events would unfold, the U.S. aircraft industry would nearly match this goal. Total aircraft production tripled from 6,028 in 1940; to 19,445 in 1941; 47,675 in 1942; 85,433 in 1943; and peaked at 95,272 in 1944. By December of 1943, America produced more than 1,000 heavy bombers (B-17 and B-24) per month and sustained this rate through D-Day. See: Office of Statistical Control, *Army Air Forces Statistical Digest - World War II*, United States Air Force, (Maxwell AFB, AL: AFHRA, 1945), 112. Kalb, Peters, and Woolley, *State of the Union: Presidential Rhetoric from Woodrow Wilson to George W. Bush*, 309.

²²⁴ Haywood S. Hansell, *The Air Plan that Defeated Hitler* (Atlanta, GA: Printed by Higgins-McArthur/Longino & Porter, 1972), 73.

²²⁵ With minor tweaks, AWPDP-1 was accepted as the blueprint for buildup of Air Forces at the Arcadia conference, which concluded on 14 January 1942. See *ibid.*, 97-99. VIII Bomber Command and its higher echelon Eighth AF activated (with their General Officers in place) on

Roosevelt knew this gambit was the best chance of keeping the conflict away from American soil. The air plan component (known as AWPD-1) of the Victory Plan called for “6,680 heavy bombers, 3740 very heavy bombers, and 13,038 replacements” along with a force of 2,050,000 Airmen.²²⁶ The services, including the AAF, would get what they’d asked for, although the charge to mobilize was an especially generous boon to the AAF.

Pearl Harbor may have been the trigger, but it was an Anglo-American handshake that tugged American strategy into the war. With grandiose media fanfare, the British Prime Minister’s delegation arrived in Washington on 22 December 1941 for the ARCADIA conference and a first opportunity to bring wartime political leaders and service chiefs together. Winston Churchill pressured Roosevelt to accept the British version of “Germany first” by way of a campaign in Northern Africa, but the meeting otherwise validated the ideas both sides tentatively arranged months earlier in combined conferences known as ABC-1.²²⁷ Without committing to detailed timelines, ABC-1 specified “a sustained air offensive against German military power” along with “defensive measures to protect the Western Hemisphere and the United Kingdom;

23 Feb under Gen Eaker, and 5 May under Gen Spaatz, respectively. Operations in the European Theater unfolded in a series of incremental firsts. Notably, the first bombing raid by the AAF in Western Europe occurs on 7 July, conducted with aircraft borrowed back from the UK. The 97th becomes the AAF's first Heavy Bomb Group ready for combat from the UK on 27 July. Its first B-17 raid occurred on 17 August, just over 7 months since the plan was authorized. For more timeline details, see: Kit C. Carter and Robert Mueller, *U.S. Army Air Forces in World War II. Combat Chronology 1941-1945*, (Maxwell AFB, AL: AFHRA, 1991).

²²⁶ While the organization of Army in 1945 differed significantly from the force projected in the Victory plan, the total size of the force was remarkable similar. The actual size of the AAF on May 31, 1945 was 2,310,436. More detail is available at: Gropman, *Mobilizing U.S. Industry in World War II: Myth and Reality*, 42.

²²⁷ Craven and Cate, *Plans and Early Operations*, 238.

maintenance of strong positions in the Near East, India, and Far East; and protection of sea communications.”²²⁸ This language reflected a compromise that allowed the U.S. to commit some ground forces to boost Allied morale prior to 1943, reduce near-term pressure on British forces, and preserve British access to the Suez Canal (a controversial concession by the Americans.)²²⁹ Another remarkable inclusion in ABC-1 was a declaration that “forces will be built up for an eventual land offensive.”²³⁰ No matter what strategic bombing might achieve in the war, the inherent design for American participation in a ground invasion had been part of the plan well prior to the first American bomb dropped across the Channel.

The Pacific was not the operational priority, but combat-ready reinforcements were necessary to contain the Japanese and defend Allied interests.²³¹ For the AAF, this meant shipping capacity and commensurate naval escort would be stretched thin with simultaneous requirements to transport troops and equipment to Africa and the Pacific.²³² Agreements at ARCADIA had given the AAF the green light to join the RAF in attacking Germany, but the shipping situation delayed hopes to get a bombing campaign underway from the UK for six more months.

Throughout 1942, as U.S. naval forces grew battle-weary in the Pacific after

²²⁸ Greer, *The Development of Air Doctrine in the Army Air Arm, 1917-1941*, 123-124.

²²⁹ Ronald E. Powaski, *The Cold War: The United States and the Soviet Union, 1917-1991* (New York, NY: Oxford University Press, 1998), 50.

²³⁰ Hansell, *The Air Plan that Defeated Hitler*, 59.

²³¹ Craven and Cate, *Plans and Early Operations*, 237-240.

²³² Richard G. Davis, *Carl A. Spaatz and the Air War in Europe*, ed. The Center for Air Force History (Washington, DC: U.S. GPO, 1993), 69.

Coral Sea, Midway, and Guadalcanal, Eighth Air Force established operations in the UK and joined the RAF in a period of experimental and asynchronous strategic bombing for the two air forces. The AAF, albeit by a task force led by Col Harry Halverson rather than by Eighth Air Force, launched its first deliberate attack across the Mediterranean on the evening of June 11-12. General Arnold picked the target himself when the original plan to attack Japan from China fell through, which began a sporadic trend of operational interference from Washington.²³³ Other accounts suggest grand strategy was at play since destruction of the Romanian oil refineries at Ploesti—the primary fuel source for the Axis—offered “the promise of maximum aid to the USSR in its struggle for survival” on the Eastern front.²³⁴

By all accounts, the sprawling Ploesti refineries should have been an easy target, but the attack resulted in utter failure with no real damage. The AAF’s Intelligence Division, relying on an unconfirmed Navy Intelligence report, related a single “oil depot at Ploesti was destroyed, one bomb fell in the woods, another hit a railroad station, while several fell on [the Black Sea Port of] Constanta without doing much damage.”²³⁵ Weather had obscured the intended impact points, the formation of 13 bombers released weapons based

²³³ Geoffrey Perret, *Winged Victory: The Army Air Forces in World War II*, 1st ed. (New York, NY: Random House, 1993), 177.

²³⁴ Assistant Chief of Air Staff (A-2), *The Ploesti Mission of 1 August 1943*, in *USAF Historical Study No. 103*, Historical Division, AAFRH-3, (Maxwell AFB, AL: AFHRA, June 1944), #101-103, IRIS 00467687, 14. This report includes an extensive review of context and results for both the 1942 and 1943 Ploesti raids. While it is quick to highlight operational failures of an inadequate attacking force and navigational errors, it suggests that collection of targeting histories was a positive contribution by AAF intelligence. Levine, *The Strategic Bombing of Germany, 1940-1945*, 94.

²³⁵ Assistant Chief of Air Staff (A-2), *The Ploesti Mission of 1 August 1943*, June 1944, 16-17.

solely on an unreliable time over target, and a disorganized egress plan resulted in aircraft scattered around the Middle East.²³⁶ “Probably the most favorable aspect of the raid,” quipped the AAF’s historians, “was the impression the big [B-24] bombers produced on the intensely interested citizens of Ankara.”²³⁷ It was a disappointing start for American bombers and certainly for those who sought to propel their machinations of strategic bombing theory.

The mission could be viewed as a success only from the standpoint that the AAF had attempted its first action derived from its plan to interrupt German industry. Unfortunately, there was not yet an AAF intelligence apparatus or collateral agreement in place in theater to provide detailed analysis of the results. If the AAF’s bomber forces were to improve on this first effort, they couldn’t just do more of the same; they would need new organizations, training, and systematic approaches to go along with technological innovation and the unprecedented boost of resources that followed. Unfortunately, roots of the AAF’s precarious debut of combat forces and air intelligence in Europe struggled to take hold many years earlier.

Air Intelligence Growth Spurt

By the Fall of 1942, more questions about a forthcoming air campaign lingered in the stuffy halls of the War Department’s munitions building than the War Plans Division could answer.²³⁸ To air-minded war planners, the

²³⁶ Levine, *The Strategic Bombing of Germany, 1940-1945*, 95.

²³⁷ Craven and Cate, *Torch to Pointblank*, 10.

²³⁸ Carl Spaatz’ office, when he served as Chief of the Air Staff beginning in June of 1941 was

drums of war presented opportunity not just for a service, but for individuals. It was no coincidence that the most capable Regular Army officers on the HQ AAF Staff were upwardly mobile officers awaiting a nod for command back in the field. During peacetime, the AAF could afford to herd its brightest into the fiery bureaucratic struggle in DC and to groom them under senior officer tutelage. However, rapid wartime growth in service manpower meant that opportunities for promotion (though in many cases temporary) abounded with the increase in field commands. The members of the so-called *bomber mafia* of the inter-war years at ACTS not only moved upward during the war, but in many cases either they led combat units or guided intelligence and planning organizations that would take on their personalities. For the AAF (especially Arnold), sending top staff officers to the field was also a way to ensure the warfighting headquarters and combat wings were moving in the same direction as Washington, with working relationships amenable to back-channel communications.

The downside of spreading the AAF's nucleus over the diaspora of a

located in the Munitions Building (a remnant of World War I) which was located on the National Mall. Consequently, his Air War Plans Division, where he had been twice previously assigned, was located in that building as well. The Pentagon began construction that year and much of the War Department had been scattered in smaller buildings around D.C., especially since they had been nudged out of their previous building by the growing State Department. Incidentally, Secretary of War Stimpson kept his office in the Munitions building as well, potentially to strengthen his argument for construction of the Pentagon, which wasn't completed until 1943. See: Davis, *Carl A. Spaatz and the Air War in Europe*, 58; Also: William Gardner Bell, *Secretaries of War and Secretaries of the Army: Portraits & Biographical Sketches*, ed. Center of Military History (Washington, DC: U. S. GPO, 2010), 8,14. Mark Clodfelter discusses the sweltering conditions to which the AWPDP was subjected in the Munitions Building basement. See: Clodfelter, *Beneficial Bombing: The Progressive Foundations of American Air Power, 1917-1945*, 92.

wartime Air Force was all but to ensure poor continuity and the loss of cohesive staff offices as the service grew. Further, the demand for pilots not only in combat units, but also for training and ferrying duty didn't leave many available for the staff. This led to another challenge for the Air service. Pilots tended not to accept advice from those who didn't fly. According to an intelligence analyst who served on the Air Staff at the time:

large numbers of non-Air Corps officers were being assigned to duty with the Air Corps. It was not long before this 'family' spirit of the old office of the Chief of Air Corps was lost. As its numbers rose from 50 to 500 and by 1942 to over 1500 there began to be a cleavage between 'first class' citizens who wore wings and 'second class' citizens who did not.²³⁹

Had the AAF fought earlier and the Army acquiesced to development of a professional corps of air intelligence airmen, many of these challenges may have been avoided. Intelligence personnel might have gained experience, provided continuity, and established credibility before the exigencies of total war further shrank the circles of trust among key leaders.

One pilot who did remain in Washington throughout the war was then-Major General Muir S. Fairchild, who was working his way up the Air Staff after recently skipping the rank of Colonel on his way from Major to Two-Star General in a span of 5 years.²⁴⁰ In November 1942, the near-term challenge for Fairchild was that the Air-Campaign Plan in circulation in the new Pentagon, AWPD-42, had been chewed to pieces by the Joint Intelligence Committee (JIC)

²³⁹ Perera, *Memoirs: Washington and War Years*, 1973, 55.

²⁴⁰ Mark R. Grandstaff, "Muir Fairchild and the Origins of Air University, 1945-46," *Airpower Journal* XI, no. 4 (1997, Winter): 30.

“for lack of systemic evaluation of industrial intelligence and unsatisfactory presentation of target information.”²⁴¹ The Navy disputed AWPD-42 as well, because the originating task from the President was to determine the “number of combat aircraft by types which should be produced in this country for the *Army and our Allies* [emphasis in original] in 1943,” but the air planners not only ignored the Navy’s desire for bombers, but they’d left the Naval planners completely out of the effort.²⁴²

As for the JIC, Michael Warner offers, “the committee benefited from a novel idea—that the armed services, intelligence agencies, and cabinet departments should send senior representatives to debate the meaning and import of the information available to the government, and then present policymakers with informed ‘assessments’ of the war or its various aspects.”²⁴³ The JIC served as a crucible of service debates over intelligence activities and had extraordinary influence with the Joint Chiefs. What the JIC did not have was an airman.²⁴⁴ Not only were AAF’s interests underrepresented, but its expanding intelligence enterprise also lost the opportunity to benefit from the interagency seasoning of a senior intelligence officer member.²⁴⁵ Michael Warner added, “The intelligence

²⁴¹ Perera, *Memoirs: Washington and War Years*, 1973, 80.

²⁴² Hansell, *The Air Plan that Defeated Hitler*, 104-105.

²⁴³ Warner, *The Rise and Fall*, 97.

²⁴⁴ Hansell, *The Air Plan that Defeated Hitler*, 146.

²⁴⁵ This shortcoming was not resolved until Major General Clayton Bissell took a seat in the JIC as A-2 in September 1943, continuing as the War Department’s G-2 the following year (discussed in chapter Eight), while also managing to pull two Colonels and a Lieutenant Colonel from the Air Staff onto the JIC staff. Based on air staff composition at the time, AAF officers supporting the JIC were likely all pilots. See: *Organizational Chart: Standing Committees in which AC/AS Intelligence Participates*, War Department, Collation of Air Technical Intelligence Information of the Army Air Arm, 1916-1947, 6, (Maxwell AFB, AL: AFHRA, ca. 15 November 1943).

brought to the table by the agencies could be seen in a fuller perspective when amalgamated, and the institutional positions of the various actors grew sharper and better honed for the debates.”²⁴⁶ The JIC offered the opportunity to get airmen’s perspectives and requirements for intelligence onto the table in ways that would at least assist mutual understanding, if not to achieve compromise on key issues. None of this could happen without a seat at the table.

The AAF’s new demand for timely and adequate air intelligence continued to outstrip its A-2 staff’s limits in terms of scope, expertise, training, and in its links to other intelligence organizations. This conundrum presented two potential options for AAF leadership: first, to grow the A-2 staff from the HQ down to the squadron level as quickly but thoroughly as possible; and second, to outsource for expertise and capacity by whatever means possible. Arnold chose both as long-term and near-term solutions, respectively. Plans to expand the Intelligence Division were already in progress by July of 1941 during then-Brigadier General Carl Spaatz’s short stint as Arnold’s Chief of the Air Staff. He took on the task with the same relentless vigor and keen foresight he would later apply to operational challenges. He cautioned that existing AAF plans for only 800 intelligence personnel in 1942 would be the absolute minimum, adding ominously: “in the event of an emergency being declared in the near future...the Intelligence Division and, of course, the Army Air Forces would be greatly embarrassed by not having the machinery functioning to produce the

²⁴⁶ Warner, *The Rise and Fall*, 97.

required of personnel for Intelligence duties.”²⁴⁷ He also secured \$1.5 million to convert office space to a 24-hour-a-day War Room, which he proclaimed as “the absolute heart-and-soul of up-to-the-minute information, serving as the basis for the war in planning and immediate Air operations.”²⁴⁸ Spaatz took his excitement for the potential of air intelligence to the new High Wycombe Headquarters of Eighth Air Force the following May. Not until a warfighting commander like Spaatz had skin in the game and could benefit from a new professional corps of airmen, would the air-intelligence orphan finally find a loving home and hit its growth spurt.

In the meantime, those in Arnold’s meager Air Intelligence section had struggled to keep up, and turnover hampered continuity. Their acting section chief, Major Bartlett Beaman, submitted a frustrated progress report just a week prior to Pearl Harbor. “It has been absolutely impossible to complete even the highest priority projects within the limit of time requested,” he wrote, due to both shortages in qualified personnel as well as workspace.²⁴⁹ Most of his sub-units were tied up in admin tasks and unable to provide overview summaries for quick digestion by the planners who depended upon them, much less perform any in-depth analysis. The handful of civilians assigned to the section were under-trained and served only as clerks, but they were dedicated. They logged 91 hours of overtime in just one month trying to keep

²⁴⁷ Carl A. Spaatz, *Comments on Air Intelligence Items*, War Department, 5, (Maxwell AFB, AL: AFHRA, 11 July 1941), #203-6, 1.

²⁴⁸ *Ibid.*, 2.

²⁴⁹ Major Bartlett Beaman, *Progress Report, Air Intelligence Section*, War Department, 5, (Maxwell AFB, AL: AFHRA, December 1, 1941), #203-6, IRIS142226, 1.

up.²⁵⁰ It was clear to Spaatz that the AAF lacked not only numbers of officers, enlisted, and civilians to perform intelligence duties, but that they also lacked skill and professional pride. They needed a standardized and quality intelligence-training program. Rather than start from scratch, however, air leaders first looked to the British.



²⁵⁰ Ibid., 2.

Chapter Three: Forming the Air Informers

*The Military Organization with the most efficient photographic reconnaissance will win the next war.*²⁵¹

—General Von Fritsch, Chief of the German General Staff, 1938

*Here at Harrisburg, in the summer of 1943, we can revise that statement. We know that the military organization with the best photographic reconnaissance and the best photo intelligence will win this war.*²⁵² [emphasis in original]

—Capt Harvey C. Brown, AAFIS Director of Photographic Intelligence

British Air Intelligence—“Through the Looking Glass”

Between the late interwar years and the end of 1942, British air intelligence coalesced of a nation’s existential necessity, and it thrived as an enterprise under able leadership and a culture amenable to malleable organizations. Unlike the AAF, treated as a repressed stepchild, the RAF had earned its independence in 1919, but this left it to feed on budget scraps left behind by the long-established Royal Navy and Army. In fact, the 1920s were austere times for all three services in Whitehall. The entire RAF budget plummeted from £52 million in 1920 to a stingy £9.4M by 1923, under Parliament’s mollifying assumption that “there would not be a major war for a decade.”²⁵³

²⁵¹ P. J. A. Riddell, “Photographic Reconnaissance and Intelligence,” *Royal United Services Institution. Journal* 90, no. 557 (1945): 92.

²⁵² *History of AAFIS*, USAF, (Maxwell Field, AL: AFHRA, ca. 1 January 1945), #266.1, IRIS 168895, chap. XV, p. 9.

²⁵³ David Ian Hall, *Strategy for Victory: The Development of British Tactical Air Power, 1919-1943* (Praeger Studies in Diplomacy and Strategic Thought) (Praeger, 2008), 17.

From the British perspective, only the U.S., Italy, Japan, and Russia were building sizeable air forces, and “none of these air forces were within striking distance of England.”²⁵⁴ Thus, the RAF retained only an ancillary role for homeland defense; its bomber development and training lost genuine commitment, and other missions fell by the wayside.²⁵⁵

Although the RAF’s nascent air-intelligence apparatus in World War I had helped to break the blood-soaked stalemate of the Somme with aerial photography—offering precious birds-eye advantage to the Allied counter-offensive—the RAF’s early interwar years were spent debating the value of fighter escort, leaving photographic interpretation in the province of the British Army.²⁵⁶ Lessons of the RAF’s adventurous aerial surveying teams, mapping the vast interests of the British Empire “along the Nile valley and Indian border with Afghanistan, and of the Anglo-Persian Oil Company in Iraq,” faded as these functions were taken over by commercial operators.²⁵⁷ As the 1920s waned, it was Sir Hugh Trenchard’s Air Force, his likely enemy was France—not Germany—and he poured every pound he could muster into Bomber Command.²⁵⁸ However, by 1936 all European eyes had fixed on Adolf Hitler. A

²⁵⁴ Air Ministry, *The RAF in the Bombing Offensive Against Germany*, Air Historical Branch, I, prewar evolution of Bomber Command 1917-1939, (Maxwell AFB, AL: AFHRA, undated draft; declassified 11 July 1984), #512.041-26, IRIS 00895741, 33.

²⁵⁵ *Ibid.*, 34-36.

²⁵⁶ Taylor Downing, *Spies in the Sky: The Secret Battle for Aerial Intelligence During World War II* (London, England: Little, Brown, 2011), 19-22; Randall T. Wakelam, *The Science of Bombing: Operational Research in RAF Bomber Command* (Toronto, Canada: University of Toronto Press, 2009), 13-14.

²⁵⁷ Downing, *Spies in the Sky*, 22.

²⁵⁸ Peter Paret et al., *Makers of Modern Strategy: From Machiavelli to the Nuclear Age* (Princeton, NJ: Princeton University Press, 1986), 633.

succession of RAF expansion schemes shifted toward the immediate need for defensive fighters, further delaying the RAF transition to “big bombers.”²⁵⁹

Nevertheless, the RAF’s proponents of strategic bombing began to connect targeting to intelligence. Air Chief Marshal Sir J.M. Steel, who led Bomber Command in 1936, portended the importance of aerial photography to the bombing offensive. With keen bureaucratic insight, he argued for full-time dedication by an Air Ministry office, because “only in this way can operational requirements, training policy, and technical development [of aerial photography] be properly related and given that impetus which is essential to progress.”²⁶⁰ Despite its smaller relative budget, the RAF’s bureaucratic disputes were its own to solve, so it could be more flexible in meeting emerging needs. Toward this aspect of air intelligence, the RAF was well ahead of the AAF, but it would take an unusual blend of dashing genius, technological innovation, and visionary leadership to build the photoreconnaissance and interpretation it would need to strike and assess across the channel. Even the RAF, with its deliberative procurement processes and culture of efficiency, could not adapt quickly enough to solve its nation’s most urgent intelligence needs alone. Help would come from unconventional sources and a new type of intelligence organization—one that would meaningfully change names and shapes many times in just a few short years—while the eventual incorporation

²⁵⁹ Air Ministry, *The RAF in the Bombing Offensive Against Germany*, undated draft; declassified 11 July 1984, 194-194.

²⁶⁰ Air Ministry, *Photographic Reconnaissance, Vol. 1, to April 1941*, 1945, 46.

of other forms of intelligence remained an entirely separate challenge.²⁶¹

Sydney Cotton and the Photographic Development Unit (PDU).²⁶² By the fall of 1938, Germany's closed borders, *Anschluss* with Austria, and bloodless annexation of Sudetenland left the British Government uneasy and under-informed about Germany's true ambitions. The British Secret Intelligence Service (SIS) was, as its official historians accounted, "exclusively responsible for espionage on an inter-service basis—indeed, on a national one," yet it struggled with its overextended clandestine intelligence mission.²⁶³ The SIS' undercover network of foreign Passport Control Officers (PCOs) was no longer able to slough mundane embassy duties onto lower staffers because "the demand for exit visas grew proportionately with the Nazi persecution of Jewish communities, [so] the actual work of gathering intelligence became permanently disrupted."²⁶⁴ The SIS needed time to form a new human network and to bolster its capacity for cryptanalysis, so it looked first to aerial

²⁶¹ Glynn and Abzug argue, "identity shifts over time are predicated upon efforts to be understandable, interpretable, and desirable to target audiences, in order to secure organizational legitimacy." Further, "in their quest for legitimacy, firms changing their names will adopt new names that align with prevalent institutional practices." This is a common theme to organizations in this study as titles shift along with organizational identities. In some cases, titles shape the organization and in other cases, titles are used to convey meaning to external actors. See: Mary Ann Glynn and Rikki Abzug, "Institutionalizing Identity: Symbolic Isomorphism and Organizational Names," *The Academy of Management Journal* 45, no. 1 (2002): 270, 272, 277.

²⁶² Distinction between photoreconnaissance and interpretation as separate functions in the RAF emerged as organizations specialized. They didn't fully split until the Photographic Development Unit (which had combined both functions) was re-designated the Photographic Reconnaissance Unit with its reassignment to Coastal Command in June of 1940.

²⁶³ F. H. Hinsley and Michael Howard, *British Intelligence in the Second World War*, vol. 1 (New York, NY: Cambridge University Press, 1979), 17.

²⁶⁴ David Faber, *Munich, 1938: Appeasement and World War II* (New York, NY: Simon & Schuster, 2009), 30.

reconnaissance.

In a partnership with the French secret service, the SIS sought a civilian businessman-aviator with knowledge of continental air travel and a plausible cover to conduct aerial photography over German territory.²⁶⁵ The plan was dubious at best, but they found their man in an Australian named Sydney Cotton. Cotton was a former Royal Naval Air Service pilot with an uncanny combination of flamboyance, imagination, and determination. If the personalities at the front of a new organization are responsible for defining its identity and charting its course, then the British Photographic Reconnaissance Unit would be in for a wild ride. It was led by “a colorful character with a love of aviation, money, and women.”²⁶⁶ At the conclusion of World War I, during which he had invented a warm and well-liked flight suit (the Sidcot), he dabbled in a variety of commercial ventures. These included airborne tracking of Newfoundland’s seal population, stock trading and land speculation, and a color-film project called Dufaycolor—all of which failed—leaving a trail of disgruntled associates along the way.²⁶⁷ However, it was the audacious marketing of Dufaycolor that provided the plausible cover story to grant him access to Germany from the air.

Cotton was a solution-seeker, the type of person who sought perfection in doing things well, even if he had to step on a few toes along the way. Over the

²⁶⁵ Downing, *Spies in the Sky*, 29.

²⁶⁶ Allan Williams, *Operation Crossbow: The Untold Story of Photographic Intelligence and the Search for Hitler's V Weapons* (London, England: Preface, 2011), photo caption after page 130.

²⁶⁷ Downing, *Spies in the Sky*, 28. Roy M. Stanley, *World War II Photo Intelligence* (New York, NY: Scribner, 1981), 40.

next year, he boldly set about photographing the German countryside, ports, and military installations from his Lockheed 12A, modifying it as he went along. Early on, Cotton begrudgingly followed the exacting guidance of the French Secret Service, who demanded to fly onboard, operate the equipment, approve all modifications, and direct all maneuvers; he had little to show for it but poor results and exasperation.²⁶⁸ Cotton was the type of character who insisted on control, demanded perfection, and didn't mince words when things went poorly, but he was every drop a salesman and he was out to prove his product: photographic reconnaissance.

By June 1939, Cotton would work exclusively with the RAF and left indelible marks on its aerial-photography enterprise.²⁶⁹ First, he pushed for further specialization and established precedent for modifying reconnaissance aircraft to suit the mission. Flying with three concealed F.24 cameras, installed in both oblique and vertical angles, he could produce continuous, overlapping strips of film and "photograph an area ten miles wide from a single flight path at twenty thousand feet."²⁷⁰ This altitude was much higher—and safer from detection—than previous reconnaissance efforts, but it was far from immune to flak and enemy fighters once the war began. Cotton learned that maximizing speed, range, and altitude, while minimizing probability of detection were the hallmarks of reconnaissance.²⁷¹ He switched his aircraft's paint scheme to a

²⁶⁸ Downing, *Spies in the Sky*, 30.

²⁶⁹ Wil Deac, "Australian Maverick Frederick Sidney Cotton Took an Innovative Approach to Aerial Reconnaissance," *Aviation History* 10, no. 6 (July 2000): 14.

²⁷⁰ Downing, *Spies in the Sky*, 31.

²⁷¹ Constance Babington Smith, *Air Spy: The Story of Photo Intelligence in World War II* (New

low-contrast “pale duck egg green,” doubled its range to 1600 miles with additional fuel tanks, and “routed hot air over the cameras to prevent the film, mechanisms, and lenses from freezing at high altitudes.”²⁷² He had the knack for technical innovation, but he didn’t stop there.

With his ardent salesmanship and flare for teasing his customer’s interests, Cotton figured out how to tie together disparate experts and advocates who would make things happen at a dizzying pace. He convinced the RAF Commander-in-Chief, Air Chief Marshal Sir Hugh Dowding, to hand over two desperately coveted spitfires; he ingratiated himself with Maj Harold “Lemnos” Hemming, an executive of the Aircraft Operating Company in possession of a Wild machine—“an elaborate Swiss machine for recording precise measurements from aerial photographs”; and he secretly enlisted the aid of Michael Spender, one of England’s top civilian aerial surveyors and a photography specialist, who proved the evidential value of comparing photographs of the same area over time.²⁷³ Cotton also brought Hemming’s pilot on board the project: Douglas Kendall, a future RAF Wing Commander, who was even then uniquely qualified both with flying experience in aerial surveying, including “forestry, soil erosion and geology,” and an academic résumé featuring coursework in “botany, forestry, and road alignment.”²⁷⁴ When cotton needed expertise, he found it. Cotton hastened to accomplish all

York, NY: Harper, 1957), 21. Stanley, *World War II Photo Intelligence*, 40.

²⁷² Hinsley and Howard, *British Intelligence in the Second World War*, 1, 29. Stanley, *World War II Photo Intelligence*, 40.

²⁷³ Babington Smith, *Air Spy*, 22-28, 47-48.

²⁷⁴ Powys-Lybbe, *Eye of Intelligence*, 22, 24.

of this with a supportive nudge from the SIS, but otherwise operating free from excess fiscal scrutiny and the machinery of government.

“Lemnos” Hemming was not without concerns of his own. For the “tall, thin, and jovial” aerial business proprietor, war had brought him the misfortune of two confiscated aircraft, a vanishing commercial market, and a dearth of available skilled labor.²⁷⁵ Such situations create opportunity for mutual self-interest with the government, though the RAF was entrenched with skepticism toward private partnership and shackled by its ministerial rules.²⁷⁶ However, his association to Cotton paid off handsomely for all involved, though it took persistence and serendipity to convince the British government that both his niche expertise and his finely tuned machinery were novelties they could not duplicate on their own. Cotton became the conduit when he donned the RAF blue as an acting Wing Commander and his improvised venture was officially re-designated the Special Flight with “*carte blanche*” operating authority.²⁷⁷ This set of circumstances, bolstered by the clever business sense of both Cotton and Hemming, provided impetus for an unofficial partnership between the two.

As all of these factors came together, the critical test for the Cotton-Hemming partnership with the wartime British military came on February 10, 1940. The British Admiralty, then relying exclusively upon the RAF for reconnaissance, had sent an urgent request to locate the German battleship

²⁷⁵ Williams, *Operation Crossbow*, 29-35.

²⁷⁶ Ibid.

²⁷⁷ Ibid., 30.

Tirpitz. When Coastal Command's Blenheims failed to deliver, it was Cotton's Special Flight's chance: An extended-range Spitfire sortie covering two ports from 30,000 feet returned with images that Spender processed on the Wild machine. Spender's photos not only showed the *Tirpitz* "still safely in dry dock," but he also "produced superb plans of the port of Emden, and of the naval base at Wilhelmshaven, with all the ships delineated to scale."²⁷⁸ Winston Churchill, then First Sea Lord, was impressed, but more than a little put out that the work had been done by a unit that was distinctly outside his chain of command. When he told the Air Ministry that if they didn't take over Hemming's developing operation, then the Admiralty would, the Air Ministry finally acted; "an agreement was achieved, back-dated to 1st April 1940, and Major Lemnos Hemming was given the rank of wing commander in charge."²⁷⁹ From there, the Photographic Development Unit (PDU) and Aircraft Operating Company (AOC) would begin to transform into a single military organization.

Cotton's aptitude for combining experts into a singular purpose continued to pay off as his undertaking matured. He bred an organization with pride in its dual specialization of brave pilots and keen-eyed interpreters. Early PDU reconnaissance pilots established the "reputation of a secret corps d'elite" for their brave low-level "dicing" runs in the unarmed spitfires, navigating at extreme low-level and with timing accuracy, and capturing photos of the most sensitive enemy targets; Distinguished Flying Crosses became common for the

²⁷⁸ Powys-Lybbe, *Eye of Intelligence*, 25. Babington Smith, *Air Spy*, 37.

²⁷⁹ Powys-Lybbe, *Eye of Intelligence*, 25.

pilots.²⁸⁰ The work of interpretation was initially tied to the AOC's Wild machine in Wembley, but the flying was only eight miles away at Heston. With timeliness and accuracy so critical to targeting intelligence and assessment, the close proximity between the reconnaissance operation and the interpreters afforded not only faster transport between the two, but also engendered common professional understanding, close personal relationships, and a growing sense of teamwork. The results were higher-quality products.

Further, photographic interpretation, as both a military and an intellectual endeavor, would benefit from diversity. When, after 28 June 1939, the RAF's Women's Auxiliary Air Force (WAAF) was established, females were welcomed into the organization, originally as "plotters, whose job it was to identify the precise areas that had been covered," but they would soon become top photo-interpreters.²⁸¹ Constance Babington-Smith, one of the more prolific of the PIU interpreters, and later chief of the Aircraft Section, viewed her job as a connection between the unique type of photographs and the abilities of those suited for the job: "The wealth of information [photographs] hold has meaning only for the initiated. Indeed, their secret language may be compared to the language of X-ray photographs, which can be fully understood only by an eye which is experienced and a mind that has been specially trained."²⁸²

Babington-Smith proved another sterling example of adapting civilian

²⁸⁰ Babington Smith, *Air Spy*, 60-63.

²⁸¹ Jeremy A. Crang, "The Revival of the British Women's Auxiliary Services in the Late Nineteen-Thirties," *Historical Research* 83, no. 220 (2010): 353. Babington Smith, *Air Spy*, 59.

²⁸² Babington Smith, *Air Spy*, 2.

specialization to wartime military endeavors. With pre-war experience as an aviation journalist, she brought with her an extraordinary background from European airshows, a keen knack for discerning aircraft differences, and an uncanny passion for fine-tuning her art.²⁸³ WAAF contributions to photo-interpretation work well exceeded any expectation Cotton may have had, including his simple rationale for hiring those with the right skill set: “My reasoning was that looking through magnifying glasses at minute objects in a photograph required the patience of Job and the skill of a good darning of socks.”²⁸⁴

Cotton had been charged directly by Air Chief Marshal Sir Cyril Newall, Chief of the Air Staff, to run an unconventional outfit however he saw fit; and it thrived through the Summer of 1940.²⁸⁵ Despite his mandate from the top and fresh commission as a Squadron Leader, Cotton was a civilian at heart, prone to eccentric methods and a brash approach to bureaucratic dealings; so, he didn’t last long as the organization grew. The orthodoxy, discipline, and rigid command structure of the RAF could not cope with the long-term experimental status of Cotton’s unit, now that it had proven an enduring success with further need for expansion. Sir Arthur Street, Permanent Undersecretary of State for Air, notified Cotton that the Photographic Development Unit, “which you [Cotton] have done so much to foster, should now be regarded as having passed beyond the stage of experiment and should take its place as part of the

²⁸³ Powys-Lybbe, *Eye of Intelligence*, 135.

²⁸⁴ Babington Smith, *Air Spy*, 59.

²⁸⁵ Downing, *Spies in the Sky*, 38.

ordinary organization of the Royal Air Force.”²⁸⁶ Cotton—the entrepreneur of aerial reconnaissance—was thanked for his service and dismissed to return to civilian life.²⁸⁷

Photo-interpretation and its linkage to reconnaissance had been rediscovered and developed as an experiment, led by a risk-taker in Cotton, who was certainly comfortable with failure. Those with skin in the game took the type of risks to which they were prone: Pilots made daring dashes with their adventurous spirit and their competitive drive to outwit enemy pursuit—many would win Distinguished Flying Crosses; a corporate manager lent his assistance, taking only the risk of devoting his time and equipment, gaining the potential for a significant pay day and wartime rank. Even the brilliant, “often arrogant and tactless” Michael Spender, for whom photographic study was a lifelong pursuit, pushed his field forward in a way that only a professional might find fulfilling.²⁸⁸ All of them would have the assurance, subconscious or

²⁸⁶ Air Ministry letter reprinted in Babington Smith, *Air Spy*, 57.

²⁸⁷ William Baumol offers a pertinent definition of the entrepreneur, evoking a Schumpeterian take: “the bold and imaginative deviator from established business patterns and practices, who constantly seeks the opportunity to introduce new products and new procedures, to invade new markets, and to create new organizational forms.” The entrepreneur responds to environmental (or market) flux, emerges among competition, and wages an idea (or capital) against the possibility of failure; entrepreneurs speculate. Success in a free market economy is driven by profit alone and inevitably leads to growth or further opportunity. In this case, Cotton is risking his life for profit and glory. See: William J. Baumol, *The Free-Market Innovation Machine: Analyzing the Growth Miracle of Capitalism* (Princeton, NJ: Princeton University Press, 2002), 57.

²⁸⁸ Michael Spender was a gifted virtuoso with a “zest for life.” He’d double-majored at Oxford and made a variety of expeditions as a surveyor to Mount Everest, the Great Barrier Reef, and Greenland. He was also an accomplished musician. Spender joined the RAF during the war, but perished in a plane crash in 1945. See Royal Geographical Society, *Everest: Summit of Achievement* (New York, NY: Simon & Schuster, 2003), 247; Williams, *Operation Crossbow*, 28-29.

otherwise, that *anything* they provided would be better than the dearth of information then available about the German military and economic disposition. They were the type of people who saw themselves as pioneers, lured into exciting pursuits for the prizes or fame, but quick to step aside (voluntarily or otherwise) when the bureaucracy swallowed their creations. The RAF released the free-spirited Cotton in mid-1940, leaving him to complain of “bureaucratic jealousy and inter-departmental rivalry” as the RAF attempted to push his unconventional operation “beyond the stage of experiment.”²⁸⁹

P.J.A. Riddell and the Photographic Interpretation Unit (PIU). To standardize this new capability within the military, a new organization would be born. To lead it, an RAF pilot from Bomber Command was selected, Squadron Leader P.J.A. “Peter” Riddell.²⁹⁰ According to one of his interpreters, Riddell was “the one and only regular R.A.F. officer in a very irregular unit,” but he was also “one of the most experienced men in the country in interpretation work.”²⁹¹ With his slicked-back hair and casual cigarette, Riddell was debonair and charismatic. He was the sort of fellow who could get along with anyone, which helped him to establish credibility with the daring wartime reconnaissance pilots as well as the “super jig-saw mind[ed]” interpreters.²⁹² He was also an exacting organizer—his greatest strength. The growth of his small team into an expansive military enterprise took the type of leader who

²⁸⁹ Deac, “Australian Maverick Frederick Sidney Cotton Took an Innovative Approach to Aerial Reconnaissance,” 64.

²⁹⁰ “Royal Air Force,” *London Gazette*, 4 September 1934, 5607.

²⁹¹ Babington Smith, *Air Spy*, 65.

²⁹² *Ibid.*, 80.

possessed a penchant for efficient processes, a gift for developing talent, and a singular focus to produce timely and accurate information for his customers. He would have to adapt to his clients at all levels of military headquarters and political leadership from the Prime Minister down to individual bombing crews. This was Peter Riddell's legacy—the founder of organizational photo-interpretation—though the work of his PIU would be far from perfect.²⁹³

Riddell had learned early at Bomber Command that the customer wasn't easily satisfied and most certainly wasn't always right. On the night of 19-20 March 1940, he was in the precarious seat as a lieutenant in charge of the damage-assessment cell when the RAF dispatched its first attack on German territory. It was a night retaliatory strike on the island of Sylt, on which German minelaying aircraft were based. Returning crews celebrated triumphant results: Twenty-six of the thirty Whitley crews and fifteen of the twenty Hampdens reported to have successfully located and attacked the target, noting "many direct hits on the air station...hangars, living quarters, a slipway, and light railway."²⁹⁴ Well after an emphatic Prime Minister Neville Chamberlain proclaimed total devastation of the target to the press, Riddell's

²⁹³ Organizations tend to take on, at least initially, the behaviors and biases of their founders. Edgar Schein uses a helpful definition of organizational culture, "the pattern of basic assumptions which a given group has invented, discovered, or developed in learning to cope with its problems of external adaptation and internal integration, which have worked well enough to be considered valid, and therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems." Riddell understood the unique attributes of photo-interpreters, and he inculcated his organizational culture into new recruits. See: Edgar H Schein, "The Role of the Founder in Creating Organizational Culture," *Readings in Managerial Psychology* 278 (1989): 1.

²⁹⁴ Charles K. Webster and Noble Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, 4 vols., History of the Second World War United Kingdom Military Series (London, England: H. M Stationery Office, 1961), 1: 211.

section finally received the post-strike photos. Much to Riddell's dismay, "there was no damage whatsoever to be seen and not even one bomb crater," recalled Ursula Powys-Lybbe, a prolific WAAF photo-interpreter.²⁹⁵ Condemned as *Sisyphus*, Riddell was sent back to look harder at the photographs while Bomber Command's leaders insisted "the damage had been either repaired or concealed."²⁹⁶ The bombs had actually landed on a Danish island.²⁹⁷

Riddell would take from this early experience the challenge of running an outfit responsible for delivering bad news. This duty was particularly volatile when visual evidence showed that the bombing hadn't gone as reported by crews or as desired by those who were responsible. In wartime, tensions were high and pressure existed on all involved to show indications of success were immense. Commanders like Arthur "Bomber" Harris, then the Group Captain in charge of No 5 Bomber Group (later famously all of Bomber Command), wouldn't hesitate to unload frustrations on the messenger. The closer the damage assessment team to the bomber crews, the greater was the pressure from within to report successful results. One WAAF interpreter, then assigned to Bomber Command, recalled:

The worst of it was, so often no damage existed, and bomber crews had to be told the truth. Can you imagine our feelings? ...It was tragic when they managed to stagger back with dead or wounded only to be told that they had been nowhere near the target by what they considered to be a bunch of idiots. We longed to be able to see successful results and hear their relieved and

²⁹⁵ Powys-Lybbe, *Eye of Intelligence*, 26.

²⁹⁶ Webster and Frankland, *Strategic Air Offensive*, 1: 140, 210-211.

²⁹⁷ Powys-Lybbe, *Eye of Intelligence*, 26.

*excited remarks.*²⁹⁸

Damage assessment challenges were not limited to instances of crews missing the target. They also derived from factors such as the type of target struck, the type of weapons used, the quality and orientation of post-strike photos, and especially the enemy's response. Attacks on rural buildings and other vertical targets were relatively straight-forward to assess when large-scale imagery was available, because structures and craters could be easily identified. However, interpretation was more challenging for urban and industrial areas, particularly when only small-scale imagery was available. In these cases, interpreters and analysts had to focus on differences in image tone to detect areas that were burned out or blasted, which could be ambiguous.²⁹⁹

Ordnance selection added another challenge for interpreters. Some weapons did not leave damage readily distinguishable by photograph. Fragmentation bombs, for example, which were intended for softer targets such as personnel or aircraft, "had thicker steel casings, often with wire wrappings, to produce more and larger fragments" and only about 15 percent of the total weight of each weapon was explosive.³⁰⁰ As a result of their design and intended effect, they didn't create very large holes in their targets. If they did not "burn, tip, or have major pieces blown off, a photo-interpreter would see them intact when in reality they might look like Swiss cheese and be beyond

²⁹⁸ Quote attributed to Stella Palmer, see: *ibid.*, 26-27.

²⁹⁹ Stanley, *World War II Photo Intelligence*, 326.

³⁰⁰ Stewart Halsey Ross, *Strategic Bombing by the United States in World War II: the Myths and the Facts* (Jefferson, NC: McFarland & Co., 2003), 106.

repair.”³⁰¹ In this case, interpreters would be more likely to underestimate the actual damage and impact to the enemy.

Other challenges led to over-estimation. This was particularly evident for immediate reports if follow-on images were not available, if the original damage was later obscured, or if the assessment of the enemy’s capacity to recuperate from the damage was incorrect. Flawed repair estimates were exacerbated by Riddell’s training philosophy that “a vertical air photograph is not a picture but a precise mathematical document”³⁰² Riddell’s philosophy drove a tendency to estimate the enemy as static rather than as a dynamic actor capable of aggressive repairs.³⁰³ When judgment came into play, interpreters were inclined to be optimistic, favoring the friendly team. Whenever an answer would be impossible to determine with certainty, it made sense to select an answer less likely to draw resistance from the decision-makers or the aircrew in charge of the organization. The cost of erroneously optimistic estimates was to misinform the judgment of targeteers, who would otherwise have prioritized follow-on attacks.

This pressure to show results also applied to the night-photography section. This section had developed a technique for plotting night-bombing

³⁰¹ Stanley, *World War II Photo Intelligence*, 331.

³⁰² Babington Smith, *Air Spy*, 101. Stanley, *World War II Photo Intelligence*, 331.

³⁰³ For example, intelligence estimates from the 18 March 1943 attack on the Bremer Vulcan plant in Vegesack (discussed in more detail later) was a case in point. Interpreters assessed from extensive visual damage that the plant would be out of production for 11 months, but the Germans had the shipyard back to full submarine production only six weeks later. See: United States Strategic Bombing Survey, *Bremer Vulcan, Vegesack, Germany*, 2nd ed., No. 100 (Washington, DC: USSBS, 1947), 117-118.

attacks using an open-shutter exposure such that light sources from the ground—including exploding bombs—caused streaks on the film that could be interpreted.³⁰⁴ The section's leader, fearful that RAF leadership had a growing sense of distrust of this technique, decided to furnish photographic results only of successful raids.³⁰⁵ But the job required confidence and credibility in both directions. Without this trust, at best it would take time for decision-makers at the top to accept assessments with a self-critical and constructive mindset. Otherwise, they might not accept (or even receive) the results at all, discard the feedback as invalid, and continue with their *a priori* assumptions and courses of action.

Command-level intelligence organizations served their masters, so there was no protection afforded for independent analyses. To avoid conflict with superiors, Riddell sought to create damage-assessment processes that were objective, thorough, expedient, and indisputable. He later opined, "interpretation of air photographs became an exact science."³⁰⁶ By this he implied it had become routinized with repeatable and consistent results—free from the very perils of human subjectivity. Riddell failed to recognize the oxymoron inherent in his conception of photo-interpretation as a science rather than an art. The 1938 Oxford English Dictionary, available to him at the time, defined *interpret* as: "Expound the meaning of; make out the meaning of;

³⁰⁴ Powys-Lybbe, *Eye of Intelligence*, 165-166.

³⁰⁵ Downing, *Spies in the Sky*, 180-181.

³⁰⁶ Riddell, "Photographic Reconnaissance and Intelligence," 80.

render, by artistic representation or performance.”³⁰⁷ His perspective carried an unfortunate consequence. By seeking to make a science out of a particularly human and subjective endeavor, Riddle helped to sanitize it of its greatest value: informed judgment, which is a cornerstone of the human side of war.

Photo-interpretation—A science of academics. By the fall of 1940, as Churchill’s Britain thanked the brave few airmen in Fighter Command for “turning the tide” and successfully defending her skies, Bomber Command began hurling high explosives and incendiaries across the Channel.³⁰⁸ The reconnaissance operation, then led by Wing Commander Geoffrey Tuttle, had been re-designated as the Photographic Reconnaissance Unit (PRU), accentuating its fraternal association to Riddle’s Photographic Interpretation Unit (PIU). British air superiority was understandably imperfect. Both units, located respectively at RAF at Heston and Wembley, began taking a battering by the Luftwaffe. “The photographic section received a direct hit,” recalled the section’s Chief; “Fortunately, it was at night and there was nobody in the building.”³⁰⁹ The wartime services of both units rose to a demand requiring 24-7 shift-work, and the RAF wasted no time ensuring their protection while attempting to assimilate them into military culture. More reconnaissance units

³⁰⁷ H. W. Fowler et al., *The Concise Oxford Dictionary of Current English* (Oxford, England: Clarendon Press, 1938), 429.

³⁰⁸ The allusion here is to Churchill's famous speech before the Commons on 20 August 1940: "The gratitude of every home in our island, in our Empire, and indeed throughout the world, except in the abodes of the guilty, goes out to the British airmen who, undaunted by odds, unwearied in their constant challenge and mortal danger, are turning the tide of the world war by their prowess and their devotion. Never in the field of human conflict was so much owed by so many to so few." See: Stephen Bungay, *The Most Dangerous Enemy: An Illustrated History of the Battle of Britain* (Minneapolis, MN: Zenith Press, 2010), 165.

³⁰⁹ H. C. Westwood, interview by David Mander, 2001, interview #22103.

quickly stood up in the UK and in other theaters, while the interpreters replanted at Danesfield House in Medmenham. There they blossomed from the roots of their organizational identity. Yet another moniker heralded their next phase as the Central Interpretation Unit (CIU).

Centralizing interpretation for the entire European theater at Medmenham meant assembling a larger staff with commensurate infrastructure and administrative support. Rows of huts for living quarters were hastily constructed on the grounds, but the addition of more personnel, including a smattering of Regular RAF officers, WAAFs, wartime commissions, and enlisted troops, resulted in a mixture of backgrounds and interests. Civilians who'd stayed with the organization were required to join the service and don the RAF blues, although for most the change was in clothing only.³¹⁰ This transition to an all-uniformed RAF outfit served to highlight the contrasts among those who worked there. Most of the administrative staff were regular RAF officers, while photo-interpretation was accomplished primarily by newly commissioned analysts who identified more as academics than as military officers. "There was quite a big division between the administrative staff and the photo-interpretation staff," noted one interpreter. "You just can't discipline all these academic types."³¹¹ Another recounted a story of Lady Charlotte Bonham Carter, a WAAF photo-interpreter of high pedigree. When rebuked by a regular RAF officer for cutting across a sporting field thereby jeopardizing the pristine

³¹⁰ RAF, *Photographic Reconnaissance, May 1941-Aug 1945*, The National Archives, II, (Kew, England: PRO, 1948), 1.

³¹¹ Ralph Merrifield, interview by Barrington Grey, 1971, interview #23159.

pitch, Lady Charlotte quipped, “I pay my sports subscription, I don’t play any games, and I shall continue to walk across the field.”³¹²

These free-spirited photo-interpreters worked hard, but they also played hard. Seldom with expectations of serving after the war, they were motivated less by the promise of long-term promotions and more by enjoying the collaborative atmosphere while the war lasted. “We used to go out on bicycles and go out to the pub every night,” One WAAF officer recalled, “I just didn’t feel I was in the war at all [because] I was doing something I loved doing... in a very nice place.”³¹³ Tensions that would later arise between senior AAF and RAF officers did not transfer into the joyful climate at Medmenham. For example, even after the Americans arrived, the Bomb Damage section was “always a close-knit and very happy group of people showing marked loyalty to their colleagues and the unit as a whole.”³¹⁴

Although CIU’s expanded scope and responsibilities warranted leadership by an RAF Group Captain, more senior at the time than Squadron Leader Riddell, his contributions were most enduring. The most important of these was to break interpretation reports into successive phases, each of increasing time and depth of analysis. The first phase was not normally accomplished by the seasoned interpreters at the CIU, but by intelligence personnel collocated with the reconnaissance unit. They processed the film while debriefing the pilot then disseminated via “flash reports by phone, teletype, air courier and/or

³¹² Shirley Komrower, interview by David Mander, 2001, interview #22107.

³¹³ Ibid.

³¹⁴ Powys-Lybbe, *Eye of Intelligence*, 157.

annotated photos” any urgent information after a cursory review of the wet images.³¹⁵ The goal for the first phase was three hours from aircraft wheels-on-the-ground.³¹⁶

During the second phase, various sub-sections with expertise by geographic or functional area provided a deeper review. This section was responsible for dispersing all photos received during the preceding 24 hours to any recipients deemed appropriate.³¹⁷ Finally, the third phase was the CIU’s *raison d’être*: long-term estimates of the enemy situation with detailed study by specialized sections, such as “the damage assessment section, Industry, Communications, Future Operations, camouflage and decoy, wireless, target material, shipbuilding, aircraft production,” or expansion of second-phase subjects.³¹⁸ This third phase would give the CIU ample justification for expansion. Not only would an increasing number of analytical sections require participation from other services, but also with more interpreters, “who in civil life had interested themselves in activities or industries such as geology, mining, shipbuilding, engineering, or railways.”³¹⁹ Over time, the more the CIU’s work came to be valued by commanders, political leaders, and the interested public, the larger it grew and the less it was cowed to the desires of its clients.

³¹⁵ Capt Norman E. Green, *Photo Interpretation*, Combat Operations AAF School of Applied Tactics, (Maxwell AFB, AL: AFHRA, June 1945), #248.261-5, IRIS 161822, 2 (figure 1).

³¹⁶ RAF, *Photographic Reconnaissance, May 1941-Aug 1945*, 1948, 32.

³¹⁷ Riddell, "Photographic Reconnaissance and Intelligence," 84.

³¹⁸ Ibid.

³¹⁹ RAF, *Photographic Reconnaissance, May 1941-Aug 1945*, 1948, 32.

Americans Under British Tutelage

Airmen who rise to great heights to command with considerable influence often launch their meteoric ascents by showing talent in opportune moments. It's what they do when tested under pressure, perhaps when challenged to solve an intractable problem for those much higher in the bureaucratic food-chain. Major (later General) Charles P. Cabell was one such airman.³²⁰ Cabell proved his mettle in Panama as an Air Corps pursuit pilot, then as a flying training instructor at Randolph Field. He'd attended the requisite schools, graduating from ACTS at Maxwell followed by the Army's Command and General Staff school at Leavenworth. Finally, he found himself assigned to Wright Field, working in the Air Corps' photographic laboratory.³²¹ He was there flying test sorties for the Air Corps' Materiel Division and sorting through research-and-development requirements—mostly driven by the ground-combat arms—for low-altitude reconnaissance, when the call came. Air Corps higher-ups in Washington, the same gentlemen who were engaged in fiery debate with the War Department over intelligence requirements, had sent

³²⁰ At the conclusion of his 37-year military career, Gen Charles P. Cabell would be viewed as a seasoned senior intelligence officer. His service culminated as the Air Force 4-star deputy CIA director. He was adept at guiding the agency's clandestine operations and synchronizing military activities, but—as with many military officers turned White House advisors—he was less successful at navigating the political constraints on his plans. Cabell's career foundered with culpability for the failed Bay of Pigs invasion of Cuba. He unsuccessfully attempted to deflect blame on the presidential decision to cancel pre-invasion air strikes and the administration's subsequent willingness to allow it to fail. Cabell had come to appreciate how air power could ease the burden on later military operations and seize the information advantage through reconnaissance. Those insights came from his experiences of many years earlier. See: Charles P. Cabell and Charles P. Cabell Jr, *Memoirs of War, Peace, and the CIA* (Colorado Springs, CO: Impavide Publications, 1997), 383-388.

³²¹ *Ibid.*, 14-19.

for him. Cabell stepped nervously into General Arnold's office in January of 1941.

The purpose of Arnold's meeting was to send off a team of observers to report back with findings from the British war experience. Direct American support to the war effort seemed increasingly probable and there was still time to adopt practices and adjust procurement plans based upon RAF lessons-learned—or at least to be informed by them. Officially, Cabell was a junior member on a team of five (including two Brigadier Generals), so he was charged only with the narrow scope of a photography study. Nevertheless, Arnold was boiling with frustration over Air Corps intelligence shortcomings and the ongoing battles with G-2, so he wasn't taking any risks that anyone on this team might miss the mark or misunderstand their responsibility. Cabell disdainfully recalled Arnold's gruff demeanor: "The way he literally backed me up against the wall, shook his finger at me and charged me with all the past ills of photography made me think I was faced with a mad man."³²² Arnold was serious. Cabell would soon be well outside the comfort of his previous experiences, helping to jump-start an intelligence apparatus neglected for more than two decades. On the 25 January 1941, he departed New York harbor aboard the S.S. *Excambion*, expecting to take a cursory sampling of RAF photography posts, while he would cautiously avoid being an imposition under wartime conditions.

What Cabell found during his two-month excursion to the UK seemed to

³²² Ibid., 20.

him a mature air intelligence enterprise, managed from the Air Ministry on down by affable personalities who were eager to adopt a mentorship role to the Americans, *especially* under desperate wartime conditions. Cabell delved deeply into their people and processes with a keen eye as to how his observations might be incorporated into the AAF. However, he was so impressed that his reports often failed to offer criticism or to project potential downsides.

Cabell noted the Air Ministry's direct advocacy for aerial photography in stark contrast to the Office of the Chief of Air Corps, where no such interest existed beyond Arnold himself. The first recommendation on Cabell's final trip report was to establish "an effective agency to formulate photographic policies and to coordinate research, development, procurement, organization, training, and methods of aerial photography," adding boldly, "the nucleus for this agency is already in existence in the Training and Operations Division of the Office of the Chief of Air Corps."³²³ Cabell felt that if the cause for his trip was important enough to have General Arnold's personal attention, then it should probably have a place on his staff. Arnold clearly agreed. Cabell was transferred to Washington to the very office he recommended upon his return.³²⁴

During his trip, Cabell also visited the CIU at Wembley (which was in the

³²³ Maj Charles P. Cabell, *Memorandum: Final Report of Military Air Observer to Great Britain to The Assistant Chief of Staff, G-2*, War Department, 5, (Maxwell AFB, AL: AFHRA, 7 April 1941), #168.7026-2.

³²⁴ Charles P. Cabell, interview by Henry L. Bowen and Alfred Goldberg, 15 January 1962.

process of moving to Medmenham), PRU-1 at Benson, PRU-3 at Oakington, Air Ministry Intelligence Directorate at Farnborough, and various camera and film corporations. Cabell was startled by the revelation of British photo-interpretation in comparison to the Americans' complete lack of attention to this field. He reported on specific details of CIU operations down to minutiae that Americans might mimic such as their shift rotations and numbers of photographs expected per interpreter per day, yet he was particularly awestruck by the skill and attributes he witnessed in those conducting the assessments. He later reflected that interpreters needed much more than just good eyesight. "Wide associations of memory and imagination were the essentials," Cabell wrote. "The interpreter with the eye could measure the dimensions of an object seen on a photograph, but only one familiar with the functions of a suspicious object, could relate the measurements to that specific function."³²⁵ He had witnessed that a tuned combination of aptitude, training, and experience seemed to produce far more than "casual study by the average individual."³²⁶

The Air Corps was well behind in developing such processes and certainly hadn't attracted or trained comparable talent. Maybe it didn't make sense to fill the intelligence staffs with pilots and administrative clerks. Cabell also found an unusual degree of dissemination-control on the most valuable assessments. Third-phase interpretation reports, the ones offering greatest promise for their

³²⁵ Cabell and Cabell Jr, *Memoirs of War, Peace, and the CIA*, 23.

³²⁶ Cabell, *Memorandum: Final Report of Military Air Observer to Great Britain to The Assistant Chief of Staff, G-2*, 7 April 1941, 3.

damage-assessment value covering “such factors as enemy airdromes or oil refining systems,” received only a “very limited distribution.”³²⁷ The Americans would have to find the right balance of security and need-to-know, but it seemed to Cabell the British erred on the side of secrecy, sending their reports only to whom they felt most needed them.

Among Cabell’s observations spanning several of his detailed reports, five in particular shaped the Air Corps perspective most. First, Cabell noted the British had a “dependence of Intelligence upon these photographs for so much of their information,” but he did not question this peculiarity.³²⁸ Rather, he was motivated by the apparent disparity from his own air force to push harder for a similar apparatus. He also lacked the experience at this stage of his career to recognize the scarcity of fusion in British analyses with other intelligence sources. In one of his reports, he parroted from CIU leadership that “information of all kinds must be available to the interpreter so that he can compare the detail he obtains from any one sortie with that information obtained of the same area from all sources.”³²⁹ It was a prescient observation, which may have had merit if it was actually followed, or if he had restrained his conclusion that a properly resourced photo-interpreter could “produce the

³²⁷ Maj Charles P. Cabell, *Interpretation of Aerial Photographs*, (Maxwell AFB, AL: AFHRA, 21 February 1941), #168.7026-2, rept. #42415.

³²⁸ Maj Charles P. Cabell, *Aerial Photography: Organization and Operation of Photographic Reconnaissance Unit Number One/Benson, England*, War Department, (Maxwell AFB, AL: AFHRA, 21 February 1941), #168.7026-2, rept. #42413, 4.

³²⁹ Maj Charles P. Cabell, *Organization of the Central Interpretation Unit*, War Department, (Maxwell AFB, AL: AFHRA, 21 March 1941), #168.7026-2, IRIS 126460, 5.

information required.”³³⁰ In reality, incorporation of other intelligence sources by Medmenham was quite limited at the time of Cabell’s visit. Prisoner reports were notoriously unreliable or intentionally deceptive, so photographs might be used to verify accuracy of the information or the integrity of the source, though even this was seldom.³³¹

Photo-interpreters were left completely in the dark about ULTRA decrypts due to the risk of compromising the source; with just one officer at Medmenham privy to this high-level intelligence source, fusion of this sort did not occur at this stage of the war.³³² Cabell’s observation applied more likely to research materials rather than full incorporation of other forms of intelligence. A later report by another AAF observer corroborated the RAF’s limited fusion: “More than 80 percent of their intelligence information is taken from photographs,” noted the observer based on a conversation with the RAF’s Director of Intelligence, despite “the fact that dozens of people are escaping from occupied countries of Europe and coming to England.”³³³ The limits and biases inherent to photographic interpreters were not fully recognized by the British; they were glossed over in the CIU sales pitch; and they were not critically evaluated by Cabell or other observers.

Second, Cabell noted their increasing reliance on night photography to evaluate bombing accuracy and damage assessment. RAF advancements in

³³⁰ Ibid.

³³¹ Powys-Lybbe, *Eye of Intelligence*, 35.

³³² Williams, *Operation Crossbow*, 24.

³³³ Maj D. W. Hutchison, *The Photographic Reconnaissance Unit*, War Department, (Maxwell AFB, AL: AFHRA, 27 October 1941), #168.7026-3, BES-282, 1.

night photography complemented their penchant for night area bombing, but their distrust of this method of BDA persisted. Despite their use of a camera on every bomber, they told him it was not “feasible to rely on the photograph taken by the bombing plane to give results suitable for damage assessment.”³³⁴ At best, strike photos from bombers might show them roughly where the bombs impacted, but not the result. Night photography presented myriad challenges with photo-flash bombs (these were flare-sized charges manually dropped by the radio operator to illuminate the ground), enemy search lights, shutter speed and timing, in addition to altitude and angle limitations.³³⁵ They’d pushed technology to the limits but they also partnered closely with industry to work through these challenges and many others. This direct collaboration with industry was another area where the Americans were well behind, and this one was partly Cabell’s fault, given his previous assignment at Wright field. The RAF was working through most of these challenges and using modified spitfires from PRU-3 (which was assigned to Bomber Command) to take the post-strike bomb-damage photos, with a setup of three cameras able to maximize coverage with simultaneous photos.³³⁶ Clearly the Brits were working hard to get the most from the photographs, but these photographs could only show so much.

³³⁴ Maj Charles P. Cabell, *Night Aerial Photography*, War Department, (Maxwell AFB, AL: AFHRA, 25 February 1941), #168.7026-2, rept. #42439, 1.

³³⁵ Maj Charles P. Cabell, AFHRA, "Night Aerial Photography", 25 February 1941, #168.7026-2, rept. #42439, 1

³³⁶ Maj Charles P. Cabell, *Aerial Photography: Organization and Operation of Photographic Reconnaissance Unit No. 3*, War Department, (Maxwell AFB, AL: AFHRA, 21 February 1941), #168.7026-2, rept. #42439, 2.

Third, CIU leadership hinted at the awkward relationship between the regular officers and the academics in uniform. RAF leadership understood the advantage, in Cabell's words, of "building the organization around individuals who know how to handle and read aerial photos, but are not bound by the World War conception of interpretation."³³⁷ The WAAFs and others brought into uniform during World War II were unaffected by the RAF's early interwar decisions or stale thinking and brought with them diversity of thought and skills. A question for Cabell was whether such an approach could work for the AAF. In spite of the AAF's rebellious behavior, it was still very much part of the War Department and tied to its traditions. Though the idea of pulling academics and businessmen, who were prone to free thought, into uniform was not entirely new to American wartime experience, this approach for the AAF had potential merit along with unintended consequence (discussed in later chapters).

Fourth, Cabell also picked up from CIU leadership its near obsession with productivity and rapid distribution of information. On the one hand, speed was paramount. He noted, "the production side of an interpretation unit must be as efficient as a business concern."³³⁸ This type of bureaucratic behavior—placing a premium on speed over quality—could result in routines that stifle innovation or overlook relationships between assessments. Cabell didn't note this potential downside. On the other hand, Medmenham leaders valued

³³⁷ Cabell, *Interpretation of Aerial Photographs*, 21 February 1941, 2.

³³⁸ Cabell, *Organization of the Central Interpretation Unit*, 21 March 1941, 5.

collaboration as much as possible without compromising timeliness. “As many opinions as time allows must be obtained on areas covered,” proposed Cabell, noting it would be the responsibility of a Duty Interpretation Officer to combine others’ assessments into a single, final report.³³⁹ This construct not only broadened the scope of opinions cast into the final assessment but also fostered competition among interpreters to provide assessments they thought would make the final report.

Finally, of the photographic reconnaissance units, Cabell was fascinated by “the free hand which the Unit Commander has had almost from the beginning in developing his own methods of operation and in altering his aircraft,” as well as picking his own personnel.³⁴⁰ This level of autonomy and trust afforded a commander below the general-officer ranks was startling, especially since it all added up to an unusual degree of motivation on the part of every member of the unit to make the mission successful. Such autonomy would be pronounced in theaters outside of Europe such as the South Pacific where, for example, George Kenney’s airmen developed skip-bombing.³⁴¹ The close eye Arnold kept on activities in London, however, meant that such activity there would be closely scrutinized.

Cabell’s reports were so well received that he set off a chain of events leading to a concerted effort by the Air Corps to catch up with RAF’s air

³³⁹ Ibid., 4.

³⁴⁰ Cabell, *Aerial Photography: Organization and Operation of Photographic Reconnaissance Unit Number One/Benson, England*, 21 February 1941, 4.

³⁴¹ Thomas E. Griffith, *MacArthur's Airman: General George C. Kenney and the War in the Southwest Pacific*, Modern War Studies (Lawrence, KS: University Press of Kansas, 1998), 83.

intelligence. While Cabell spent the next two and a half years under Arnold's wing implementing his observations via various air staff positions (culminating as Chief of Arnold's Advisory council), other AAF officers would follow up with the British. The key was to figure out how many steps of the RAF's intelligence evolution they could skip and to adopt methods that would work for the AAF, both militarily and culturally. Major David W. Hutchison was next to cross the Atlantic, this time focused on training, morale, and procurement priorities in preparation for a potential North Africa campaign.

In October of 1941, Hutchison spent some time observing the CIU's training program, which was by then firmly established at Medmenham. He noted the formal courses were 4 weeks long, comprised 25-30 students, and consisted of primary skills, notably "studying photographs and learning to identify military objects."³⁴² The course included real-world intelligence photographs and followed on to a secondary phase, during which students reported to an operational section of the CIU until their on-the-job training was deemed complete by the respective section chief. CIU leadership was closely involved in the selection of students as well as the training, and instructors were hand-picked among the best qualified. While the CIU clearly had an effective program for spinning up their newbies, Hutchison ascertained that "selection of the student is far more important than the training the student receives."³⁴³ He recommended that the AAF immediately stand up a photo-interpretation school

³⁴² Maj D. W. Hutchison, *Central Interpretation Unit Training*, War Department, (Maxwell AFB, AL: AFHRA, 27 October 1941), #168.7026-3, BES-287, 1.

³⁴³ Ibid.

and leverage the RAF's willingness to send liaisons to the U.S. to help out.

Hutchison noticed other stark contrasts between the AAF and RAF upon his visits to the RAF's photography school at Farnborough and various other RAF stations. First, he observed that British manpower shortfalls had driven the RAF to fill non-combat technical jobs with WAAFs as well as those "physically unfit or too old for the active Army service."³⁴⁴ This was as yet unfamiliar in the American military.³⁴⁵ At the RAF's photography school, he noted "as a whole the girls make better students and equally as good laboratory personnel as the men," despite their relative lack of experience.³⁴⁶ Hutchison's observations presaged service by American women in the European theater. General Arnold was impressed by the dozen British WAAFs working for Major General Ira Eaker when he visited in June 1942, but it was not until the following month, when General Eisenhower replaced a resistant General James Chaney as theater commander, that American women received advocacy to assume such roles in England.³⁴⁷

Hutchison found the morale at RAF stations to be equally intriguing. RAF officers still surged on a jolt of enthusiasm from the Battle of Britain, but they'd lacked almost every source of entertainment except alcohol. "It is

³⁴⁴ Maj D. W. Hutchison, *Photographic Training*, War Department, (Maxwell AFB, AL: AFHRA, 27 October 1941), #168.7026-3, BES-280, 1.

³⁴⁵ Although American women had enlisted in the Army Nurse Corps, Signal Corps, and as Navy yeoman in World War I, the first female officers in U.S. Armed Forces history did not enter training until July 1942. See: Wilma L. Vaught, "In Defense of America: Women Who Serve," *USA Today Magazine* 122, no. 2586 (1994).

³⁴⁶ Hutchison, *Photographic Training*, 27 October 1941, 1-2.

³⁴⁷ Charles W. McArthur, *Operations Analysis in the U.S. Army Eighth Air Force in World War II*, History of Mathematics (Providence, RI: American Mathematical Society, 1990), 34.

amusing to see how much pilots drink, knowing they are leaving on operations the next morning,” Hutchison observed before recommending, “proper recreation facilities such as pool tables, card rooms, game rooms, and motion pictures would attract the officers from the tap rooms.”³⁴⁸ On the positive side, he concluded that the American Air Forces were “far ahead of the RAF in providing entertainment and recreation for its men,” but the consequence was that the Americans had come to expect it.³⁴⁹ Cultural differences would continue to surface not just between the two Allied air services, but also between the pilots and other officers within each service.

In summary, Cabell and Hutchison’s visits were essential to the AAF’s wartime formulation of air intelligence. Cabell had the necessary credibility at the right time to maneuver in both the senior AAF leadership and RAF intelligence circles. In many ways, however, the relationships both Cabell and Hutchison built through their humility and gratitude paid more to the AAF than the details of their observations. They’d learned of the necessity for efficient and autonomous assessment organizations, but they also discovered that the AAF would need to find the right people, give them the right training, and provide the right environment for them—and the air campaign—to be successful.

³⁴⁸ Maj D. W. Hutchison, *Morale-Welfare of R.A.F.*, War Department, (Maxwell AFB, AL: AFHRA, 27 October 1941), #168.7026-3, BES-283, 1.

³⁴⁹ *Ibid.*, 2.

American Air Intelligence Training: A School of Apprehension

The few hours of intelligence training conducted at ACTS, already inadequate, was lost when the school was temporarily suspended in June of 1940. Its would-be students and experienced instructors were necessary to fill field and staff positions as the air service ballooned.³⁵⁰ However, the real problem was much deeper. The AAF needed to build a professional air-intelligence corps quickly, and it needed officers—about 2,000 of them in three years—who understood intelligence challenges and requirements unique to the air service.³⁵¹ Unfortunately, the official air-intelligence training program stumbled over a rocky start. Even the manner of finding a location reflected the impetuous, *ready-fire-aim* planning style then typical of Arnold and his staff.³⁵² The training program relocated among Bolling Field in Washington, the University of Maryland's College Park campus, and Harrisburg, Pennsylvania, all within the first three months. The location-jockeying robbed its initial cadre of the opportunity to iron out administrative and logistical challenges before its first crop of students arrived. The Air Staff's Intelligence Division had inexplicably failed to consider facility requirements, construction timelines, and faculty travel—much less course curriculum—before setting the class dates.³⁵³

³⁵⁰ Colonel E. F. Koenig, *Final Report to Commanding General, First District, AAFTTC*, (PA) Headquarters Air Intelligence School (Harrisburg, (Maxwell AFB, AL: AFHRA, 30 September 1942), #266.1-1, IRIS 168896, 9:2.

³⁵¹ Maj Gen George Brett, "Budget Estimate for F.Y. (Fiscal Year) 1943, Air Corps--Intelligence Items" cited in: *History of AAFAIS*, ca. 1 January 1945, 2.

³⁵² Parret discusses Arnold's impulsive management style and "aversion to standard operating procedures extended even to his own Air Staff" through several anecdotes; see Parret, *Winged Victory: The Army Air Forces in World War II*, 137-139.

³⁵³ Cohen, *Air Intelligence*, ca. 1 January 1954, 9:4-9.

This fledgling school put its graduates on a path to form a new air-intelligence career field in the AAF. The next section follows how the professional identity of these air intelligence officers was the shaping of how they were selected, how they were trained, and what was expected of them after they graduated. Though these three factors weren't static throughout the war, the school bred cohorts of officers with different training experiences and expectations of their military service.

The Air Staff's Personnel Procurement Division retained authority for student admissions and initially patterned its selection criteria after the RAF. Colonel E.F. Koenig, the school's first commandant, included a detailed discussion of student quality in his final report: "The first class sent here represented, with very few exceptions, a most unusual and most competent group of individuals...they were all men of affairs, intensely patriotic, and unfailing in their devotion to duty."³⁵⁴ They were certainly a mix of intellectual and eccentric gentlemen, but they weren't young by comparison with typical Army junior officers as they averaged nearly 41 years old.³⁵⁵ Maturity could be an asset, except that many of the older intelligence officers "found difficulty in understanding the feelings and attitudes of the younger crewmembers," as noted in an unpublished report.³⁵⁶ A small minority seemed to match the RAF's penchant for architects, engineers, and scientists who would follow on to photographic intelligence, but the vast majority of AAF recruits were attorneys,

³⁵⁴ Koenig, *Final Report to Commanding General, First District, AAFTTC*, 30 September 1942, 6.

³⁵⁵ *History of AAFAIS*, ca. 1 January 1945, 3:2.

³⁵⁶ Cohen, *Air Intelligence*, ca. 1 January 1954, 12.

bankers, business executives, and teachers.³⁵⁷ This latter group would specialize in combat intelligence, meaning most would follow on as group or squadron S-2s who dealt most closely with aircrew. The second class, Koenig remarked, “showed a marked deterioration.”³⁵⁸ The third improved after Koenig complained up the chain of command about student quality, but the fourth was abysmal. Students began to arrive with an inflated sense of entitlement and a negative attitude about the training. Some poor performers even expected to continue on to foreign service despite failing out, while others clearly didn’t even want to be there.³⁵⁹ Later classes tended to be less selective, less educated, and much younger as the pool of highly educated and experienced eligibles dried up.

Coordination for total class sizes, specialized training allotments, and student placement after graduation was poor. Class size at Harrisburg swung between 77 and 900, reflecting haphazard planning and communication between the Air Intelligence School, Technical Training command, the Air Staff, and combat headquarters.³⁶⁰ By the end of 1942, AAF officer accessions had dwindled. As the demand for air intelligence officers by VIII Bomber Command so exceeded the output at Harrisburg, officers were shipped from Officer Training School in Miami directly to Eighth Air Force in England to receive training there.³⁶¹ This left an even greater burden on those in theater and

³⁵⁷ *History of AAFAIS*, ca. 1 January 1945, class roster, 9:14.

³⁵⁸ Koenig, *Final Report to Commanding General, First District, AAFTTC*, 30 September 1942, 6.

³⁵⁹ *Ibid.*

³⁶⁰ *History of AAFAIS*, ca. 1 January 1945, 17.

³⁶¹ Cohen, *Air Intelligence*, ca. 1 January 1954, 9:18.

dropped standardization across the career field completely.

The school's full schedule of academic instruction and military drill brushed aside other necessary ingredients of a professional military corps. As Clausewitz professed, "no matter how much one may be inclined to take the most sophisticated view of war, it would be a serious mistake to underrate professional pride (*esprit de corps*)..."³⁶² Morale wasn't just undervalued in the early days at AAFIS, it was non-existent. Promotions were routinely passed by, even for the hardest-working and superior-quality instructors. Instructors who'd stayed on after graduating at the top of their class found this especially acerbic, "while their classmates basking in the spotlight in Washington have gained one and sometimes two grades." Those fortunate few in Washington were enjoying a slower pace of temporary duty, either studying or helping out the under-staffed Intelligence Service with menial tasks, while awaiting their Numbered Air Forces to stand up and ship overseas.³⁶³ The disparity in duty expectations was considerable.

Meanwhile, instructors back at Harrisburg received promises to rotate into combat theaters, yet were held back on the staff.³⁶⁴ The school's leadership at that time also failed to encourage social bonds, to develop unit cohesion, or to develop a sense of professional pride among intelligence officers. Guidance to both students and faculty stated with the force of regulatory authority that

³⁶² Clausewitz, *On War*, 187.

³⁶³ *Draft Memorandum: Intelligence Officers on Temporary Duty in Washington*, War Department, (Washington, DC: United States Army Air Force, Ca. October 1942), #266.1.

³⁶⁴ Lt Col L.W. Johnson, *Investigation of Conditions at AAF Air Intelligence School*, AAF Technical Training Command, 2, (Maxwell AFB, AL: AFHRA, 16 February 1943), #266.152-1, 38.

social activities were not required. "This is a serious school," published the first Commandant, "engaged in the grim business of preparing officers for battle."³⁶⁵ Not until the school failed a higher-headquarters inspection did the third Commandant improve "unsatisfactory" officers' mess conditions or establish an officers' club.³⁶⁶

Perhaps the school's greatest flaw in its early days was to pull the top graduates directly onto the faculty before they gained any real-world experience.³⁶⁷ This policy was especially problematic since most of the original faculty had lacked military experience as well. The result was to undercut the school's credibility to its own students while it robbed the combat theaters of the most promising graduates. One example was First Lieutenant Eugene McGuckin, Jr. He was an immensely popular Princeton-educated industrial engineer with a reputation to "play football at a pace that wore down everyone's endurance but his own."³⁶⁸ There's no doubt he was a charismatic and talented officer. However, instead of pushing him to thrive in combat (perhaps to bring him back later), the school tapped him to teach such material as "recent information on Photo Intelligence and Air Support Operations," despite the fact that he had no experience with either.³⁶⁹

³⁶⁵ AAF Intelligence School, *Information Bulletin*, (Maxwell AFB, AL: AFHRA, 10 April 1942), #266.1, M-VII-(6), 5.

³⁶⁶ Colonel Harvey Holland, H., *Progress Report*, Headquarters Air Intelligence School, (Maxwell AFB, AL: AFHRA, ca. 10 March 1943), #266.1, IRIS 168895, 4.

³⁶⁷ Cohen, *Air Intelligence*, ca. 1 January 1954, 9:10.

³⁶⁸ *History of AAFASIS*, ca. 1 January 1945, chap. 3 (pages not numbered).

³⁶⁹ Capt Arthur A. Jr. Houghton, *Memorandum, "Indoctrination Course"*, Headquarters Air Intelligence School, (Maxwell AFB, AL: AFHRA, 4 February 1943), 266.1, 6.

A course of contradictions. Challenges with student selection, the training environment, and post-graduation expectations were many; the quality of training during the school's early days fared no better. The school's curriculum evolved during its tenure but most improvements came too late to impact graduates bound for the European theater. The school's initial charge from General Marshall was to "instruct and train students in interpretation of aerial photographs and kindred subjects allied to the subject of Air intelligence," but the balance favored the latter at Harrisburg; none of the first class received specialized photo-intelligence training and even by the third class, 262 students generalized in Combat Intelligence, while only 52 specialized in photo-intelligence.³⁷⁰

Squadron- and Group-level intelligence training conducted at the school in 1942 reflected the broader AAF struggles for independence from the Army as well as the primacy of pilots in the service. The school's official texts were shamelessly informal and awkwardly oriented toward cramming basic military knowledge into civilians. The school's text professed to its own students, "in view of the extreme youthfulness of our flying personnel and the admitted respect which young and active men have for age and success, it is advisable to choose the intelligence officer from among those men over thirty, who have made their mark in life in other fields of endeavor and thereby deserve and command respect and consideration."³⁷¹ This passage reveals the brazen

³⁷⁰ General George C. Marshall, *Military Education: The Air Corps Intelligence School*, War Department, (Maxwell AFB, AL: AFHRA, undated), #266.1, Army Regulations No. 350-560.

³⁷¹ Army Air Forces Air Intelligence School, *Group and Squadron S-2*, ed. United States Army

demands for primacy by the AAF's aircrew, and the challenges confronted by anyone outside the flying community who attempted to exercise a position of authority at the unit level. Since respect and credibility in the AAF derived from proof of aptitude and prowess in flight, the officer responsible for interrogating bomber crews had to establish respect in other ways. As incoming students tended toward the younger and less experienced, they were ever more set up for failure in their duties to follow.

The school also demanded of its intelligence officers that they be more than merely a little enthusiastic about aviation and up to date as tactics changed. The effective intelligence officer "is always mingling with pilots and trying to get their point of view; he never misses a chance to fly in an airplane," whereby one "who is not familiar with the latest developments in the art of warfare, particularly of aerial combat, is a menace to his command," offered the text.³⁷² There was no middle ground. Of course, the AAF's need for intelligence officers who understood air tactics and possessed air-minded approaches to their profession had underwritten the argument behind the school's existence. However, the attitude evident in the text takes the argument so far as to undercut professional pride in themselves as intelligence officers. The more subservient they would be to aircrew, the less objective their assessments might be.

This expectation of a subservient mentality especially pervaded the

Air Forces, Revised ed. (Washington, DC: U.S. GPO, 1943), 5.

³⁷² Ibid., 7-8.

intelligence officer's role in damage assessment. Post-mission analysis began with intelligence officers questioning aircrew about the mission. The school's 1943 textbook for training Squadron S-2's (the unit intelligence officer) defined this process as *interrogation*:

*The extracting from a crew on its return from a mission of the maximum amount of reliable information...then transmitted to a higher authority, and thence downward to other units, in order that all flying personnel may derive the maximum benefit from the experiences from any particular crew on any given mission.*³⁷³

The intelligence officer played the role of a compassionate filter. Despite the charge to obtain information "promptly, completely, and accurately," the intelligence officer was to be conscientious and considerate of combat crews.³⁷⁴ "It is the announced policy of the Army Air Forces that combat crews returning from a mission shall not be harassed by being required to render complicated written reports," demanded the text. "At times, it may seem like a cruel task to quiz pilots and crews just returning from a dangerous mission, exhausted, tired, hungry, and thirsty."³⁷⁵ But it was necessary to get information to higher headquarters as soon as possible, and that meant getting it out of the aircrew while it was still fresh in their often-shell-shocked minds. The course text clearly reinforced the preferences of aircrew to be treated with special attention and portrayed the intelligence officers' work as tricky but mundane.

Nevertheless, the intelligence officer was prized less for his intellect and more

³⁷³ Army Air Forces Air Intelligence School, *The Briefing and Interrogation of Bomber Crews* (Harrisburg, PA: United States Army Air Forces, 1942), 16.

³⁷⁴ Army Air Forces Air Intelligence School, *Group and Squadron S-2*, 31.

³⁷⁵ *Ibid.*, 9.

for his inter-personal skills. To be successful, added the course, the interrogator “requires tact, skill, patience, and a good knowledge and understanding of life.”³⁷⁶ Sometimes that skill meant not just coaxing information from the aircrew, but also sifting through their claims.

Intelligence-officer training clearly placed the onus for accurate reporting onto the intelligence officer vice the aircrew. “It is a good policy to adopt that the S-2 should always stay on the conservative side in reporting the results of bombing,” the textbook insisted; “should he not do this, there is a tendency to jeopardize seriously the reputation of the crew and the S-2 because a report is submitted in which, for example, an aircraft factory is claimed as completely destroyed, and a reconnaissance mission over the area soon after the mission shows the aircraft factory to be standing and absolutely intact.”³⁷⁷ The intelligence officer was to filter out excessive claims by the crew in bombing accuracy as well as air-to-air kills. The service tended to accept exaggeration by aircrew, as if expected, but made no concessions for potential bias by its intelligence officers. Instead, these intelligence officers were caught between aircrew who needed to feel their sacrifices were validated, commanders who preferred positive feedback (to reinforce promotion), and an imperative to find the truth with inadequate analytical tools and training. This put them in a position to make the strongest claims they could reasonably defend with the information they teased out of the aircrew. General Arnold noted that this

³⁷⁶ Army Air Forces Air Intelligence School, *The Briefing and Interrogation of Bomber Crews*, 16.

³⁷⁷ *Ibid.*, 20.

predicament drove behavior reminiscent of an entirely different profession: “Intelligence Officers...seemed to me...to use psychologists’ methods in getting accurate answers from the crewmen.”³⁷⁸ Without any means of independent verification at the Group level, unless photos were available and of adequate quality, aircrew claims prevailed.

Furthermore, since the squadron and group commanders for whom the intelligence officer worked were pilots, this arrangement put the intelligence officer in a position not only to speak truth to power, but to *extract truth from power*. Even the most mature and professional of intelligence officers could be caught between pragmatism and cynicism, either leaving threads of aircrew exaggeration uninvestigated or potentially irritating the boss by doubting a mission’s success. A training text concluded with a macabre play to the intelligence officer’s conscience: Poor interrogation or reporting “may lead to the loss of aircraft and bomber crews,” the text threatened, and “this loss is directly attributable to the S-2 who carried out the interrogation.”³⁷⁹ Positive motivation was not a strong suit of the Harrisburg school.

The school’s photographic interpretation training during this era met with its own challenges: an awkward mix of apologetic caveats, unreasonable expectations, and an idea—borrowed unfiltered from the RAF—that interpreters should limit subjectivity in their assessments. One course text set the apologetic tone up front: “Photo intelligence is comparatively a newcomer in the

³⁷⁸ Arnold, *Global Mission*, 223.

³⁷⁹ Army Air Forces Air Intelligence School, *The Briefing and Interrogation of Bomber Crews*, 24.

field of military science and tactics,” cautioned the 190-page textbook, declaring itself to be “preliminary in nature...[until] a more thorough knowledge of what the problems are and what type of photo-intelligence organization and procedures are necessary to cope with them.”³⁸⁰ Despite the course’s limitations, this observation was spot-on. The Harrisburg school showed a prescient self-awareness that technical demands levied onto air intelligence were reaching beyond the experience of the organization charged to meet them. Much of the rest of the volume carried either a speculative tone or a notably narrow viewpoint, reflecting the limited operational experience possessed by Harrisburg’s instructors. The fledgling school, beginning to sense its inadequacy, could not yet determine the nature of its shortcomings, much less how it might address them.

When the photo-interpretation instructors did feign confidence, they placed unreasonable expectations upon their students. In stark contrast to the S-2 course, the photo-interpretation instructors prized different traits of their student-analysts than those sought of unit intelligence officers. “Patience, a flair for detail, and a retentive photographic memory,” were required for this type of work, so “the research-minded type of individual will probably make the most success of this job,” a course text stated.³⁸¹ The pool of patient researchers willing to sign up for AAF intelligence was shallow indeed. Further, a brilliant mind for research wasn’t enough; the school demanded of its

³⁸⁰ Army Air Forces Air Intelligence School, *Photo Intelligence for Combat Aviation* (Harrisburg, PA: United States Army Air Forces, 1942), 2-3.

³⁸¹ *Ibid.*, 177.

students the same passion for flight exuded by the AAF pilots. This type of work also required a “keen interest... in all activities regarding flying, airdromes, air forces, and the aircraft industry,” declared a course book.³⁸² These were lofty selection-criteria for a new school with a large enrollment.

Further still, the gifted mind and interest in aviation also needed a foundation in target information. The photo-interpretation course attempted to incorporate the AAF’s budding relationship between air intelligence and industrial knowledge. This linkage derived directly from the AAF’s strategic-bombing doctrine, but the school lacked the resources to teach to the depth it desired. Knowledge of industrial target systems had to be acquired by the interpreter because the quality of his or her assessments depended upon it.

Here the photo-interpretation course was aspirational beyond reason:

*A good interpreter must have first of all a knowledge of what he is looking for, what it looks like, and where possible, how it works. He must become thoroughly acquainted with the enemy country, that is, the geography, the economic structure, the industries and transportation system, and the military organization, He must know their life as it is today and keep himself currently informed of everything of significance happening in their country as well as his own, gleaning the information from all possible sources.*³⁸³

Even had the school’s preferences for student selection held true, the depth of knowledge necessary across various industrial systems could not be obtained in a six-week course or have been reasonably possessed by incoming students. Just as it had with the S-2 training, the school levelled the apparent

³⁸² Ibid., 67.

³⁸³ Ibid., 18.

contradictions of photo-interpreter duty squarely onto the shoulders of the student intelligence officer. As it stood, unless the interpreter was not only gifted with a mind for detail and highly motivated to acquire an understanding of enemy intelligence, then his analysis could be incomplete, inadequate, or inaccurate.

Conscious that their students could not meet expectations after graduation, the school's leadership taught students to hold back on subjective assessments. Both aircraft interpretation as well as damage assessment training captured this sentiment. In aircraft interpretation, for example, the course argued there were "no substitutes for knowledge and practice," so the intelligence officer should "work conservatively in his early 'learning stage'...[because] a good aircraft interpreter never guesses."³⁸⁴ The idea, adopted from P.J.A. Riddell's scientific approach, was that if new interpreters hadn't acquired the necessary knowledge base for informed judgment, then they shouldn't use judgment in their assessments at all. It certainly wasn't clear when intelligence officers possessed enough experience to offer subjective assessments, but as they'd learned to offer only objective assessment from the start, they'd be unlikely to buck this routine.

Damage assessment training, given only a cursory two pages in the primary course text, was also clearly lifted from the RAF and included examples from before U.S. entry to the war. The final paragraph concluded:

It is stressed that the work of damage assessment is highly scientific and absolute accuracy must prevail. Often damage

³⁸⁴ Ibid., 67, 73-74.

*assessment reports given by interpreters will clash with pilots' reports and the ground sources available to intelligence officers. The interpreter must be accurate enough so that intelligence and operations will have confidence in his findings. Raid assessment is a most complex and responsible task and is ultimately bound up with operational problems and general bombing policy.*³⁸⁵

Here the passage hints at factors beyond the intelligence officer's control, as if to caution against needless frustration. The burden of proof was to be levied upon the intelligence officer to resolve contradictory evidence and to convince skeptical aircrew of intelligence findings. Further, the tone here tiptoes around the issue of intelligence subordination to operations as it captures the political nature of bomb-damage assessment. As intelligence professionals, the appeal was to seek the truth. At the unit level, however, where intelligence was subordinated to operations personnel, this task could be exhausting. In situations where intelligence officers worked for each other, such as at Medmenham, they possessed greater flexibility in their assessments along with their autonomy. Effective BDA had to address two audiences: both the intelligence staffs at higher headquarters as well as the crews and commanders. Given the limits of bombing accuracy and the political pressures on the generals to show results, BDA analysts were left to fend for their own credibility.

Overcoming aircrew animosity. Intelligence officers were not the only ones receiving intelligence training. The AAF also attempted to educate aircrew about photo-interpretation and bomb-damage assessment via both publication

³⁸⁵ Ibid., 154.

and film. Because of a secondary purpose to inspire and reinforce credibility of intelligence officers, they tended to mix hyperbole with reality. The February 1943 edition of *Air Force*, the Official Service Journal of the USAAF, featured an article loaded with exaggerated claims about stereoscopic photography—the act of using an optical device with two images in order to perceive depth.

“Advances in aerial photography and photo interpretation make the camera a super-human military observer who seldom, if ever, is fooled,” claimed the article’s author. “It would not be out of the question to plan an entire campaign from a stereoscopic study of terrain as revealed in modern aerial photographs.”³⁸⁶ Intentional or otherwise, this romanticism for an emerging field engendered a general lack of awareness throughout the service of its limits. Since the article’s author was assigned to the HQ AAF, it was nothing short of propaganda in order to foster confidence. The downside was that it reinforced a tendency to over-rely on visual intelligence. Aircrew would tend to remain skeptical.

An official AAF training film, also produced in 1943, intended to curb animosity typical of bomber aircrew. Harrisburg’s AAFIS sent a photo-interpretation instructor, Capt. Frederick M. Brown, to serve as technical advisor. The school’s first commandant supported the effort, but he also contributed to the tensions between intel and aircrew by inculcating his attitude into his students. “Neither pilots not combat crews have the faintest

³⁸⁶ Captain L.B. Wright, "Three-Dimension View of the Enemy," *Air Force, Official Journal of the U.S. Army Air Forces* 26, no. 2 (February 1943): 32.

appreciation of the value of intelligence and the assistance which it renders them in accomplishing their mission and returning alive,” noted the Commandant.³⁸⁷ The video’s narrator opens with deprecating sarcasm toward the B-17 aircrew, capturing service culture of the 1940s AAF:

*This is story of Bill Wayne, a bombardier, with a two day leave in London. He's just been out on his first bombing mission and he's sure he's blown up his target single handed. Boy is he cocky.... He's a real hero all set for a binge.*³⁸⁸

The video portrays an American photo-interpreter as a mature, almost paternal figure (though both officers were Lieutenants), who explained the detailed process of bomb-damage assessment to the bombardier. Strike photos, taken by the bombers themselves in six-second intervals after release, had several purposes:

*It gives you a quick summary of the results of the mission without waiting for reconnaissance pictures. In case the high command wants an immediate report, it'll tell you pretty closely what percentage of the bombs landed in the target area. The strike plot comes in very handy for the damage assessment interpreter because it's a sure way of ruling out old hits when he's examining reconnaissance pictures. Finally, it can be referred to at any time for the bombing record of the lead bombardier.*³⁸⁹

The AAF wanted its aircrew to understand that all of the perceived hassle associated with uploading, operating, and downloading cameras was part of a scientific record for assessment, not a contrived scorecard or a meaningless waste of time. After viewing his own results, as annotated by the interpreter,

³⁸⁷ Koenig, *Final Report to Commanding General, First District, AAFTTC*, 30 September 1942, 6.

³⁸⁸ First Motion Picture Unit Army Air Forces, *Photographic Intelligence in Damage Assessment* (War Department, 1943), Training Film, I-3340, <https://www.awm.gov.au/collection/F02322/>

³⁸⁹ Ibid.

the bombardier concludes,

*'Next time I'm going to keep my big mouth shut until I see those snapshots of yours.'*³⁹⁰

The idea was to get aircrew to stop speculating and spreading word of raid results and to trust in the intelligence assessment. The training video also depicted a bias by the American photo-interpreter favoring the RAF's 1,000 bomber area-targeting raid as the acme of destruction to the enemy, which stood awkwardly in contradiction to the 8 AF's daylight precision bombing tactics:

'Wait 'till you see what the British call saturation bombing,' said the interpreter as he points to a photograph of a city area without roofs.

'That's Cologne, Bill. See what a good job looks like? Over a half a million incendiaries were dropped. See those orderly white spots in the street? That's the sun shining through the window holes of the standing wall...we can use those shadows sometimes to tell how far down the fire went.'

'They sure blasted that town,' offered Bill the bombardier.

*'We didn't decide the means by which this war is being fought, Bill. They brought that type of war to us and we have to use the same white gloves.'*³⁹¹

The AAF sought to instill in its members that idea that strategic bombing was not only serious business, but that bombing was, in a sense, a special delivery service that would exceed expectations. Both the aircrew and the intelligence officers could face questions of morality behind their work. The sense captured here was to send reassurances that maximum damage per raid

³⁹⁰ Ibid.

³⁹¹ Ibid.

was the noble aim. Further, this idea of a white-glove weapons delivery could only be achieved with dedication and teamwork by crew members as well as those charged with assessment. If aircrew, who also comprised the leadership chain, did not trust in the assessors, then the service would not learn from its mistakes.

Unfortunately, when official training films such as the one described here addressed only the strengths, while omitting the limitations of their subjects, they also contributed to cynicism, rather than ameliorate it. Unsurprisingly, this film and another supported by the Harrisburg school became part of the curriculum. They were also widely disseminated to both air and ground forces.³⁹²

Although the Air Staff met its production goals for air intelligence personnel, the harried effort was not without consequence. Rather than view the Harrisburg school as the deliberate development of a new air-minded profession, AAF leadership saw it as a factory for stamping a minimum of operations-led intelligence training onto recruits to get them down range quickly. In essence, they tried to make up for too-little-too-late with too-much-too-fast, and the result was to send unit intelligence officers forward who lacked confidence and photo-interpreters to Medmenham whom the British found to be “pretty useless,” or otherwise “completely lacking in any interpretation of operational photographs.”³⁹³ This led to a misguided effort by

³⁹² *History of AAF AIS*, ca. 1 January 1945, pages not numbered (REEL A2988: Frame 2681).

³⁹³ Downing, *Spies in the Sky*, 229; Air Ministry, *Photographic Reconnaissance, Vol. 2, May 1941 - August 1945*, Air Historical Branch, (Kew, London: UK National Archives, 1948), AIR

the AAF to educate the rest of the service about air intelligence, and a search for other agencies to support growing requirements for intelligence assessment.

The Harrisburg school lasted only a little more than two years and proved a flawed experiment with too much independence and too little support. Early school administration drew the ire of a series of unsatisfactory inspection ratings covering just about every facet required of a military post: housing, mess facilities, appearance and discipline of personnel, management of post funds, medical attention, post regulations, and handling of orders and regulations.³⁹⁴ Well-intentioned but over-zealous efforts by the third commandant to correct all of the school's administrative shortcomings met with subversive resistance from a pocket of disgruntled instructors. This group of resisters were led by a frustrated previous acting commandant.³⁹⁵ They convinced a visiting Intelligence officer from VIII Bomber Command, Lt Col Carl Norcross, to report observations of the school's "serious decline" to the Assistance Chief of Staff, A-2: "Resentment against the present Commanding Officer boils down to the following: He is not an intelligence officer," Norcross suspected. "In over 10 weeks he has done nothing to convince the faculty that he is even mildly interested in the instruction given to students."³⁹⁶ The

41/7, 79.

³⁹⁴ Holland, *Progress Report*, ca. 10 March 1943, 4.

³⁹⁵ *History of AAF AIS*, ca. 1 January 1945, pages not numbered (frame 520 on reel A5988); Lt Col L.W. Johnson, *Investigation -- AAF Air Intelligence School*, Army Air Forces Technical Training Command (Greensboro Headquarters First District, North Carolina), (Maxwell AFB, AL: AFHRA, 18 March 1943), #266.152-1, 368-369, 693.

³⁹⁶ Lt Col Carl Norcross, H., *Memorandum for the Assistant Chief of Staff, A-2: Army Air Force Intelligence School*, D.C.) Headquarters War Department (Washington, (Maxwell AFB, AL: AFHRA, 22 January 1943), 266.1-1, 1-2.

nascent community of air intelligence officers, who did not respect a leader whom they viewed as an outsider, would rather have been led by one of their own. Although much of Norcross's report was proven unsubstantiated, it nevertheless precipitated an intrusive investigation by Technical Training Command that hung a cloud over the school until its dissolution.³⁹⁷ The school saw five commandants in its short tenure—hardly a recipe for continuity, even in the best of circumstances. On the positive side, six weeks after the investigation completed, Gen Arnold transferred oversight responsibility from Technical Training Command to his A-2, a move which immediately boosted the school's access to "intelligence data, training aids, and equipment."³⁹⁸

The school chose as its motto the word *apprehension*; an apparent reference later noted by an Air Force historian to "signify the prowess basic to the learning of intelligence procedures."³⁹⁹ However, a dictionary available to the faculty at the time shows prophetic irony. They may have intended "the act of conceiving [or] perception" necessary for intelligence officers, but another meaning, "fear or distrust of the future" more closely aligned to their attitudes.⁴⁰⁰ New air-intelligence officers streamed into the European Theater despite ineffective training and a lack of a collective identity as intelligence

³⁹⁷ The investigation marked faculty morale at "the lowest in the history of the school," due partly to a failure by the Commanding Officer "to inspire or imbue [the faculty] with confidence in his ability as a commander and as an educator." See: Johnson, *Investigation -- AAF Air Intelligence School*, 18 March 1943, 1-10.

³⁹⁸ Cohen, *Air Intelligence*, ca. 1 January 1954, 9:31.

³⁹⁹ *Ibid.*, 9:17-20.

⁴⁰⁰ Noah Webster, *Webster's New Modern English Dictionary* (Chicago, IL: Consolidated Book Publishers, 1922), 46.

officers. Since they lacked the experience and credibility in Europe to engage in immediate target-intelligence challenges, those duties would fall on another organization.



Chapter Four: Picking Up the Slack

*I want a group of civilians to be as able as my best officers... I want them free of all operational and administrative duties so that they can go out and investigate a problem and sit down and study it for three days or longer, until they come up with the answer.*⁴⁰¹

—Lt Gen Ira C. Eaker, CG, VIII Bomber Command

*The Americans at this time were buying their intelligence from the British readymade, and we had to prove ourselves by showing that the British made mistakes.*⁴⁰²

—Charles P. Kindleberger, Economist with the OSS, 1942-44

Donovan's OSS Branches Out

The AAF's struggles to secure requisite intelligence for planning an air offensive over Germany in late 1942 reflected broader challenges with information flow within the United States Government extending all the way up to the White House. Gaps in espionage expertise, foreign contacts, and intelligence-research acumen were eventually filled by the Office of Strategic Services (OSS), which operated under the venerable leadership of Colonel (later Major General) William "Wild Bill" Donovan. The OSS also found the AAF to be an eager and voracious consumer of intelligence produced by its Washington-based Research and Analysis (R&A) branch as well as its London-based US

⁴⁰¹ According to Charlotte Knight, among the nicknames for Operational Analysts in Eighth Air Force were "Quiz Kids," "Op Annie's," or simply "Doc." Eaker also Quoted in: Charlotte Knight, "Ask Them Another," *Air Force* 28, no. 8 (1945): 31.

⁴⁰² Charles Poor Kindleberger, interview by Richard D. McKinzie, 16 July 1973.

Embassy's Enemy Objectives Unit (EOU).

Donovan, whose WWI gallantry in the infantry earned him the Medal of Honor, has been described by a CIA historian as a “mild mannered, imaginative, energetic, innovative, ambitious, and inspiring leader.”⁴⁰³ He was the champion for an intelligence empire and was revered by his subordinates. Not all would see him in such positive light, however. These same traits, which Donovan often took to extremes, would also galvanize others against him for being “indiscrete,” with “intense personal ambition” and an “inclination to flashy work.”⁴⁰⁴ Donovan was not just a soldier-turned-intelligence-officer, but a Columbia-educated lawyer and a conservative Republican with close cross-party ties to FDR.⁴⁰⁵ Donovan's OSS came to be out of a series of events derived as much from the politics surrounding its leader as from actual imperatives of wartime intelligence. Both of these yielded unlikely, yet important, contributions the CBO by sharing intelligence and adding brain power where American forces overseas needed it most.

By July of 1940, as the British had eighteen months earlier, Roosevelt grew concerned about the quality of information he was receiving about events that transpired in Europe. The speed and ferocity with which Germany toppled its

⁴⁰³ Thomas F. Troy, *Wild Bill and Intrepid: Donovan, Stephenson, and the Origin of CIA* (New Haven, CT: Yale University Press, 1996), 4.

⁴⁰⁴ Dick Ellis of British MI6, quoted in: Nelson MacPherson, *American Intelligence in War-Time London: The Story of the OSS* (Portland, OR: Frank Cass Publishers, 2003), 54.

⁴⁰⁵ There are conflicting accounts of Donovan's relationship with FDR. According to Thomas Troy, a CIA historian, Roosevelt claimed to know Donovan from Columbia Law School, a fact that Donovan later disputed. It is clear in either case, that Roosevelt established trust and rapport with Donovan whether by experience or by reputation. See: Troy, *Wild Bill and Intrepid: Donovan, Stephenson, and the Origin of CIA*, 25.

neighbors and expanded its power left too many unanswerable questions and Roosevelt with a sense of strategic paralysis.⁴⁰⁶ He needed details vital to his mobilization plan—and it was best not to accept what little he did receive at face value. Further, early concerns about Hitler’s bellicose intentions were supplanted by the reality of German expansion, and atop Roosevelt’s list of concerns was British resolve to resist. Despite the best of intentions by seasoned diplomats of America’s Foreign Service, “the dispatches and cables from Europe were meager fare, heavy with rumor and short on analysis,” while reports from the Office of Naval Intelligence and Military Intelligence Division were otherwise unsystematic and uncoordinated.⁴⁰⁷ Even if the Brits could hold off the German bid for air superiority over the British Isles, how much time would America have and how great a force would be necessary to defend the West?

Roosevelt needed a man who could hack through the tangle of unfruitful intelligence reaching the White House—a man who could just as easily fit in with rank-and-file soldiers, intelligence operatives, and blue-blooded dignitaries in America and other countries. He chose Donovan because he needed reassurance from someone whom he could trust and whose impeccable military background and Republican-party affiliation would lend credibility and objectivity to his reports.⁴⁰⁸ Donovan proceeded to London, where he spent a

⁴⁰⁶ George C. Chalou, *The Secrets War: The Office of Strategic Services in World War II* (Washington, DC: NARA, 1994), 13.

⁴⁰⁷ Ibid.

⁴⁰⁸ MacPherson, *American Intelligence*, 46.

whirlwind two-weeks as the President's special envoy; he was welcomed with unexpected honors, "received by Churchill, granted an audience with King George IV, and taken to meetings with most of Britain's Intelligence Chiefs."⁴⁰⁹ Donovan had opened doors and shaken hands with a demeanor and an intellect that would keep those doors open for the many who followed, though Churchill was desperate to court Roosevelt through whatever means he could.⁴¹⁰

Donovan returned from London eager to foster intelligence cooperation across the Atlantic, starting with each country's Naval intelligence and expanding rapidly in scope over the coming months.⁴¹¹ Both sides enjoyed this intensified arrangement for bilateral partnership. Although, according to an official British intelligence history, new agreements advocated "full and prompt exchange of pertinent information concerning war operations," the two-way

⁴⁰⁹ Donovan was well received by everyone except the American Ambassador to the UK, Edward Kennedy, who felt slighted that the administration sent a reporter, Edgar Mowrer of the Chicago Daily News to investigate Fifth Column activities (public subversion) concurrent with Donovan's trip. Clearly the Ambassador was defending his turf and the fact that FDR's cabinet was compensating for an underperforming embassy wasn't lost on Kennedy. See: Thomas F. Troy, *The Coordinator of Information and British Intelligence (An Essay on Origins)*, Central Intelligence Agency, Articles from "Studies in Intelligence", 1955 - 1992, (College Park, MD: NARA, 1974), Record Group 263: Records of the Central Intelligence Agency, 1894 - 2002, 33-36; Also, Military History Symposium, "The Intelligence Revolution: A Historical Perspective" (paper presented at the Proceedings of the Thirteenth Military History Symposium, U.S. Air Force Academy, Colorado Springs, CO, 1991 October 12-14, 1988), 114.

⁴¹⁰ Churchill's efforts to attract America into the war via his relationship with Roosevelt were captured in his statement, "no lover ever studied every whim of his mistress as I did those of President Roosevelt." Certainly Churchill would have accepted graciously and thoroughly assessed an emissary sent by Roosevelt. Quoted in: William Thomas Johnsen, *The Origins of the Grand Alliance: Anglo-American Military Collaboration from the Panay Incident to Pearl Harbor*, Battles and Campaigns (Lexington, KY: The University Press of Kentucky, 2016), 241-243.

⁴¹¹ Troy, *The Coordinator of Information and British Intelligence (An Essay on Origins)*, 1974, 39.

flow of intelligence showed very quickly that the American products lacked polish and reliable insight into the Axis.⁴¹² The Chairman of the British Joint Intelligence Committee pointed toward an underlying cause: "I believe their [American] intelligence departments are primitive and rather inexperienced... there is little contact or collaboration between American Government Departments."⁴¹³ American intelligence experts would have to earn the respect of their British counterparts, and they were starting in a serious deficit.

Donovan also reported back on the British situation. He observed that their morale was strong, as would be their potential to repel an invasion, yet their defeat in France had left them woefully lacking in equipment.⁴¹⁴ As for American materiel and political support, their wish list was considerable:

*Destroyers topped the list; behind them came the Sperry bomb sight, flying boats, Flying Fortresses, and many aspects of the critical need of the British for pilots, air instructors, training aircraft, training facilities, and especially U.S. government cooperation in solving the nice political and diplomatic problems involved in extending such aid to a belligerent.*⁴¹⁵

Donovan's trip abroad extended far deeper than surface-level observations. "As a strategist he studied the terrain, the people, the military forces, the economy, the organization of the government, anything related to defense and offense," claimed Thomas Troy, a CIA historian, "and these he then interpreted

⁴¹² Hinsley and Howard, *British Intelligence in the Second World War*, 1, 313.

⁴¹³ Victor Cavendish-Bentinck, British JIC Foreign Office Chairman, cited in: Dr. Michael S. Goodman, "The Foundations of Anglo-American Intelligence Sharing," *Studies in Intelligence* 59 (June 2015): 2.

⁴¹⁴ MacPherson, *American Intelligence*, 46.

⁴¹⁵ Troy, *The Coordinator of Information and British Intelligence (An Essay on Origins)*, 1974, 41-42.

as capabilities and requirements and fused them for both the British and the American governments as an order of priorities.”⁴¹⁶ Donovan set a standard for thorough, informed, and coordinated analysis he later brought to the OSS, but not before the President again ordered him overseas, this time proceeding from London around the Mediterranean, North Africa, Eastern Europe, and the Middle East, gathering data for a series of detailed reports before circling back to London and heading home over the course of three months.⁴¹⁷

Donovan’s subsequent rise to cabinet-level confidant sparked a Machiavellian bureaucratic battle among American intelligence organizations. Brigadier General Sherman Miles as Army G-2 (during the same period he battled with Arnold’s A-2), wrote:

*In great confidence O.N.I. [Office of Naval Intelligence] tells me that there is considerable reason to believe that there is a movement on foot, fostered by Col. Donovan, to establish a super agency controlling all intelligence. This would mean that such an agency, no doubt under Col. Donovan, would collect, collate, and possibly even evaluate all military intelligence which we now gather from foreign countries. From the point of view of the War Department, such a move would appear to be very disadvantageous, if not calamitous.*⁴¹⁸

The intelligence organizations, especially that of the Navy and War Department, were deeply entrenched defending their perceived fiefdoms. Their inability to collaborate on matters other than fending off Donovan as a mutual threat worsened Roosevelt’s predicament and left him struggling to show resolve to

⁴¹⁶ Troy, *Wild Bill and Intrepid: Donovan, Stephenson, and the Origin of CIA*, 65.

⁴¹⁷ Troy, *The Coordinator of Information and British Intelligence (An Essay on Origins)*, 1974, 59-72.

⁴¹⁸ Memorandum from Miles to Marshall: "Coordinator for the three Intelligence Agencies of the Government," 8 April 1941, cited in: *ibid.*, 74.

the American people. The War Department G-2, already engrossed in what it saw as an insider threat with its A-2, now perceived a formidable external threat as well. This sort of organizational paranoia, often manifested as “hostility, suspicion, secrecy,” or even “grandiosity and pronounced ideas of persecution,” can be especially deleterious for an intelligence organization.⁴¹⁹ The G-2 was unwilling to cooperate or share information even when it should.

In July of 1941, Roosevelt sought to improve inter-departmental communications and further boosted Donovan’s prominence, appointing him as Coordinator of Information (COI).⁴²⁰ This position would ensure Donovan routine access to the highest levels of the US Government. Despite his title or Roosevelt’s intentions, the coming year would be a struggle for Donovan to tally any noteworthy successes in the position, and America’s precipitous entry into the war six months later would only make matters worse as the stakes increased. The forces defending bureaucratic fiefdoms were simply too tough to crack even with presidential authority. William Odom captured Donovan’s earnest, but failed, effort succinctly: “he used his considerable reputation and political connections to overcome the opposition of the military departments to this new entity, but as its first director, he was unable to assert control of the army and navy intelligence capabilities.”⁴²¹ America entered the war abroad with the ongoing war for information in Washington unresolved. The

⁴¹⁹ Singer later labelled “suspicion and secrecy” as a form of organizational pathology reflecting a “striking parallel between organizational manifestation and individual symptoms.” See: Benjamin D. Singer, “Crazy Systems and Kafka Circuits,” *Social Policy* 11, no. 2 (1980): 48-49.

⁴²⁰ Troy, *The Coordinator of Information and British Intelligence (An Essay on Origins)*, 1974, 1.

⁴²¹ Odom, *Fixing Intelligence: For a More Secure America*, xviii.

organizations Donovan bequeathed, however, would carry on his appetite to tackle the toughest intelligence challenges—except for the most important of all—to increase the degree of coordination and centralization on behalf of the President.

After ruffling more than a few feathers in his first year, the overt side of Donovan's \$10 million, 600-person organization spun off in 1942 as the Foreign Information Service, while the clandestine side emerged as the Office of Strategic Services, then realigned under the Joint Chiefs.⁴²² This split paved the way for OSS expansion into overseas operations, allowed for uninhibited and unacknowledged ties with foreign governments, and precipitated even greater competition with domestic intelligence and counterintelligence organizations. The OSS was exceptionally nimble under Donovan's leadership, able to attract extraordinary talent, although efforts to produce all-source analysis lagged between its various branches and their imperatives for information security and compartmentalization. To a fault that would later reflect in criticism of Donovan for free-wheeling, over-reaching, and erratic behavior, the OSS followed its leader and redefined itself—unhindered by the bureaucratic red tape typical of both the War and State Departments.⁴²³

Now with closer ties to the military, yet with a separate emergency budget stream, Donovan pressed the service toward irregular- and psychological-warfare operations, while leveraging Army and Navy infrastructure for

⁴²² Michael Warner, *The Office of Strategic Services: America's First Intelligence Agency* (Washington, DC: Central Intelligence Agency, 2002), 8.

⁴²³ MacPherson, *American Intelligence*, 218-220.

training.⁴²⁴ Donovan desired field work by independent, highly trained and well-educated operatives to serve as the cornerstone to OSS activities, but much of its value to the Cabinet as well as the Joint Chiefs came instead from the “good old-fashioned intellectual sweat.”⁴²⁵

OSS functions and responsibilities, especially as they related to other existing organizations, would not resolve clearly in the first year, and many never did. By the end of 1942, OSS had fought for and subsumed the psychological warfare mission from the War Department and continued to expand through a pattern of adding functionally and geographically aligned support branches as it took on additional tasks and field work. As OSS expansion ensued, internal tension arose from its dual aspirations to provide unique capabilities to field commanders while also offering strategic analysis to the highest authorities in Washington. The OSS War Report, published begrudgingly in Washingtonian ink, claimed that priority normally remained with urgent matters in the field, offering the following example:

R&A might wish some of its personnel in a given area to search out facts or material necessary to a long-range strategic survey in progress in Washington. In the field, on the other hand, the demands of immediate operations might require that the R&A personnel devote themselves to the preparation of intelligence for pinpoint selection, briefing, etc. Also, an R&D man in the field might be under constant pressure from Washington to send back information of value to the progress of research and development in the United States, when the immediate demands of the theater required his attention to the demonstration of weapons and devices already produced or to the production of documents or

⁴²⁴ United States War Department, *Washington Organization*, ed. Strategic Services Unit History Project, vol. 1, War Report, Office of Strategic Services (Washington, DC: US Government Printing Office, 1949), 26-27.

⁴²⁵ Corey Ford, *Donovan of OSS*, 1st ed. (Boston, MA: Little, 1970), 148.

*physical accessories necessary for immediate agent operations.*⁴²⁶

Donovan's emphasis on field work and freedom for independent, unconventional operations came at the expense of direct internal oversight. This style allowed operations in the field to take on whatever shape local officers felt most expedient, but could consume resources and perform activities that the Washington headquarters might have considered wasteful or even detrimental. Adding to this, OSS field offices sought advisory roles, but steered clear from subservience to military authority. The OSS War Report further argued, "the value of the unorthodox services rendered by OSS depended upon its strategic position with ultimate jurisdiction at the highest echelon and its freedom from the possibility of operating bias which would have attended its attachment exclusively to any one command or any one branch of service."⁴²⁷ Simply put, the higher the OSS tied into the bureaucracy, the freer its analysts felt to conduct independent research. The OSS valued its perceived independence from external influence, either unaware or unwilling to acknowledge that this independence made it further subject to its own biases. OSS would bring its skills along with its biases into air intelligence in the European Theater, but its conduit into airpower dealings began in Washington with another man in an entirely different organization.

⁴²⁶ United States War Department, *OSS War Report*, 1, 112.

⁴²⁷ Ibid.

Spaatz's Team: Under-resourced and overstretched

Richard D'Oyly Hughes, a stuttering former British Army officer, had spent the interwar period enthusiastically scrutinizing German industry and culture before eventually settling down with an American woman whom he'd met on a cruise ship.⁴²⁸ Originally born in Utah to British parents, he was comfortably managing a dairy farm in St. Louis when he learned that the Luftwaffe sunk the Royal Navy aircraft carrier commanded by his brother.⁴²⁹ This misfortune abruptly ended his regard for Germany and the serenity of private life. It was February of 1941 when Air Corps Major Haywood "Possum" Hansell showed up on his doorstep accompanied by Captain Malcolm Moss, an old friend of Hughes and a businessman with a PhD in industrial economics; Moss had just returned to active duty to work on the Air Staff with Hansell.⁴³⁰ They'd come seeking to attract more talent into General Arnold's struggling Intelligence Division, then headed by Hansell himself. Stories such as these were not uncommon as the Army sought civilian talent during its expansion. Those who pulled others into the inner planning circles tended to leverage old friendships and trusted relationships until their networks dried up. Hughes accepted the offer, and soon found himself commissioned as a Captain, contributing whatever he could to the hasty development of an air plan called *AWPD-1*.⁴³¹

⁴²⁸ Cabell and Cabell Jr, *Memoirs of War, Peace, and the CIA*, 110-111.

⁴²⁹ Ibid.

⁴³⁰ Hughes, *Memoirs: Chapter VIII, 1941-1945*, 1957, 1.

⁴³¹ Definitive accounts of the nine-day *AWPD-1* planning process tackled by George, Hansell, Kuter, and Walker do not make specific mention of Hughes' contributions, except to acknowledge his membership in the Strategic Air Intelligence Section. There is no reason to doubt his involvement as a member of Hansell's staff, but his statements were likely found

According to Hughes' account he, along with Moss, "arbitrarily made up our minds," as they suggested oil, aluminum, and aircraft industries as primary target sets; deprived of these, they figured, "no country could wage modern war."⁴³² His opinion was duly noted, but the planning team needed more concrete data—both figuratively and literally—from inside the Reich. It was Moss's Wall Street insights that paid off. American banks had lent money to German industry, which they did not do, "without making careful investigations of the proposed structures," and they surely kept the plans on file.⁴³³ Moss was right, and they successfully obtained a great wealth of data, particularly on the German electrical power system, from New York banks.

During Hughes' year on the Air Staff, new agencies emerged in Washington, including Donovan's Office of Strategic Services. "There was great competition between these agencies rapidly to build and expand their respective empires," Hughes noted, "and each expressed a very strong interest in getting into the 'strategic bombing advisory business.'"⁴³⁴ While there were inevitable shortages of regular Army officers, especially those who understood airpower, there seemed to be an abundance of academics now working for the federal government who offered themselves to whatever problems abounded. What

unremarkable by the planning team. Other than a few insights regarding basing, Hansell's intelligence section probably had little in material to contribute. See: Hansell, *The Air Plan that Defeated Hitler*, 49-54, 157. Also: James C. Gaston, *Planning the American Air War: Four Men and Nine Days in 1941: An Inside Narrative* (Washington, DC: National Defense University Press, 1982).

⁴³² Hughes, *Memoirs: Chapter VIII, 1941-1945*, 1957, 2-10.

⁴³³ Hansell, *The Air Plan that Defeated Hitler*, 51.

⁴³⁴ Hughes, *Memoirs: Chapter VIII, 1941-1945*, 1957, 11.

these civilian academics lacked in national-security acumen, they compensated for with confidence. Charles P. Kindleberger, an economist then on the OSS payroll, later reflected, “the hypothesis was, a good one I think, that any economist who put his mind to something could learn it,” adding loftily, “we could create instant experts.”⁴³⁵ The OSS was inclined to hire for talent and trust rather than résumés full of experience. The inner circle of OSS Research and Analysis were academics not industrial engineers, so the chosen few often had to manufacture their own technical expertise.

Nevertheless, Hughes and those on the Air Staff initially appreciated the help, not so much for the expertise, but for the habits of intellectual rigor and ready access to additional resources that seemed to come with these civilian outsiders. Over the course of his year in Washington, Hughes noticed that these analysts brought something else to the staff: a vainglorious contempt toward the drudgery of staff work. “I realized that the economists in these agencies were basically only interested in doing the grandiose things they themselves wanted to do,” Hughes lamented, “and not at all in those simple things which I wanted them to do.”⁴³⁶ In D.C., the analysts had options. If they felt the work was unfulfilling or unrewarding, they could pursue other prospects. Hughes was a quick study of the War Department’s planning and intelligence bureaucracy, and he internalized his insights. Opportunity soon knocked at his door in the form of a desperate and clueless planner in need of

⁴³⁵ Kindleberger, *Oral History Interview with Charles P. Kindleberger*, 16 July 1973, 15.

⁴³⁶ Hughes, *Memoirs: Chapter VIII, 1941-1945*, 1957, 11.

his experience and assistance.

When Brigadier General Carl A. “Tooe” Spaatz assumed command of the newly activated Eighth Air Force on the 5th of May, 1942, his immediate concern was to fill the gaps on his staff with capable cronies. A calm, deliberative, and confident leader, Spaatz prized trust and aptitude in his subordinates over recent military experience. He sought those whom he knew from private life had proven leadership and business acumen. Historian Davis Mets offers, “Spaatz seemed quite ready to accept people, even to recruit them, from civilian occupations to take care of staff functions related to their former work.”⁴³⁷ As a commander, Spaatz was renowned for his keen attention to operational particulars and for delegating the administrative tasks; he was self-aware of this tendency and it shaped the way he built his team. “Just out of civilian clothes...They were all close personal friends of General Spaatz,” Hughes reflected, “none of them ever made an operational war plan before in their lives, none of them had had the opportunity to study the problems involved, and a more scared and nervous bunch of officers, I have seldom seen.”⁴³⁸ Hughes rose to the occasion when one of them stumbled into his air staff office looking for help putting together the details of Spaatz’s initial bombing plans. By Hughes’ own account, he drafted the plan himself, ended up personally briefing Spaatz and General Marshall, then soon afterward landed in London with a promotion to Lt Col as Spaatz’s lead target planner.⁴³⁹

⁴³⁷ Mets, *Master of Airpower: General Carl A. Spaatz*, 116.

⁴³⁸ Hughes, *Memoirs: Chapter VIII, 1941-1945*, 1957, 16,27.

⁴³⁹ Ibid., 15-20.

Through the remainder of 1942, Eighth Air Force bedded its headquarters and subordinate units down in the U.K. and began operations. Major General Ira Eaker, after assuming command of a skeleton VIII Bomber Command at Langley Field on 1 February and establishing his headquarters at High Wycombe (near the RAF's Bomber Command Headquarters) on 15 April, relayed back to Washington, "Intelligence represents the section of activity in which we are weakest."⁴⁴⁰ The task-load under Eaker's A-2 at VIII Bomber Command grew rapidly to include 16 functions, beginning with:

*...providing the Commanding General and his staff with intelligence required. This includes: the strength, composition and location of the enemy air force; performance of enemy aircraft; airdrome details; state of the enemy defenses, especially flak defenses; information concerning targets under consideration; raid assessment; in fact, all information concerning the enemy.*⁴⁴¹

But other duties varied widely and required the creation of subordinate units within the intelligence section for security, operational intelligence, analysis, duty room, training, photo-intelligence, reports and reporting, RAF liaison, as well as public relations and the command historian.⁴⁴² Quality intelligence for its bombing operations was but one of many challenges as Eighth Air Force began its growth from "6 officers and no planes in February 1942 to 185,000

⁴⁴⁰ Eaker, Bomber Command Plan, p.4, cited in: Craven and Cate, *Plans and Early Operations*, 613-624; quote on 624.

⁴⁴¹ Lt Col Harris B. Hull, *Memorandum to Commanding General, VIII Bomber Command, Subject: Organization of the Intelligence Section*, in *Report of Lt Col John T. McCall on Eighth Air Force*, Headquarters VIII Bomber Command, (Maxwell AFB, AL: AFHRA, ca. December 1942), #520.601C V.1.

⁴⁴² Lt Col Harris B. Hull, *Organization Chart, Asst. Chief of Staff, A-2*, in *Report of Lt Col John T. McCall on Eighth Air Force*, Headquarters VIII Bomber Command, (Maxwell AFB, AL: AFHRA, ca. December 1942), #520.601C V.1.

[Airmen] and 4,000 planes by December 1943.”⁴⁴³

Many heavy bomber groups, as committed by the Combined Chiefs to TORCH (the invasion of North Africa) were beyond Spaatz’s control in the near term as they’d been redirected units destined for the Mediterranean.⁴⁴⁴ With the paltry numbers at his disposal, Spaatz’s Eighth Air Force busily practiced and experimented with each raid as the tail count and combat range of his bomber forces all-too-slowly increased. Weather frustrated bombing efforts, which he limited to coastal targets. By the end of October, Eisenhower constrained the highest priority to attacks on U-boat bases in order to protect forces flowing to the Mediterranean.⁴⁴⁵ Further complicating Spaatz’s progress, evolving variants of Focke-Wulf 190s menaced his bombers as losses drained morale.⁴⁴⁶ As David Mets noted, a stalwart Spaatz “cautioned Arnold not to leap to conclusions on the evidence of the early missions because they would contain too few planes to saturate the defenses.”⁴⁴⁷ Between September and November, more heavy bombers finally trickled into England, increasing Spaatz’s precarious tally of B-17s from 144 to 180 and of B-24s from 34 to 41.⁴⁴⁸

Even as the numbers grew, only a little more than half were expected to be flyable in combat at any given time. As a planning factor, Eighth Air Force

⁴⁴³ Parton, *Air Force Spoken Here*, 155.

⁴⁴⁴ Craven and Cate, *Plans and Early Operations*, 588-590.

⁴⁴⁵ Craven and Cate, *Torch to Pointblank*, 237.

⁴⁴⁶ Walter J. Boyne, "FW 190 Wurger," 92, no. 4 (2009): 80.

⁴⁴⁷ Mets, *Master of Airpower: General Carl A. Spaatz*, 133.

⁴⁴⁸ Davis, *Carl A. Spaatz and the Air War in Europe*, appendix 8, 618

statisticians estimated that 75 percent of aircraft in theater would be allocated to combat units (others were either in transit or temporarily possessed by service command), of which only 75 percent would be serviceable for bombing raids at any given time.⁴⁴⁹ Holding for reserves, this meant that less than 100 heavy bombers could be made available per raid—well below Eaker’s then-preferred threshold of 300, which he felt “could attack any target in Germany by day with less than 4 percent loss,” as noted by AAF historians.⁴⁵⁰ General Frank Andrews’, as the top airman in theater, would set a more aggressive estimate the following Spring, when he insisted that at least two formations of 100 bombers each per day to “penetrate enemy defenses” and destroy most targets, but those numbers were well out of reach in 1942.⁴⁵¹

The bombers were not the only aircraft shortage effecting the plan, as escort aircraft during this period were not much help either. They were too few in numbers, short on performance, as well as range to compensate for bomber self-protection challenges. P-39s, introduced in October, but phased out after just a couple of months, were outclassed by the German fighters. P-38s, despite struggling in the cold and humid European environment, boasted

⁴⁴⁹ In practice, some months of the war less than 40% of the aircraft in theater were available for combat. See: Headquarters Eighth Air Force, *Review of Operational Considerations, in Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: First Phase*, (Maxwell AFB, AL: AFHRA, July 1943), #168.61-10, IRIS 124347; Headquarters Eighth Air Force, *B-17 Statistics, in Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: First Phase*, (Maxwell AFB, AL: AFHRA, July 1943), #168.61-10, IRIS 124347.

⁴⁵⁰ Craven and Cate, *Torch to Pointblank*, 236.

⁴⁵¹ *Notes on Meeting with General Eaker*, Eighth Air Force, (Maxwell AFB, AL: AFHRA, 3 April 1943), #168.61-10, IRIS 124347.

improved performance and range.⁴⁵² Unfortunately, P-38 numbers peaked at just 184 in October, even before Arnold syphoned them off to North Africa.⁴⁵³ Only the short-legged British Hurricanes and Spitfires remained available for the escort role. “This limited the range of our operations to a narrow area over Northern France and the Bay of Biscay,” Hughes grumbled, “with the possible exception of the German submarine bases, there were virtually no targets of any military or economic importance.”⁴⁵⁴ Even as small numbers of German fighters spiraled to earth defending the coast, attacks on German submarine-bases contributed little value to the emerging air superiority battle. Eighth Air Force was off to a slow start with its bombing operations, and its shortages in aircraft were also matched by shortages in intelligence personnel.

By the end of the 1942, Colonel George MacDonald, then Spaatz’s Assistant Chief of Staff for Intelligence, had left target planning to Hughes’ office while he focused on personnel issues. Expressly prioritizing arrival of fresh intelligence officers in theater over the time it took to train them at Harrisburg, MacDonald pressed the Air Staff to fill his rosters fast. Sizing the Eighth Air Force Headquarters staff wasn’t the immediate problem. Its subordinate VIII Bomber Command intelligence staff, however, was overwhelmed at just two-thirds strength as it splintered away its newly trained officers into four new units. In a frustrated dispatch fired uphill, Lt Col Harris Hull, VIII Bomber Command’s intel chief declared, “it is not believed that any officers in the Intelligence Staff

⁴⁵² Craven and Cate, *Torch to Pointblank*, 74, 322.

⁴⁵³ Ibid., appendix 9.

⁴⁵⁴ Hughes, *Memoirs: Chapter VIII, 1941-1945*, 1957, 24.

at VIII Air Force are familiar with the organizational problems and the combat intelligence load now being carried by the Intelligence Staffs of VIII Bomber Command. [emphasis in original]⁴⁵⁵ By taking his anger straight to Arnold's staff, Hull bit the hand that was trying to feed him.

Unfortunately, there was so much work to be done setting up subordinate units in England, and many of those trained for intelligence work found themselves engaged in whatever unrelated duties local leaders deemed expedient. On October 2, Colonel Ed Sorensen, Arnold's A-2 in Washington, followed up with MacDonald's request and sent officers "without training, but earmarked for intelligence work," adding a not-so-subtle threat, "to take every precaution to fasten on to those fifty-one men and not lose them from intelligence."⁴⁵⁶ Arnold had already expressed concern to Spaatz about "the diversion of intelligence officers," as word even made it back to Harrisburg about its early graduates "being employed...as mess officers, counter-intelligence officers, or simple clerks in the headquarters to which they are assigned."⁴⁵⁷ Many of Eighth Air Force's carefully selected and trained intelligence officers took on other tasks while they were back-filled by untrained recruits, yet to be acculturated to the combat theater. The lack of

⁴⁵⁵ Lt Col Harris B. Hull, *Personal Letter to Colonel Lucius P. Ordway, Assistant Chief of Staff, A-2, Headquarters VIII Bomber Command*, (Maxwell AFB, AL: AFHRA, 13 December 1942), #520.6031.

⁴⁵⁶ Edgar P. Sorensen, *Letter, Sorensen to MacDonald*, HQ AAF War Department, (Maxwell AFB, AL: AFHRA, 2 October 1942), #520.603-1, IRIS 224458.

⁴⁵⁷ Edgar P. Sorensen, *Memorandum to All Eighth Air Force Subordinate Commanding Generals*, HQ AAF War Department, (Maxwell AFB, AL: AFHRA, 3 October 1942), #520.603-1. Also ; Koenig, *Final Report to Commanding General, First District, AAFTTC*, 30 September 1942, 6.

aircraft arriving in theater left Eighth Air Force strength inadequate to meet its operational goals, as the paucity of trained intelligence personnel left it incompetent to effectively evaluate its results. Help soon arrived, though not just from the Air Staff.

The OSS arrives in London. For Richard Hughes, what started as a dearth of quality information about potential German targets quickly became a mind-boggling mass of incomprehensible reports. No one at the Air Staff or Eighth Air Force had developed a systematic approach to prioritize and analyze the data, much less sort it, until the OSS showed up in London. The OSS analysts also brought another benefit. They could establish relationships in the Allied intelligence community the military officers could not, which would help not only to obtain preferred reports from the British, but also to shape how they were written. Civilians in British intelligence preferred to work with U.S. counterparts rather than directly with military officers. If a functionally equivalent office or entire agency didn't exist, the OSS nimbly restructured or added a branch and hired more academics.

This behavior suited both the British and American air-intelligence organizations. The British shored up their status quo amid shifting military strategy and political priorities, while the OSS validated its expansionist aims. According to an OSS internal history, "every British office of importance made an effort to distinguish the one American agency which most closely corresponded to its own function, and to establish more or less exclusive

relations with that agency.”⁴⁵⁸ Relationships formed that were both competitive and symbiotic as both sides vied for influence over the combined Chiefs while they both helped to justify each other’s existence. For Hughes’ team at Eighth Air Force, the OSS delivered intelligence products with expanded access and sharpened analysis, although time would show the finer edges tended to resemble the analyst.

How exactly the OSS came into the role of Eighth Air Force targeting is historically equivocal. By one account, the OSS would have had no such opportunity, but for Hughes’ request directly to Ambassador Winant, the former World War I pilot then running the State Department mission in London, and Winant’s eagerness to help.⁴⁵⁹ Alternatively, an OSS version suggests that Hughes extended the request to Mr. Chandler Morse of the OSS’s Washington R&A branch, during a visit by the latter to London.⁴⁶⁰ Yet a third account credits Dr. Edward Mason, also of the OSS (prior to his joining the Committee of Operations Analysts), for arranging “a unit that would sort of work for the Eighth Air Force and which would do two things: help pick targets

⁴⁵⁸ War Diary, R&A Branch, OSS/London, Vol. 1, Early History, pp. 10, 12, 16, 87, Reel 3, Entry 91, RG 226, NARA, cited in: MacPherson, *American Intelligence*, 59-60, 105. Macpherson's analysis suggests these relationships led to unnecessary demarcation between OSS branches and hindered collaboration within the OSS to produce comprehensive analysis as a result.

⁴⁵⁹ Rostow, who was part of the original EOU team, claims Hughes reached out directly to the Ambassador. See W. W. Rostow, "Waging Economic Warfare from London," *Studies in Intelligence* 7, no. 1 (1992): 73.

⁴⁶⁰ Tyson, a rare EOU member who was not an economist, but was Harvard-educated ran their aircraft industry assessments. He claimed Hughes first contacted Chandler Morse of the OSS R&A branch. See James L. Tyson, "The EOU vs. Hitler's Mini-Missiles," *International Journal of Intelligence and CounterIntelligence* 12, no. 1 (1999).

and help assess bomb damage.”⁴⁶¹ Collective memory may tend to spread the credit for good ideas. In all likelihood, a combination of all three of these events transpired. The result was the formation of the Enemy Objectives Unit (EOU) by the OSS and a most unusual arrangement with its gargantuan British counterpart, the Ministry of Economic Warfare (MEW). A comparison of these two organization reveals their character and their influence on the air campaign.

Targeting by Economists—A Micro- and a Macro-enterprise

The two organizations would arrive, over time, to be similar in function, though their size and origins were starkly different. As for the EOU, throughout its three-year existence, it was a small but industrious outfit, counting a total of only just 15 people who passed through its employ; of these, all but 2 were on the OSS payroll.⁴⁶² Further, as with similar spin-off agencies and committees in Washington, the EOU roster comprised almost entirely economists. Their way of thinking could contribute to strategic bombing evaluation in ways often under-emphasized by other approaches.⁴⁶³ If they were not tuned in to the enemy mind, they were at least inclined to consider

⁴⁶¹ Marc Trachtenberg, David Rosenberg, and Stephen Van Evera, "An Interview with Carl Kaysen," Working Papers, *MIT Security Studies Program* (1988), http://web.mit.edu/ssp/publications/working_papers/Kaysen%20working%20paper.pdf.

⁴⁶² Rostow, "Waging Economic Warfare from London," 73.

⁴⁶³ The economists, it should be noted, demonstrated a tendency similar to that of Gareth Morgan's notion of an egocentric organization. As Morgan recognized of other professions, this also held true for EOU's economists, whose "understanding of the environment was a product of their identity." Their desire to impart models of rational and efficient targeting decisions also inclined EOU to seek its own goals. See: Gareth Morgan, "Organizations as Flux and Transformation," in *New Thinking in Organizational Behaviour: from Social Engineering to Reflective Action*, ed. Haridimos Tsoukas (Oxford ; Boston: Butterworth-Heinemann, 1994), 142-143.

how the enemy might mitigate the effects of bombing. As one EOU member assured,

I would say the most important idea that as an economist I had, all of us economists had, which wasn't in ordinary military thinking, was the idea of substitution. If you take the whole strategic materials business, we were among the first people to see through this argument about 'strategic materials' and say this is going to be crap, because they'll find ways around it.⁴⁶⁴

The economists' specialization contributed in other ways as well. Through the crucible of war and its swirling ideas of how to win, they were the type who valued intellectual rigor over keen intuition in decision-making processes. The downside of this intellectual rigor was that they were not prone to appreciate the style of quick decision-making prized by military leaders. In their own words, they had "learned that theories, no matter how elegant or attractive, had to be disciplined forcefully against the facts before a policy decision is reached."⁴⁶⁵ Of course, not every policy decision has time for all of the facts, and facts, like statistics, can be spun to support different theories. The economists tended to project a sense of personal valuation into their arguments, as many of their reports and intense debates later show.

Loaded with unremitting and cocksure personalities, yet limited in manpower, the EOU selected both its personnel and its outputs carefully. Since America did not employ a system such as Britain's Central Register, which allowed civilians to be selected for government service according to their qualifications, the OSS relied upon its senior professors at prestigious

⁴⁶⁴ Trachtenberg, Rosenberg, and Van Evera, "An Interview with Carl Kaysen". 2.

⁴⁶⁵ Rostow, "Waging Economic Warfare from London," 78.

academic institutions to recruit the crème among the younger generation.⁴⁶⁶

The EOU economists were among America's brightest, and they saw themselves as the all-star team. As Walt Rostow, an EOU economist, later reflected, "Britain had the Air Ministry full of people, Lansdowne House [used by the RAF and the MEW] full of people, and we were about five or six fellows who operated like the Globe-Trotters basketball team."⁴⁶⁷

In fact, the EOU members sensed they were compensating for decades of military failure—especially within the G-2 and its air arm by extension—to recruit and develop highly capable intelligence officers. "The military services put overriding priority on operational virtuosity and consigned their least competent permanent officers to intelligence," purported Rostow, "and there was no way that situation could be rapidly changed from the top."⁴⁶⁸ This team of ambitious all-star analysts sought to perpetuate their penchant for quantitative methods into air intelligence writ large.⁴⁶⁹ The EOU's slight but significant team saw its opportunity to support the air campaign with its brand of science and seized it.

Sacred cows go MEW. The MEW, by contrast, included a ponderous cast of

⁴⁶⁶ MacPherson, *American Intelligence*, 104.

⁴⁶⁷ Of note, Walt Rostow was a Rhodes scholar and later National Security Advisor to President Lyndon Johnson. See: W. W. Rostow, 17 October 1970, interview Document Number 0016244. See also: Tyson, "The EOU vs. Hitler's Mini-Missiles," 81.

⁴⁶⁸ Rostow, "Waging Economic Warfare from London," 78.

⁴⁶⁹ Carl Kaysen, another EOU economist, recommended notably to the Air Force post-war, "the desirability of recruiting, as far as possible, economists, economic statisticians, engineers, and to some extent, lawyers for intelligence service, as opposed to a tendency in World War II to recruit people with experience in the advertising, newspaper, publicity, and selling fields." See: Carl Kaysen, *Notes on Strategic Air Intelligence in World War II (ETO)*, The RAND Corporation, (Santa Monica, Calif.: Project RAND, October 1949), R-165, 29-30.

a thousand or so, and “a truck load of paper emerged from their offices every day,”—so it seemed to Hughes.⁴⁷⁰ The Americans weren’t the only ones taxed by the MEW’s prolific but unsystematic writing; RAF’s Bomber Command became so saturated by the MEW’s “vast and rapidly obsolete” reports, that the Air Ministry requested a more simplified analysis of industrial targets.⁴⁷¹ Sifting through the MEW’s analyses was more complicated than simply sorting the wheat from the chaff.⁴⁷² It was best to manage the MEW’s outputs with relationships and specific requests.

Despite their difference in size, both the MEW and the EOU shared an economic bent. From the Air Ministry’s perspective, as both a rival and a customer, the MEW “would appear to have been designed almost exclusively to manage the naval blockade”; it grew into the mission of target selection to the

⁴⁷⁰ Hughes, *Memoirs: Chapter VIII, 1941-1945*, 1957, 90. For a sense of MEW’s scope, its Enemy Branch in 1943 “comprised 12 technical sections (armaments, engineering, metals and minerals, power, inland transport, chemicals, textiles, petroleum, labour, finance, trade, and administration); a shipping section (strength and movements of merchant shipping controlled by Germany and Italy); three ‘country’ sections covering Axis Europe, including the occupied territories; a Far Eastern department; a bomb damage assessment section; a Russian section; and finally an Information and Procurement department concerned with the war activities of individuals and firms and distribution of intelligence material.” See: Peter Davies, “Geoffrey Vickers and Lessons from the Ministry of Economic Warfare for Cold War Defence Intelligence,” *Intelligence and National Security* 31, no. 6 (2016): 812.

⁴⁷¹ Hohn adds, “in November 1941, it was calculated that 2,400 targets were included in the German target books at the Bomber Commands’ stations and that dossiers and maps existed for 1,500 of them.” See: Uta Hohn, “The Bomber’s Baedeker - Target Book for Strategic Bombing in the Economic Warfare against German Towns 1943-45,” *GeoJournal* 34, no. 2 (1994): 214.

⁴⁷² Many MEW reports included obscure data. They reported, for example, that Germany imported 214 tons of Hungarian wheat via rail from Hegyeshalom in March of 1944. See: Foreign Office Enemy Branch and Ministry of Economic Warfare, *Appendix IX, Summary of Specific Commercial consignments passing to and from Balkan countries, March, 1944*, in *Enemy Inland Transport Notes, No. 4*, (Maxwell AFB, AL: AFHRA, 17 July 1944), #512.6111D, IRIS 211829.

extent that air action could substitute for “other forms of economic warfare.”⁴⁷³ Insofar as air power might topple the Third Reich, MEW economists sought to crumble the foundation of the German economy—an unsurprising inclination given their organizational title, but the implications for British bombing policy were significant. The MEW’s analysts saw themselves as contributors to an analytical behemoth, and they defended their reputation for the depth and complexity of their reports. An EOU economist complained of the less-focused MEW, “its papers tended to be collections of economic data, rather than intelligence studies.”⁴⁷⁴ The larger organization hedged against irrelevance reporting on everything it could.

Whereas the EOU had materialized at the behest of a dire AAF need, the British Committee of Imperial Defense installed the MEW into a position of superiority vis-à-vis the Air Ministry; its charge was to monitor and advise targets related to “distribution of enemy industry, centers of storage and sources of supply, and to the key points of his transport system.”⁴⁷⁵ The MEW was to be a check against the RAF because military-service intelligence tended to reflect and reinforce rather than to regulate service behavior. This was especially pertinent since the RAF’s own intelligence apparatus could assess the enemy’s “economic situation and the morale of the civil population,” asserted the RAF’s historians.⁴⁷⁶ Bickering and collusion among intelligence

⁴⁷³ Air Ministry, *The RAF in the Bombing Offensive Against Germany*, undated draft; declassified 11 July 1984, 331.

⁴⁷⁴ Rostow, *Rostow Report*, ca. 30 April 1945, 15.

⁴⁷⁵ Webster and Frankland, *Strategic Air Offensive*, 261.

⁴⁷⁶ *Ibid.*

organizations was undesirable as the truth could be muddled and spun, while key intelligence might be held close rather than shared. The British consolidated in the MEW an overall advisory role for target selection along with the Air Ministry and the RAF, though all three would have biases of their own.

Despite its relative position, the MEW found itself as a target for marginalization by the RAF's Bomber Command. The MEW analysts had lost credibility with Harris because of their dogmatic pursuit of industrial "bottlenecks" ("panacea mongering" to Harris), largely because they had falsely assumed, during blockade planning years prior, that German industry had been operating at "fever pitch."⁴⁷⁷ Historian Barry Katz argued otherwise, that Hitler underwrote his *Blitzkrieg* with "ample reserves" in the German economy, which permitted:

*Capacity to draw upon food supplies and industrial materials long after they were supposed to have been depleted, to move factories to double-shifts, and to replace specialized equipment damaged in bombing raids with general-purpose machine tools without severe reductions in plant efficiency.*⁴⁷⁸

This meant the very idea of bottlenecks could be challenged in the absence of definitive proof that an industry faced shortage, work-arounds were limited, and repairs would not be expeditious. Such proof in wartime was not easy to come by, but the flawed assumption had underwritten the RAF's targeting

⁴⁷⁷ MacPherson, *American Intelligence*, 127-128. Tami Davis Biddle, *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas about Strategic Bombing, 1914-1945*, Princeton Studies in International History and Politics (Princeton, NJ: Princeton University Press, 2002), 199.

⁴⁷⁸ Barry Katz, *Foreign Intelligence: Research and Analysis in the Office of Strategic Services, 1942-1945* (Cambridge, MA: Harvard University Press, 1989), 101.

theory.

In Harris' view, the MEW had not only misjudged Germany's internal production situation, but also its access to external resources. The MEW, he felt, had been "in its glory, planning a campaign against Germany's synthetic oil plants, together with factories making aluminum, and aircraft works," because their myopic study of Germany in 1940 had overlooked German access to foreign resources through its "non-aggression pact" with Russia, as well as its conquest of French aluminum and sources of Romanian oil.⁴⁷⁹ Disputes about Germany's industrial position were not Harris' only concerns. He also found the MEW's analyses and target recommendations to be a ceaseless source of misdirection, because they had not adapted to Bomber Command's operational realities.

Bombing by area of expertise. By the spring of 1940, still two years prior to Harris taking Bomber Command's yoke, the Air Ministry's hopes for successful daylight raids against the resource-rich Ruhr had dimmed. Although the daylight raids had allowed for improved navigation and targeting accuracy compared to night attacks, German fighter and anti-aircraft resistance were too strong; the approach was unsustainable for the British bombers. As Tami Davis Biddle has described, "losses of 50 percent or more of the attacking forces would not only demoralize British bomber crews but would also kill those men who might later fly more capable bombers."⁴⁸⁰ Thus began a

⁴⁷⁹ Arthur Travers Harris, *Bomber Offensive* (South Yorkshire, England: Pen & Sword Military Classics, 2005), 45-46.

⁴⁸⁰ Biddle, *Rhetoric and Reality*, 184-185.

one-way transition to night bombing, due to the necessity of preserving the bomber force rather than a particular preference in air strategy.

In 1941, Mr. D.M. Butt submitted his famous (and eponymous) report, then assessing Bomber Command's night attacks: "Of those aircraft recorded as attacking their target, only one in three got within five miles," and when navigating through conditions of thick haze or a new moon, the appalling ratio had fallen to "only one in fifteen."⁴⁸¹ This statistician's review of photographic evidence confirmed that crew reports differed dramatically from reality; the startling result drew Churchill's ire and stirred institutional soul-searching for the RAF.⁴⁸² It would have to figure out how to survive in daylight, bomb more accurately at night, or shift its approach to targeting. Otherwise, any reasonable offensive contribution of British airpower was doomed.

Air Chief Marshal Charles Portal, then Chief of the Air Staff, pushed all of his chips in "to improve the accuracy of our night bombing," which was, as he saw it, "perhaps the greatest of the operational problems confronting us."⁴⁸³ Bomber Command's Operations Research "Boffins" set to developing radio and radar technologies to assist with night navigation and blind bombing while crew training and tactics evolved.⁴⁸⁴ Meanwhile, British air-intelligence

⁴⁸¹ David M. Bensusan-Butt, *Memorandum, Bomber Command: Night Photograph Analysis*, Offices of the War Cabinet, Air 8 - Air Ministry and Ministry of Defence: Department of the Chief of the Air Staff, (Great George Street, S.W.1: UK National Archives, KEW, 18 August 1941), AIR 8/1356.

⁴⁸² Biddle, *Rhetoric and Reality*, 1-3.

⁴⁸³ Denis Richards, *Portal of Hungerford: The Life of Marshal of the Royal Air Force Viscount Portal of Hungerford KG, GCB, OM, DSO, MC* (New York, NY: Holmes & Meier, 1977), 303. Cited in: Wakelam, *Science of Bombing*, 23.

⁴⁸⁴ For a concise history of Basil Dicken's role with GEE and Oboe development, along with Bomber Command's resultant experimentation with Path Finder Force tactics due to Oboe's

organizations gnashed over competing ideas about what best to attack with the inevitably reduced accuracy of bombing at night. Both the MEW and the Air Ministry persisted in their efforts to link night area bombing to successful attacks on German industry.

Throughout 1942, Harris' inclination to incinerate German morale city-by-city chafed against the MEW's increasingly bloated but detached sense of purpose. Jockeying to restore its relevance to bombing policy, the MEW economists sought to co-opt Bomber Command's morale-bombing practices into a scientific approach to targeting for economic effect. A narrow strip of common ground finally emerged for the various competing interests after two key events: First, Bomber Command had finally received formal approval for area bombing on 14 February 1942. This gave Harris authority to commit his forces full-time to night attacks, and it forced the intelligence organizations to find ways to support those attacks. Second, the order was reinforced the following month by a memorandum from Frederick Lindemann (a.k.a. Lord Cherwell), Churchill's top scientific advisor, to the Prime Minister himself, professing the merits of "de-housing" the German population.⁴⁸⁵ The memorandum read, in part:

Investigation seems to show that having one's house demolished is most damaging to morale. People seem to mind it more than having their friends or even relatives killed. At Hull signs of strain were evident, though only one-tenth of the houses were

operational limitations, see: Wakelam, *Science of Bombing*, 60-63, 74-76. Not until H2S (air-to-ground radar mapping) became available at the end of 1942, was long-range blind bombing possible.

⁴⁸⁵ Hohn, "The Bomber's Baedeker - Target Book for Strategic Bombing in the Economic Warfare against German Towns 1943-45," 220.

*demolished.*⁴⁸⁶

Lord Cherwell added a modicum of scientific credibility to morale bombing at a precipitous moment. His approach, the RAF's intelligence history contended, "provided an opportunity to estimate the effect of the destruction of housing and amenities on the capacity or determination of the working people," though the report also admitted, "but in this period judgment on this question tended to be based on more speculative reasoning which had a strong appeal to certain minds."⁴⁸⁷ Lord Cherwell had data to demonstrate that the bombers could demolish houses, but any assurances that "this would break the spirit of the people," as he contended, were spurious at best.⁴⁸⁸

In January 1943, the MEW followed suit with a scientific report of its own, the first of several volumes entitled *The Bomber's Baedeker*. In appearances, it was a prioritized hit list of towns each containing a population greater than 15,000 inhabitants with special preference to those of greater than 250,000—certain to rouse an interest from "Bomber" Harris. What the report provided was actually an internally consistent logic that connected "the economic importance of each town" to:

Direct effects:

a) Destruction and damage to dwellings and de-housing of population;

b) Destruction and damage to factories and commercial property and the interruption of public utility services and

⁴⁸⁶ Memorandum, Cherwell to Churchill, 30 March 1942, Cited in: Max Hastings, *Bomber Command*, Zenith Military Classics (Minneapolis, MN: Zenith Press, 2013), 90.

⁴⁸⁷ Webster and Frankland, *Strategic Air Offensive*, 1: 270.

⁴⁸⁸ Memorandum, Cherwell to Churchill, 30 March 1942, Cited in: Hastings, *Bomber Command*, 90.

communications; [and]

Indirect effects:

c) Loss of working time due to general dislocation of economic life;

d) Expenditure of manpower and materials in rehabilitation measures;⁴⁸⁹

The economists' logic sold in spades, if only the report's audience was willing to accept some sleight-of-hand on its assumptions, and Bomber Command certainly was. The following passages from the report's introduction, laced with the MEW's seductive logic, are worthy of review to this express this point:

At this stage of the war and with the tactical methods at present employed, the heaviest effect on the enemy's war effort is probably produced by the combination of a) and d). The proportion of the nation's manpower and economic resources which the enemy can devote to the manning of the Armed Forces and the production of equipment and munitions for them is only the surplus left over after the minimum allocations essential for the maintenance of the civilian population and the national economic machine generally have been met. These needs will always demand the attentions of the major fraction of the working population. The devastation of the cities produced by night bombing serves to raise the proportion of the national resources which must be devoted to meeting these needs...

...This result can be obtained in theory by the devastation of any built-up area in Germany regardless of the economic activities of its inhabitants. It is, however, likely in practice that the German Government will be induced to spend its resources more freely for rehabilitation purposes in cities which play a vital part in the national war effort...

...Concentration of night bombing effort on such targets would not only produce at least as great a drain on the enemy's

⁴⁸⁹ Ministry of Economic Warfare, *The Bomber's Baedeker*, in *Guide to the Economic Importance of German Towns & Industries*, Enemy Branch, (Maxwell AFB, AL: AFHRA, January 1943), #512.611-39, IRIS 211815, Part I: 1.

*economy as elsewhere through the destruction of houses and the diversion of resources to rehabilitation measures, but it would also ensure the maximum direct and indirect damage to economic activities which are of primary importance to the enemy's war effort.*⁴⁹⁰

To this end, the report would later classify highest priority targets as those:

...reserved for factories with pronounced 'bottleneck' characteristics which would merit specific attack if this were practical. This distinction is applied only to factories possessing the following qualifications: –

- a) that the activity involved is of primary importance to the enemy war effort;*
- b) that this activity is concentrated in a large degree in a small number of places;*
- c) that the supply and demand position is sufficiently tight to ensure that effects of loss of productive capacity would be serious and immediate;*⁴⁹¹

The cleverness of the MEW report lay not in the expanse of its supporting data or in its industrial analysis, although both were immense. The MEW economists had engineered a logic, notably *ex post facto*, to suit Harris' brutish intentions along with Bomber Command's operational realities to its own *a priori* assumptions that industrial dislocation would lead to victory. In other words, the MEW reestablished its status quo. It could justify its monstrous energies into its economic and industrial reports, if only to which cities should be de-housed first. Harris would unleash hell as city after city went "up in flames."⁴⁹² He was content as long as his hands were not tied, but if the MEW

⁴⁹⁰ Ibid., Part I: 1-2.

⁴⁹¹ Ibid., Part II: 2.

⁴⁹² Harris, *Bomber Offensive*, 105.

had gained back any credibility with Harris, it would not last long.

Enemy Objectives Unit—Economists on a mission. The EOU, by contrast, had no recognized charter, no formal authority, and limited resources. It compensated for these shortfalls by deliberately cultivating the skills and reputation of its small team and farming out its expertise. It grew slowly along with the scope of its opportunistic mission after the first five members arrived in the fall of 1942, and they became, as they saw it, “the only organization in theater devoted solely to the development of target intelligence and target thinking.”⁴⁹³ The EOU’s position, outside of the AAF’s chain of command, gave it credibility for objective assessment in ways that the AAF’s air intelligence could not enjoy. The EOU team was close-knit with consistent membership, and its economists were able to form personal relationships with their Eighth Air Force customers as well as their British counterparts.⁴⁹⁴

Consistency among its core membership was essential. Because they were outside of Washington, working close to the war effort and to each other, the EOU members could sense the impact of their contributions. This made them less apt to leave for other employment opportunities—at least until the war was over. Had Hughes marginalized their access, rejected their ideas, or simply shelved their reports, the ambitious EOU economists would have risked

⁴⁹³ Rostow, *Rostow Report*, ca. 30 April 1945, 6, 11, 16-18. Mr John De Wilde, who had been employed by the Board of Economic Warfare rather than the OSS became a core member in addition to those who were OSS.

⁴⁹⁴ Although Rostow mentions that EOU was “never incorporated into the United States Strategic Air Force,” members did make significant contributions to organizations outside of AAF, the European theater, and the scope of this study. *Ibid.*, 3-4.

irrelevance or may have disbanded and returned to Washington. For the competitive high-achievers that they were, with long-term designs on government service, an early and unceremonious return home would have been perceived as failure.⁴⁹⁵

The relationship between the EOU and Hughes indeed proved reciprocal. In a pragmatic sense, EOU members appreciated Hughes and ingratiated themselves with him because their success depended upon it. But he was also the type of character to whom they could relate. Carl Kaysen, an EOU economist, later reflected of Hughes, "he really was a terrific guy, very focused, very smart, he understood what we were doing, he was a good politician, he had *enormous* courage... He was our marketing agent, our contact with the Air Force and he was quite adept at it."⁴⁹⁶ Hughes had expressed frustration toward the economists and lawyers who supported the War Department in Washington, but he had nothing but praise for EOU members: "They backed me up, supplemented me, and supported me, in every way possible through the next two hectic years."⁴⁹⁷ Mutual reliance formed an extraordinary bond and tendency for cooperation between Hughes and the EOU.

The command environment added another reason for this cooperative

⁴⁹⁵ Most of EOU's central figures, notably Rostow, Kaysen, Kindleberger, and Morse, went on to leverage WWII service into prominent careers in the federal government or academia with enduring federal influence. Rostow later reflected, "it was an irreversible experience of public service that shaped the subsequent lives of its members. As nearly as I can relate, virtually all of us subsequently spent some time in government." See: Rostow, "Waging Economic Warfare from London," 78.

⁴⁹⁶ Trachtenberg, Rosenberg, and Van Evera, "An Interview with Carl Kaysen". 5.

⁴⁹⁷ Hughes, *Memoirs: Chapter VIII, 1941-1945*, 1957, 22.

arrangement. According to Hughes, "General Eaker kept even the most minute administrative details in his own hands, and seemed to have very little time, or inclination, for discussing operational plans... With no sympathetic intellectual support, or understanding from my Commanding General it was a difficult and heavy burden."⁴⁹⁸ Hughes needed support with both the intellectual weight-lifting and the slog of day-to-day planning. The EOU was eager to offer their services.

The EOU mission steadily evolved into four functions, which kept its members busy "almost every night and most Saturdays."⁴⁹⁹ In economist Walt Rostow's words:

First came the Aiming Point reports, the detailed analyses of the layouts of the targets, and the objectives within them whose destruction would cause the maximum loss of production;

Second, were the analyses of the industries as target systems, furnishing the basic data for the comparative calculations of cost of systematic attack and of probable returns;

Third, were the occasional but important ventures in drafting air plans;

*Fourth, were the jobs carried out by various individuals within EOU in helping to guide particular branches of the Air and Ground Staffs;*⁵⁰⁰

When there was breathing room, they would seek out other opportunities. The EOU economists tended to channel their efforts toward those most likely to expand their influence and prestige, while steering clear of those likely to draw

⁴⁹⁸ Ibid., 28-29.

⁴⁹⁹ Tyson, "The EOU vs. Hitler's Mini-Missiles," 84.

⁵⁰⁰ Rostow, *Rostow Report*, ca. 30 April 1945, 3.

ire from the AAF.⁵⁰¹ For example, Aiming Point reports were tedious, but comprised the bulk of day-to-day duties. Rostow admitted that these reports tested the economists' "energy and inventiveness" but failed to satisfy their intellectual affinities.⁵⁰² So the group took on something more interesting, initially bypassing the AAF's urgent need for a robust damage-assessment methodology, to propose a targeting theory instead.

The EOU's Targeting Economics 101. The ACTS graduates filling the most senior positions of the AAF and Eighth Air Force command and operations staffs, given their confidence in doctrine they'd published at Maxwell Field, were not likely to accept new ideas from anyone who had never flown an aircraft, much less never attended their hallowed school. Undeterred by this, the EOU economists applied their deeply ingrained habits of mind to target-thinking. Whether or not they adopted the approach espoused by ACTS graduates, the economists were inclined an office to be efficient in their support to Hughes and Eighth Air Force. Likewise, their training as economists oriented them toward guiding Eighth Air Force to be efficient in the air campaign. To these ends, the economists needed a methodical approach to help prioritize target selection. In the absence of command-level guidance, they attempted to

⁵⁰¹ Meyer and Rowan explain organizational worth in environments such as the complex bureaucracy of intelligence organizations. In their view, organizations "become sensitive to, and employ external criteria of worth," such as "ceremonial awards... endorsements by important people, the standard prices of professionals and consultants, or the prestige or programs or personnel in external social circles." In the EOU members' case, several of the above are applicable. Among their top motivators were endorsement of their products by Allied senior generals and prestige of their work and individual intellectual ability by any leaders external to their own organization. See: Meyer and Rowan, "Institutionalized Organizations: Formal Structure as Myth and Ceremony," 350.

⁵⁰² Rostow, *Rostow Report*, ca. 30 April 1945, 34.

develop their own targeting theory.

The economists began their task with an analytical model, published internally on 17 December 1942, which they divided into two parts. The first was to develop criteria for the selection of target industries, and the second was to prioritize individual targets for attack. As to industry selection, they identified 11 potential criteria, such as: “importance of product to war production,” “tightness of supply situation,” “ease of repair,” and “possibility of substitution.”⁵⁰³ However, they decided that mathematically prioritizing targets by these criteria was too complex to “bear a simple additive relation to each other.”⁵⁰⁴

The encountered another problem as well. Although the economists were confident their approach had incorporated all criteria relevant to target selection, they also regarded “the judgment factor”; this they felt “may be required to fill gaps in factual data or to re-evaluate appraisals previously made.”⁵⁰⁵ Recognizing economic theory may not explain enemy behavior, Rostow added, “the balance may be turned by judgment concerning the intentions of the enemy, the relative degrees of disorganization likely to be created, or the manner in which the enemy is likely to react to the destruction of alternative targets.”⁵⁰⁶ In short, they lacked the experience to make the

⁵⁰³ Salant, The Selection of Industrial Bombing Targets: Some Analytical Notes, 17 December 1942. Cited in: *ibid.*, 36-37.

⁵⁰⁴ Salant, The Selection of Industrial Bombing Targets: Some Analytical Notes, 17 December 1942. Cited in: *ibid.*

⁵⁰⁵ Enemy Objectives Unit, *Handbook of Target Information*, Office of Strategic Services, (Maxwell AFB, AL: AFHRA, May 1943), #118.042-2, IRIS 110538, 8.

⁵⁰⁶ *Ibid.*

judgment calls.

It would seem there were too many factors to consider, too much information unavailable, and too much judgment at play to impart such a model.⁵⁰⁷ In order to limit their assumptions, the economists simplified their model. Instead of attempting to weigh all of the potential criteria, the EOU economists narrowed their focus to three questions:

- 1) *How great is the impairment of the enemy's efforts of per unit of physical destruction?*
- 2) *How many units of physical destruction will be achieved per ton of bombs dropped on the target?*
- 3) *How many tons of bombs can be dropped per unit of air effort, or per unit of cost? (Including losses and wastage of planes and crew, expenditure of bombs and gasoline, etc...)*⁵⁰⁸

These questions were reduced and represented mathematically as:

$$\frac{\text{Impairment to enemy}}{\text{Physical damage}} \times \frac{\text{Physical damage}}{\text{Tons of bombs}} \times \frac{\text{Tons of bombs}}{\text{Cost to us}} = \frac{\text{Impairment to enemy}}{\text{Cost to us}}$$

Since physical damage and tons of bombs cancel out, the solution was simply “the ratio of impairment to enemy’s effort to cost to us.”⁵⁰⁹ With their elegant formula, the EOU had developed a model for efficient target nomination—one

⁵⁰⁷ Both William Salant, who penned the EOU's original notes on target selection and Charles Kindleberger, who led the EOU during this period, have been described among prominent Keynesians, which was the dominant school of economic thought at the end of the Great Depression into WWII. See: Lawrence H. Officer, review of International Monetary Economics, 1870-1960: Between the Classical and the New Classical., M. June Flanders, *The Journal of Economic History* 50, no. 3 (1990): 780-781. Also of note, efficiency (especially the marginal efficiency of capital) is central to Keynes' economic theory. The idea of maximizing bombing efficiency in terms of imposing costs on the enemy while minimizing bomber losses would likely have resonated with EOU economists. For a contemporary example, see: Carl Landauer, "A Break in Keynes's Theory of Interest," *The American Economic Review* 27, no. 2 (1937): 260-266.

⁵⁰⁸ Salant, The Selection of Industrial Bombing Targets: Some Analytical Notes, 17 December 1942. Cited in: Rostow, *Rostow Report*, ca. 30 April 1945, 39-40.

⁵⁰⁹ *Ibid.*, 40.

that injected an assumption of risk-aversion that was otherwise absent from ACTS' doctrine and Arnold's expectations in Washington.

A Calculating Bunch of "Quiz Kids"

Work by Eaker's intelligence-economists was helpful, but he was going to need other approaches to gain efficiency. In addition to decreasing costs, he looked to the increase effectiveness of each raid by turning to hard science as well. If Eighth Air Force could boost its accuracy or the damage caused by its bombs, then it would not have to revisit targets as often only to face more losses to enemy flak and fighters. To make such improvements, however, required formal research for which crews had no training to conduct, remained outside of nominal intelligence responsibilities, and exceeded the capacity of Eaker's busy planning staff. Such work by an entirely different team of civilians had actually begun nine months earlier, when Eaker was still commanding Eighth Bomber Command.

As with many other analysis-related initiatives, Americans emulated the British. The Air Ministry had employed a team of scientists under Henry Tizard to develop radar in the 1930s, and later employed civilian teams to conduct "operational researches," which was less about new laboratory work or technology development, and more about "doing the best you can with what you have."⁵¹⁰ A thread from this new organization also ties back to COA's

⁵¹⁰ Joseph F. McCloskey, "The Beginnings of Operations Research: 1934-1941," *Operations Research* 35, no. 1 (1987): 144-146.

Barton Leach.

In July of 1942, Leach was sent by Vannevar Bush, then Chairman of the Joint Committee on New Weapons and Equipment, to “obtain all possible information as to the Operational Research Sections in England,” and to report his findings “with a view to considering the feasibility of using operations analysis groups with various commands.”⁵¹¹ Leach returned with glowing praise, and he advocated for the Joint Chiefs and the Air Forces to establish Operational Research sections.⁵¹² These sections may not have seemed like part of the intelligence apparatus, but their work was inextricably linked to targeting decisions, bomb-damage assessments, and addressing operational limitations. They were an indispensable component in the cycle of air-campaign feedback and they introduced preferences and tendencies of their own.

Arnold, who was then about to establish the COA, pushed the idea out to his field commanders, although Spaatz had already read the Leach report and had the ball rolling for Eighth Air Force. Under Arnold’s direction, these groups were given noteworthy autonomy at each commander’s discretion:

*A group is attached to a command only if the commander requests it; it reports only to the commander to whom it is attached and to no other military or civilian authority; the group remains permanently with the command, subject only to necessary withdrawals for the purpose of establishing a nucleus of trained personnel for a new group.*⁵¹³

⁵¹¹ Vannevar Bush, *Memorandum to Maj Walter B. Leach: Investigation and Report on Operations Analysis*, Joint Committee on New Weapons and Equipment, (Maxwell AFB, AL: AFHRA, 7 July 1942), #118.201-2, IRIS 110584.

⁵¹² John M. Harlan, *The Operational Research Section at the Eighth Air Force*, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, 18 July 1944), #520.303-1, IRIS 219640, 7.

⁵¹³ Fred C. Milner, *Operations Analysis Memorandum to all Commanding Generals, All Air*

When a team of six operational researchers arrived in England in late October of 1942, they formed under the leadership of Mr. John Harlan, and Eaker declared their purpose as the following:

[To analyze] bombing operations with a view to finding weak points in our method of attack in bombing and also any weaknesses in the employment of the enemy defense system; to ascertain the cause of casualties with a view to their reduction. To assess and evaluate the effectiveness of bombing attacks and also to investigate various communications problems relating to this command. ⁵¹⁴

The words above were published on Eaker's behalf by his chief of staff.

Other accounts suggest that he met them and simply asked, "How can I put twice as many bombs on my targets?"⁵¹⁵ Whichever the case, these were open-ended challenges, any of which could pay serious dividends even if only incremental improvements could be made. Too much of this strategic bombing trial had been untested in combat conditions, and the early results did not seem to match stateside expectations. Informal trial and error was better than nothing, but the stakes were too high not to learn as quickly and as smartly as possible. If these operations-research quiz kids got it right, they could "dig out the lessons of this war for application in this war rather than to await postwar analysis for use in future wars."⁵¹⁶ In many cases, however, data were not

Forces, All Army Forces Commands, USAAF, (Maxwell AFB, AL: AFHRA, 24 Oct 1942), IRIS 110571, 1.

⁵¹⁴ Colonel Charles B. B. Bubb, *Memorandum: Operation Research Section, to Commanding Officers, 1st, 2nd, 3rd Bomb Wings, Headquarters VIII Bomber Command, (Maxwell AFB, AL: AFHRA, 23 October 1942), #520.303-1, IRIS 219640. Quoted in: Harlan, The Operational Research Section at the Eighth Air Force, 18 July 1944, Appendix II.*

⁵¹⁵ Leroy A. Brothers, "Operations Analysis in the United States Air Force," *Journal of the Operations Research Society of America* 2, no. 1 (1954): 1. Knight, "Ask Them Another," 31.

⁵¹⁶ Leslie H Arps, *Report: Operational Analysis Section, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, 1 June 1945), #520.303-3, IRIS 219642, 2.*

readily available and any recommendations the researchers might have would necessarily await direction from above to implement.

Eaker extended to his operations researchers the unprecedented autonomy and access envisioned in Arnold's memo:

*This section will be independent of all other Staff Sections of this Headquarters and will operate directly under the Chief of Staff... It will be necessary for the members of this section to visit all Headquarters within this command and have ready access to all facilities therein. This includes contact with air crews, authority to visit operations rooms, situation rooms, attend briefings of crews, and in short, all activities that would aid them in their work.*⁵¹⁷

The Eighth Air Force Operational Research Section (ORS) was a different sort of team with an entirely different dynamic. It began with only six members, swamped from the day of their inception with producing 14 distinct studies covering VIII Bomber Command's "most pressing" operational challenges.⁵¹⁸ As for their internal leadership, Harlan, along with Leslie Arps, another member of Harlan's New York law firm, were both attorneys. Lawyers in such leadership positions, either in Arnold's COA or in Eaker's ORS, were not a coincidence. Without further explanation, Leach had followed up his report to Vannevar Bush with a memorandum stipulating Operations Analysis sections "should be

⁵¹⁷ Bubb, *Memorandum: Operation Research Section, to Commanding Officers, 1st, 2nd, 3rd Bomb Wings*, 23 October 1942. Quoted in: Harlan, *The Operational Research Section at the Eighth Air Force*, 18 July 1944, Appendix II.

⁵¹⁸ Colonel Charles B. B. Bubb, *Memorandum: Directive to Section Chief, Operational Research Section*, Headquarters VIII Bomber Command, (Maxwell AFB, AL: AFHRA, 23 October 1942), #520.303-1, IRIS 219640. Quoted in: Harlan, *The Operational Research Section at the Eighth Air Force*, 18 July 1944, Appendix III.

led by a non-scientist, preferably a lawyer.”⁵¹⁹

The similarity in makeup to the other intelligence and analysis organizations stopped there. Other ORS members included Dr. James Alexander, a mathematician on the Navy payroll from Princeton’s Institute of Advanced Study; Dr. H.P. Robertson, a Princeton-educated physicist who’d worked for the Office of Scientific Research and Development; Dr. W. Norris Tuttle, also a physicist and director of research at General Radio Corporation; and Dr. W. J. Youden, statistician and biochemist working for the Boyce Thompson (Plant Research) Institute.⁵²⁰ Leach later reflected his ideal candidate for the team was “a genius who hasn’t forgotten that the answers to hard questions come by hard work and not by looking into a crystal ball. In picking men that’s the standard we shoot at. Sometimes we hit it.”⁵²¹ Recruitment wasn’t easy and turnover could be high.

Operations researchers typically resisted pressure to take officer commissions, though all of them in any combat theater were required physically to wear the uniform; civilians went without insignia.⁵²² From the service’s standpoint, commissioning of analysts was the preferred option because it gave their commanders more control over them in terms of both

⁵¹⁹ Charles R. Shrader, *History of Operations Research in the United States Army*, ed. Office of the Deputy Under Secretary of the Army for Operations Research, CMH pub (Washington, DC: U.S. Army, 2006), 25.

⁵²⁰ McArthur, *Operations Analysis*, 7. Arps, *Report: Operational Analysis Section*, 1 June 1945, 8.

⁵²¹ Knight, "Ask Them Another," 34; See also: Shrader, *History of Operations Research in the United States Army*, 27-28.

⁵²² Knight, "Ask Them Another," 60.

accountability and authority. Senior commanders thought groups comprised of civilians-leading-civilians might stray too far from task, so the chief and deputy of the Eighth Air Force ORS eventually received commissions.⁵²³ This option also offered more flexibility to the more senior commanders as to how these scientists could be employed and when they might be released from service.⁵²⁴ Recruitment required intellectual courtship, but retention required rules.

Most operations analysts preferred to remain outside of the rank structure if they were not forced into a commission. This would preclude the distractions and obligations of military decorum and put them “on an effective working basis with either enlisted men or general officers.”⁵²⁵ Their civilian status also served, in a way, to shield them from criticism and to reinforce their objectivity, especially when they produced critical reports. This helped as they routinely received delegations from bombardment wings—typically skeptical commanders and lead bombardiers—who probed their work.⁵²⁶ The fact that these analysts reported to a higher-echelon commander, coupled with their civilian status, kept their arguments on substance and disarmed protesting officers from any attempts at pulling rank.

That many of the scientists remained civilians also allowed the AAF to

⁵²³ According to the ORS history, both commander and deputy had been commissioned by July of 1943. See: Arps, *Report: Operational Analysis Section*, 1 June 1945, 3.

⁵²⁴ Civilians in service in WWII, including Operations Analysts as well as WASPs had “the nonmilitary rights of optional resignation and rejection of assignments.” See Jane A. Barlow and Clinton C. Gardner, *World War II Remembered* (Hanover, NH: Kendal at Hanover Residents Association, 2012), 151.

⁵²⁵ Knight, “Ask Them Another,” 60.

⁵²⁶ Leslie H. Arps et al., *Operations Analysis in the Eighth Air Force, 1942-1945: Four Contemporary Accounts* (Linthicum, MD: INFORMS, 1997), 196-198, 204-212. Arps, *Report: Operational Analysis Section*, 1 June 1945, 56-57.

attract talent from a broader pool that might otherwise have been intellectually uninterested, physically unqualified, or otherwise potentially unfit for military service.⁵²⁷ One OA chief later reflected, “if no civilian were permitted, the section would not have had available to it many of the men who contributed substantially to its success.”⁵²⁸ Pay was also a factor. Leach, who was ultimately responsible for AAF’s hiring of analysts, struggled to put policies in place to keep pay and benefits competitive with other civilian jobs. In order to keep them interested, the analysts’ pay “exceeded the direct salary and allowances of commissioned personnel,” which led to tensions when the topic came up.⁵²⁹ Pay was best left undiscussed between the analysts and the officers.

These analysts were math people—serious researchers and scientists, but they knew that their work could have value only insofar as it had operational applicability. An independent charter did them no good if their work was sequestered or stove-piped. In their minds, “the nearer [we] were to the actual operating units and, at the same time, have available sufficient data for study, the more effective the section could be.”⁵³⁰ They spent considerable time interacting with and learning from the Bomb Groups, especially those of the 1st Bombardment Wing, made available by their then-commander, General Newton Longfellow. As the operations analysts saw it, their contributions should be

⁵²⁷ Arps, *Report: Operational Analysis Section*, 1 June 1945, 3; Knight, “Ask Them Another,” 60.

⁵²⁸ Arps, *Report: Operational Analysis Section*, 1 June 1945, 3.

⁵²⁹ Shrader, *History of Operations Research in the United States Army*, 29.

⁵³⁰ Arps, *Report: Operational Analysis Section*, 1 June 1945, 9-18.

judged not upon scientific merit or individual recognition, but by whether “results were used effectively by the command being served.”⁵³¹ To this end, their relationship with the command mattered. Their research may have reflected the command’s problems out of necessity, but they would still have to promote the value of their work.

Interactions with the rest of Bomber Command and Eighth Air Force staff were not always smooth. Despite General Eaker’s letter, access to A-2 and A-3 information hit with resistance and suspicion from mid-level officers. It took time to build familiarity and trust, but the analysts felt they had “neither sufficient background nor prestige” to break down barriers or to accomplish independent reports without additional support from Eaker.⁵³² Over time, however, ORS members received all of the data they could handle about both current and future operations, and then some. They were swamped.

Eaker’s operations researchers developed a distaste for mundane administrative hassles and managed to augment their numbers for clerical support.⁵³³ Harlan fought so that his “men trained in scientific, technical, and

⁵³¹ Arps et al., *Operations Analysis in the Eighth Air Force, 1942-1945: Four Contemporary Accounts*, 3. Text from Hugh Miser’s introduction.

⁵³² This type of tension between ops and intel “insiders” and analyst “outsiders” is developed in organizational research. For example, Dunbar and Ahlstrom argue, “Insiders still wish to minimize the impact on practice of any constraints or pressures that may be imposed by outsiders. They may claim simply that their perspective is institutionally approved and hence superior because historically it has attracted institutional support.” As the COA relied on Arnold, the ORS relied on senior commanders for legitimacy until they might be perceived by others as insiders. See: David Ahlstrom and Roger L. M. Dunbar, “Seeking the Institutional Balance of Power: Avoiding the Power of a Balanced View,” *The Academy of Management Review* 20, no. 1 (1995): 176. Also, Arps, *Report: Operational Analysis Section*, 1 June 1945, 20.

⁵³³ This was not unique to Eighth Air Force. The Committee of Operations Analysts had not only requested a mix of six civilian administrative assistants and stenographers to support

general analytical work who, having no responsibility for the day to day conduct of operations, could devote their full time to analysis work.”⁵³⁴ They started with a WAAF secretary and a few RAF civilians and expanded throughout the war to a total of 25 officers and 45 support staff, eventually including thirteen American Women Army Corps (WAC) analysts.⁵³⁵ Fencing ORS analysts from administrative duties and attracting best talent proved critical to their laser-like focus on quality research.

Despite Harlan’s appointed position as Chief, the section operated with a flat organizational structure and an ad-hoc approach to determining its own priorities and direction. Formative questions such as “What should ORS do?” and “What should its objective be?” were tackled as a group rather than by leadership from Harlan.⁵³⁶ Operational researchers eschewed the idea of ambiguity in the world around them—especially in the bombing campaign, so they organized in a manner consistent with sensing, discovering, and analyzing all aspects of bombing operations.⁵³⁷ The flat structure maximized openness

their reports and meetings, but Gates had authorized unlimited overtime during their busiest month. See: Col Guido R. Perera, *HQ AAF Routing and Record Sheet, Overtime for Civilian Employees*, HQ AAF, (Maxwell AFB, AL: AFHRA, 16 January 1943), #118.161, IRIS 110573.

⁵³⁴ Harlan, *The Operational Research Section at the Eighth Air Force*, 18 July 1944, 2.

⁵³⁵ Arps, *Report: Operational Analysis Section*, 1 June 1945, 22. McArthur, *Operations Analysis*, 34.

⁵³⁶ Tsoukas proposes that this type of ambiguity derives from four sources: “organizations are often unclear what their intentions are; they do not know unequivocally what is appropriate for them to do; they are usually unable to identify exactly what they did in the past and why; and it is not always clear who in the organization is responsible for what.” See: Haridimos Tsoukas, *New Thinking in Organizational Behaviour: From Social Engineering to Reflective Action*, Management Readers (Oxford: Butterworth-Heinemann, 1994), 11; Quotes from: Arps, *Report: Operational Analysis Section*, 1 June 1945, 25.

⁵³⁷ Daft and Weich categorize Operations Research sections as discovering organizations, which “take an active approach, but they also assume that the environment is analyzable... Operational researchers and other staff personnel will perform computations on environmental

and creativity.

While the researchers lived, ate, and worked together, sharing camaraderie underscored by “none too dignified poker games,” they did not share the longer-term sense of commitment or sacrifice exhibited by members of Donovan’s OSS serving in the EOU or of the WAAFs at Medmenham.⁵³⁸ In fact, just three months into the job, Harlan sought to leave the Eighth Air Force and return to Washington in a recruitment role, an act of self-interest that Eaker personally blocked.⁵³⁹ Brigadier General H.M. McClelland, an ACTS classmate of both Eaker and Sorensen, then serving as AAF’s Director of Technical Services, shared his insights in a response to Eaker’s concerns: “These Operational Research people are, in a sense, prima donnas, or perhaps I should say strong individualists,” he wrote, adding, “that is why they are able to do the work that they do.”⁵⁴⁰ The same egocentric personality traits that made them tough to keep on the team were the same traits that gave them the personal confidence and self-driven focus to accomplish research others could not.

data and weigh alternatives before proceeding. This organization’s decision process will be characterized by logic and analysis.” In this sense, the Eighth Air Force ORS team is charged with interpreting operational aspects of bombing and helping the bomber force to learn from BDA and other operational assessments. See: Richard L. Daft and Karl E. Weick, “Toward a Model of Organizations as Interpretation Systems,” in *New Thinking in Organizational Behaviour: from Social Engineering to Reflective Action*, ed. Haridimos Tsoukas (Oxford; Boston: Butterworth-Heinemann, 1994), 78-80, 84-88 (quote from p. 84).

⁵³⁸ Arps, *Report: Operational Analysis Section*, 1 June 1945, 26.

⁵³⁹ Maj Gen Ira C. Eaker, *Letter, Eaker to McClelland*, Manuscript Division, Eaker Papers, Box 16, (Washington, DC: Library of Congress, 10 January 1943).

⁵⁴⁰ Brig Gen H. M. McClelland, *Letter, McClelland to Eaker*, Manuscript Division, Eaker Papers, Box 16, (Washington, DC: Library of Congress, 15 February 1943); Robert T. Finney, *History of the Air Corps Tactical School, 1920-1940* (Maxwell AFB, AL: Research Studies Institute, USAF Historical Division, Air University, 1955), 126.

Similar to the EOU, they rejected mundane work—no matter how important to their customer. In the ORS' conception, it "should never engage in a project which can be said to be routine or recurrent," thus otherwise workable by an existing military staff.⁵⁴¹ The ORS deviated from this tenet only when conducting the type of research whereby the analysis itself took on a routine character.⁵⁴² Bombing accuracy and battle damage reports were necessarily routine given the iterative nature of the air campaign.

At its finest, however, Operations Analysis was not intended to challenge the existing paradigm of strategic bombing, but to refine the rules, measurements, and tools that determined its effectiveness. Hugh Miser, "one of the grand old men of OR [Operations Research]," argued that their research did not concern "the genesis of grand overarching theories, rather the tools used were closely adapted to the problems of the moment."⁵⁴³ As Thomas Kuhn might suggest, operations analysts were constrained to exploring operational

⁵⁴¹ Arps, *Report: Operational Analysis Section*, 1 June 1945, 30. Routines do not always drive an organization to stagnate. In manners of administration, March argues counter-intuitively, "effective systems of routine behavior are the primary bases of organizational adaptation to the environment." See: James G. March, "How We Talk and How We Act: Administrative Theory and Administrative Life," in *New Thinking in Organizational Behaviour: from Social Engineering to Reflective Action*, ed. Haridimos Tsoukas (Oxford ; Boston: Butterworth-Heinemann, 1994), 67.

⁵⁴² Arps, *Report: Operational Analysis Section*, 1 June 1945, 31.

⁵⁴³ Arps et al., *Operations Analysis in the Eighth Air Force, 1942-1945: Four Contemporary Accounts*, 3. Text from Hugh Miser's introduction; Arnold Reisman and Muhittin Oral, "Soft Systems Methodology: A Context within a 50-Year Retrospective of OR/MS," *Interfaces* 35, no. 2 (2005): 171. Operations Research was the British term for the same type of work as performed by American Operations Analysis Sections in World War II. The inception of Operations Research as a profession proved controversial in the decades that followed. Miser continued to argue of the validity of Operations Research as a legitimate and unique profession until his death in 1999. See: Hugh J. Miser, "The Easy Chair: Is OR/MS a Profession?," *Interfaces* 31, no. 4 (2001).

problems within the “normal science” of strategic bombing.⁵⁴⁴ In some cases, the analysts’ studies gave way to other studies, because they discovered questions that no one was asking or had not been asked correctly within narrow operational mindsets. Although ORS did not break the ACTS paradigm for strategic bombing during the war, two examples of ORS work best exemplify its contributions and the limitations of each.

Accurately assessing accuracy. ORS’ Bombing Accuracy Subsection members furthered the practice of examining post-strike photographs as overall hit-or-miss snapshots into effective learning tools for Eighth Air Force. ORS analysts found data reported by crews and recorded by unit interrogators to be unreliable and inaccurate, so they needed to develop more objective measures.⁵⁴⁵ Prior to their formal approach to the study of bombing accuracy, each bomb plot produced by a USAAF liaison to the CIU had included a composite view of all strikes in the target area. While these images could reasonably answer the question, “where did our raid’s bombs land?” they could not be used to determine why some formations or individual aircraft had bombed with greater success than others.

Learning depended upon attributing performance to a smaller unit of study than the entire raid. The ORS’s first contribution was to refine the bomb-plot

⁵⁴⁴ Kuhn describes normal science as puzzle solving, which is akin to the ORS work. See Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 3rd ed., International Encyclopedia of Unified Science Foundations of the Unity of Science, v 2, no 2 (Chicago, IL: University of Chicago Press, 1996), 35-42. Brothers offers, “Operations analysis is not reasearch for the sake of research, nor is it for the sole purpose of extending the fronteirs of knowledge.” See Brothers, “Operations Analysis in the United States Air Force,” 14.

⁵⁴⁵ Brothers, “Operations Analysis in the United States Air Force,” 3.

process. They used cameras already onboard the aircraft, along with information about each aircraft's position in the formation, altitude, and track to disaggregate the composite-bomb plots into separate images. This allowed them to determine which unit or even which aircraft dropped which bombs.⁵⁴⁶

This process was relatively straight-forward, as long as the cameras worked and the photographs were of suitable quality. The contentious limitation was that the bomb plots accounted only for bombs that appeared in photos as craters, collapsed roofs, damaged infrastructure, etc. Any of various reasons a bomb might not appear in a strike photo, such as a double hit, delayed fuse, dud weapon, or obscured impact could not be counted, thereby falling into the same category as bombs that had fallen too far off target to appear in the image anyway. This was a limitation of their source data, which was beyond their control, not their math, so the researchers adamantly defended their process.

Their second contribution was to develop a standard for measuring bombing accuracy. One method was to determine, using all identifiable craters, a Mean Point of Impact (MPI) assessed by “the length (along track) and width (across track) of the pattern” from the intended target.⁵⁴⁷ Another method involved depicting arbitrary, but standardized, 500', 1,000', and 2,000' circles around each target, then determining the percentage of bomb craters found within each for the total bombs released. After evaluating a multitude of other

⁵⁴⁶ Arps, *Report: Operational Analysis Section*, 1 June 1945, 41-42.

⁵⁴⁷ For an evaluation of the ORS researchers' methods, see: Statistical Control Division, *AAF Bombing Accuracy*, USAAF, (Maxwell AFB, AL: AFHRA, 31 March 1945), #134.71-83, IRIS 113034, 52-54.

possible metrics, they selected the 1,000' circle, despite its limitations, as the measurement against which bomb scores were graded.⁵⁴⁸

The limitation here was that their method failed to take into account both the overlapping bomb patterns particular to formation bombing (since not every bomber can aim at the center point), as well as the size and shapes of various targets.⁵⁴⁹ In practice, this may have been more significant than it sounds, because it meant aircrews could be held accountable for bombs that appeared off-target, but fell where they logically should have, which was not directly on the aiming point used by the lead aircraft. As long as they evaluated each group against its own aiming point, all was fair. If a particular crew other than the lead aircraft happened to hit the aiming point, then the result for that crew was just as much a function of luck as skill. The more egregious problem with this overly simplified method was its failure to account for the shape of the target. Accuracy was not always the best indicator of bombing performance with larger targets (specific examples below), but the mathematicians vigorously defended their method anyway.

In fact, they even produced a report that evaluated their own bomb evaluation methodology. From a comparison of 270 different bomb plots that scored percentages of bombs within the prescribed circles, they concluded: "There was no evidence of significant systematic error, and indeed, the method seems on the surface to be free of any tendency for one operator [bomb damage

⁵⁴⁸ Brothers, "Operations Analysis in the United States Air Force," 3.

⁵⁴⁹Statistical Control Division, *AAF Bombing Accuracy*, 31 March 1945, 52.

assessor] to contribute higher percentages to bombing operations than another.”⁵⁵⁰ They may have proven their method was consistent but that didn’t make it valid for all circumstances.⁵⁵¹ Nevertheless, the method seemed the most defensible, and it persisted.

The researchers had their customers clearly in mind, not just General Eaker, but all levels of their assigned Air Force, as they approached their work. They had to select methods and draft arguments that could be grasped easily, not by the scientific community, but by the Airmen fighting the war. Hugh Miser suggested, “in practice the tool adopted should be the simplest one that will be effective.”⁵⁵² It wasn’t that the officers lacked the intellect, but as Leach had included in his report, “these officers are so inevitably absorbed with carrying out today’s mission and planning tomorrow’s they simply don’t have the time and uninterrupted attention which most of these matters required.”⁵⁵³ In light of this, whatever method they selected for bombing accuracy had to be within their capacity (in terms of manpower and available data) to accomplish and useable by their customers, so their choice of a simple and expeditious

⁵⁵⁰ Operational Research Section, *Operations Analysis Report: Memorandum on Methods of Analysis and Reliability of Measures Employed by ORS, Eighth Air Force, in the Study of Bombing Accuracy*, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, 4 October 1944), #520.310, IRIS 220144, 26.

⁵⁵¹ Carmines and Zeller provide useful definitions for clarity. By reliable, the method has “a tendency for consistency found in repeated measurements of the same phenomenon,” whereas a validity indicates “the extent that it measures what it purports to measure.” In this case, how well the bombers performed. See: Edward G. Carmines and Richard A. Zeller, *Reliability and Validity Assessment*, ed. John L. Sullivan and Richard Niemi, G., *Quantitative Applications in the Social Sciences* (Beverly Hills: Sage University Papers, 1987), 12.

⁵⁵² Arps et al., *Operations Analysis in the Eighth Air Force, 1942-1945: Four Contemporary Accounts*, 3. Text from Hugh Miser’s introduction.

⁵⁵³ Knight, “Ask Them Another,” 31.

method was commendable. That they appeared to advertise it as a tool for policy decisions without cautioning against its limitations was not.

What followed from their bombing analysis could be the researchers' most tedious but significant contribution to the air campaign. They'd developed strike summaries for every raid, which incorporated all relevant operational factors as well as the rank-ordered performance of each participating Bombardment Group.⁵⁵⁴ They published these regularly to all of the units involved and defended their results. Rather than avoid conflict and the additional time spent in meetings with infuriated aircrew, they relished the challenge of intellectual arguments. Differing from the AAF's unit-level intelligence officers, who tended to report what they were told and hitched their morale to the successes or failures of their units' performance, these mathematicians relished the independence of their findings.

The researchers did not have to solve every tactical challenge or conceive of every possible improvement. After all, they were not experts at formation flying, aircraft performance, crew resource management, or target-location techniques. They did experiment, but they were not particularly innovative. Their data collection, research, and reporting resolved disputes and facilitated experimentation by operators. Once they gained credibility, they advocated particular practices across the entire command. Crews paid attention to their results, which bred competition and rivalry between units for the best bomb scores. Though the researchers had not anticipated their products would

⁵⁵⁴ Arps, *Report: Operational Analysis Section*, 1 June 1945, 54-56.

become report cards for bomb groups, they gravitated toward leaders like Curtis LeMay, who appreciated their work, and used their reports “to keep his commanders on their toes.”⁵⁵⁵



⁵⁵⁵ Arps et al., *Operations Analysis in the Eighth Air Force, 1942-1945: Four Contemporary Accounts*, 208.

Chapter Five: Targeting and Assessing from Washington

*I am enthusiastic about the possibilities of using this report of an impartial group of analysts as a means of presenting to the Combined as well as to the Joint Chiefs of Staff the concept that Airmen have known for years to be sound.*⁵⁵⁶

—H. H. Arnold, Commanding General, AAF, 24 March 1943

A Committee of Lawyers and Industrialists

By the fall of 1942, Arnold's steps to build and train an air-intelligence cadre and to adopt lessons learned from the RAF could not adequately address near-term planning gaps. The forthcoming meeting of the Combined Chiefs at Casablanca intensified his sense of urgency, because he knew this event would set policy for the next phase of Allied bombing in Europe. Without a detailed, feasible, and executable plan, or at least a credible estimate of potential targets in Germany—one that could garner support outside of his staff—U.S. air involvement could get caught playing second fiddle to the RAF's night area bombing. Equally unconscionable, there could be pressure from RAF senior leaders or Churchill himself to give up on daylight precision targeting of specific industries altogether. This would mean abandoning the AAF's bombing doctrine before it had a chance to prove its validity and would undermine the AAF's precious credibility in its bid for resources vis-à-vis the other services.

Although Arnold received regular updates from Spaatz and others on

⁵⁵⁶ H. H. Arnold, *Letter, Arnold to Andrews*, (Maxwell AFB, AL: AFHRA, 24 March 1943), #168.61-10, IRIS 124347.

developments in Europe, he wanted the targeting plan developed in Washington. Arnold knew—or so he thought—his generals in the U.K. were too busy dealing with operational challenges to help win the Washington battles, much less arguments with the Combined Chiefs. Arnold also knew that his own planners lacked the intelligence resources, expertise, and time to propose a more thorough and acceptable analysis than had led to the troubled roll-out of AWPD-42.⁵⁵⁷ This predicament left Arnold with few options, and none was ideal.

To address the expertise problem, he could assign additional training or pursue academic credentials for his staff, but either would take time he didn't have. Besides, many of them had already graduated from the Army's Command and General Staff School (CGSS) in succession with the Air Corps Tactical School. Those, in addition to the Army's War College and Industrial College, should have met that purpose insofar as the War Department was concerned.⁵⁵⁸ Alternatively, he could hire credentialed civilians to augment his

⁵⁵⁷ Various histories offer slightly different perspectives on Arnold's formation of the COA, although appraisals of his motives are relatively consistent: he needed credible air intelligence and could not get it from his staff. The COA's official history offers the credit to Maj Gen Fairchild, who'd recognized that "the research and analysis necessary to the formulation of plans and solutions of strategic bombing problems...was [an activity] for which a regular army career did not necessarily prepare an officer." There may have been problems of competency as well as credibility. See: Col Guido R. Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, (Maxwell AFB, AL: AFHRA, 1944), #118.01 v.1, IRIS 110402, 3-4.

⁵⁵⁸ As official Army historians reference the matter of interwar education for officers, "the Army Industrial College prepared senior officers of demonstrated ability for the most responsible command and staff positions and assisted in the development of war plans. By establishing the Industrial College, the Army acknowledged the high importance of industrial mobilization and logistical training for the conduct of modern warfare." Of course, the school's attendees were trained on the American military-industrial complex since its inception in 1924, not the destruction of foreign industries. See: Richard W. Stewart, *American Military History*, vol. 2,

staff, but assigning them to his existing intelligence or planning organizations might not help with their credibility problem. He went for a third option, which was to hire a team of premiere civilian analysts who could operate independent of his staff—at least in appearances. This team of reputable civilians, he conjectured, would fill his intelligence gaps with industrial expertise.

An Air Force history posits that Arnold and Fairchild “may have believed that the establishment of a group outside the normal intelligence and plans organizations, especially one including prominent civilians, would carry greater weight with the other services and with political leaders such as the Secretary of War and the President.”⁵⁵⁹ This logic is plausible, but it also suggests that Arnold may have been more interested in employing civilians to add credibility and rigor to his intent for bombing over Germany than any real hopes for original thought on their part. Arnold’s idea, then, was that a special committee might add meat to the bones of ACTS doctrine without jostling any skeletons in view of the other services. In either case, Arnold needed them to track down and assemble vast sources of information that his intelligence could not obtain (or was otherwise blocked by War Department G-2). He needed their study to convey impartiality, and he needed it quickly.

As to the more tangible problem of near-term intelligence deficits regarding Germany, Arnold had turned to Mr. Robert Lovett, Special Assistant for Air Affairs to the Secretary of War, for advice. “The easiest way to secure the

Army Historical Series (Washington, D.C.: United States Army Center of Military History, 2005), 95.

⁵⁵⁹ Kreis, *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II*, 152.

information would be to get it from engineers, bankers, or construction people who had actually done the construction in foreign countries; men who had loaned money, and in loaning money, had secured descriptions of the various plants,” suggested Lovett.⁵⁶⁰ Arnold latched onto Lovett’s idea. He could directly hire some of the brightest civilians available, who could then use their connections and influence to reach out to others.

Arnold then directed Colonel Byron Gates, his Assistant Chief of Staff for Management Control—a position “normally concerned with staff procedures, correspondence channels, and management techniques,” rather than his planning or intelligence chiefs—to begin hiring a new team of civilians for this purpose.⁵⁶¹ Gates, who’d instructed at ACTS with Fairchild just a few years prior, was the only regular Air Corps officer originally associated with the committee and, along with juggling the demands of his other duties, he lacked the time to commit to full-time participation.⁵⁶² Gates, soon promoted to Brigadier General, could provide just enough oversight as the military chairman of committee meetings when he was available. This arrangement helped to keep the civilians from straying too far from ACTS doctrine, while he maintained a duty title innocuous enough not to undercut Arnold’s intent to

⁵⁶⁰ Arnold, *Global Mission*, 534-535.

⁵⁶¹ Hansell, *The Air Plan that Defeated Hitler*, 148.

⁵⁶² Gates previously held the section chief position for both observation and pursuit at ACTS as well as taught in the Department of Air Tactics and Strategy. Even if he was not directly responsible for instructing bombardment doctrine, he would certainly have been aware of ACTS viewpoints as he steered COA. See: Finney, *History of the Air Corps Tactical School, 1920-1940*, 106-112.

portray his outside group as unbiased.⁵⁶³

Arnold's intelligence staff, already exasperated by its own shortcomings, was demoralized to lose a responsibility that seemed so clearly in its lane. Arnold had anticipated that disgruntled staff members might undercut the new committee with security and classification barriers, so he expressly ordered "all personnel having knowledge or custody of relevant material, including such as may be classified, to place the same at [Gates'] disposal."⁵⁶⁴ This arrangement permitted Gates to then distribute information to the committee as he saw fit. From the start, Arnold's civilian committee operated in an environment hostile to its existence, so survival perpetuated as a central concern.

Arnold's Committee of Operations Analysts (COA) formed as a core group of prominent economists and lawyers who orchestrated a legion of sub-committees, each representing a different potential target industry and comprising its own set of expert advisors.⁵⁶⁵ This construct—much like a tree trunk with branches and vines—gave the COA its identity and shaped its behavior among other intelligence organizations. Committee leaders could attract highly educated participants and foreign industry experts with relative

⁵⁶³ The presence of direct oversight or involvement by ACTS graduates (both Gates and Sorensen) is an important distinction between the COA and the EOU. By contrast, especially given Eaker's alleged laissez-faire role in his staff's operational matters, EOU did not have continuous or direct involvement by ACTS graduates excepting only the intermittent interactions between Fred Anderson, Haywood Hansell, and Curtis Lemay with Richard Hughes. EOU thus had a wider berth to stray from ACTS doctrine. For examples of the latter interactions, see: Hughes, *Memoirs: Chapter VIII, 1941-1945*, 1957, 18, 30, 33. Rostow, *Rostow Report*, ca. 30 April 1945, 41.

⁵⁶⁴ H. H. Arnold, *Memorandum, Research and Analysis to Fix Earliest Practicable Date for Invasion of Western Europe*, HQ USAAF, (Maxwell AFB, AL: AFHRA, 22 Dec 1942), #118.161, IRIS 110571.

⁵⁶⁵ McArthur, *Operations Analysis*, 9.

ease to the nation's capital, particularly while the war still seemed an existential threat to Western democracy in 1942 and early 1943. This also meant the COA's individual members did not need to acquire massive amounts of personal knowledge about German industrial systems because the organization could collectively invest less energy by finding additional experts, or at least someone who presented as such.⁵⁶⁶ Thus, the COA's challenges centered less on creating new experts and more on validating the expertise they'd found. It also needed to tie disparate expertise into reports that linked industrial conclusions with strategic-bombing doctrine and elusive operational factors—an even knottier problem for the COA's tree of civilian experts.

Aside from Gates, other notable members included: Colonel Guido Perera, Harvard-educated lawyer, previously activated to duty as a reservist Judge Advocate; Malcolm Moss, by-then promoted to Lt Col, serving as the A-2 (Targets Section) representative; Lt Col W. Barton Leach, Harvard Law professor; Dr. Edward Mason, OSS representative and Harvard economics professor; Mr. Fowler Hamilton, Board of Economic Warfare and former Department of Justice anti-trust lawyer; Dr. Edward Earle, Princeton economist and historian; Dr. Elihu Root Jr., New York lawyer and director of

⁵⁶⁶ Haridimos Tsoukas categorizes organizations of this type as “distributed knowledge systems, whose effective action is the result not so much of individuals acquiring more and more knowledge as of finding ways of utilizing widely distributed organizational knowledge.” See: Tsoukas, *New Thinking in Organizational Behaviour: From Social Engineering to Reflective Action*, 16. Also, an organizational challenge of hiring outside experts is one of lacking the internal expertise to hold them accountable. See: Robert Gilpin and Jean M. Gilpin, *Global Political Economy: Understanding the International Economic Order* (Princeton, NJ: Princeton University Press, 2001), 71.

the Carnegie Foundation; and Mr. Noel Hall of the British Ministry of Economic Warfare (MEW).⁵⁶⁷ From their résumés alone, they were as credible and eminently qualified for intellectual endeavors as the War Department might muster. How such a team would approach its problem remained to be seen.

Elihu Root Jr., son of the former Secretary of War, proved extraordinarily valuable to the COA's formational period. Despite his lack of experience with industrial economics or strategic bombing, he brought "good judgment and all-around wisdom," as purported in the COA's official history, along with "many years' acquaintance with corporate problems...and had maintained close personal contact with leaders in the field of business."⁵⁶⁸ In other words, he could navigate bureaucracy and knew who to call to find the industrial expertise that the Air Staff didn't have. The COA clearly placed a higher premium in its core members for their persuasiveness and connections than their ability to verify subcommittee reports or to tackle the operational challenges of strategic bombing. In a sense, the committee operated like a business within the Air Staff; it needed corporate-style leadership in order to be successful, and it peddled its ideas to the generals who mattered in order to survive.

Some of the committee's members had other allegiances. Participation by representatives from intelligence organizations outside the War Department

⁵⁶⁷ Parton, *Air Force Spoken Here*, 249-251; McArthur, *Operations Analysis*, 9; Byron E. Gates, *Memorandum to Maj Gen Fairchild*, War Department, (Maxwell AFB, AL: AFHRA, 15 December 1942), #118.161, IRIS 110571.

⁵⁶⁸ Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 7.

(notably Hamilton and Hall) and from the OSS injected a dual-edged phenomenon: On one side, they shared information, though sometimes selectively, and they facilitated common perspectives among the various intelligence organizations. Open discussions would help reduce friction where compromise was possible. On the less-obvious side, external participants also harkened back to their masters with information and prepared counter-arguments as disagreements arose.

The EOU, for example, wasn't shy about returning its London-based members to Washington to join the COA in order to help "the people there grasp and accept the working concepts" that it developed overseas.⁵⁶⁹ This behavior was not necessarily sinister. In an institutional "marketplace of ideas," there was competition not just to produce the most convincing viewpoints, but also to propagate those viewpoints into other organizations. In a market where each individual's relationships, experience, and loyalties held considerable value, organizations preferred to keep the same individuals involved with other organizations' projects, unless it was clearly more advantageous to move them.⁵⁷⁰

⁵⁶⁹ Charles Poor Kindleberger, *Memorandum for Colonel R.D. Hughes, Subcommittee Reports to the Committee of Operational Analysts*, in *Personal Collection of Gen Henry H. Arnold part 3 of 6*, American Embassy Office of Strategic Services, Economic Warfare Division, (Maxwell AFB, AL: AFHRA, 7 April 1943), MICFILM 28253, IRIS 2053776.

⁵⁷⁰ The "marketplace of ideas" metaphor has deep roots in First Amendment literature with respect to individual rights, but its application to institutional (or organizational) phenomena has gained traction since the early 2000s with economists and lawyers who have argued of the importance of accounting for institutional "transaction costs" traditionally ignored by neoclassical economists. The metaphor is important to this narrative because intelligence organizations assumed the "time, energy, and money" costs of exchanging their ideas without yet a clearly-established set of norms particular to their profession. Intelligence organizations did tend to mitigate transaction costs by relying on "repeat players," as Blocher mentions in his

The COA subcommittees also included a handful of notable foreign experts. In some cases, although their general contributions regarding target-system analysis could be valuable, their specific insights regarding German industrial practices were priceless. These insights, according to Colonel Ed Sorensen, the British did not have, and they helped to arm the Theater Commander “with the thorough analyses which should have been made during the past twenty years of peace.”⁵⁷¹ Preeminent among these foreign experts were: Dr. Max von der Porten, former President of the German aluminum industry; Dr. Ludwig Homberger, former Vice President of German railroads; Mr. Henry Behrens, German citizen and former director of Diesel Elektron, a Dutch locomotive company and close collaborator with German locomotive works; Mr. Otto Stern, who oversaw Shell Oil interests in Romania; Mauritz Straus, German citizen and former owner/General Manager of Argus Motoren Gesellschaft, leader among German aircraft engine manufacturers; and Lippmann Bloch, Polish citizen with university experience in Berlin and Munich, and owner of Ore Trading Corporation.⁵⁷²

Employ of foreign experts brought risks as well. At least four of the initial consultants were actively seeking American citizenship, while providing their insights on German industry to the War Department.⁵⁷³ These personal

conclusion. See: Joseph Blocher, "Institutions in the Marketplace of Ideas," *Duke Law Journal* 57, no. 4 (2008): 824-826, 838-847, 857.

⁵⁷¹ Edgar P. Sorensen, *Letter, Sorensen to Kuter*, in MS 6, *Hansell Papers*, (USAF Academy, CO: Clark Special Collections Branch, 3 January 1943), Series 2, Box 2, Notebook 1.

⁵⁷² Howard Bruce, *Memorandum for Asst Chief of Air Staff, A-2; Subject: Foreign Experts*, (Maxwell AFB, AL: AFHRA, 12 Dec 1942), #118-161, IRIS 110571, 2-3.

⁵⁷³ *Ibid.*

motives could undermine the consultant's objectivity, since the experts would not have felt comfortable offering opinions contrary to that of the Americans' for fear of possible deportation. Further, they may have been more likely to offer contrived information than to acknowledge information gaps since they wanted to appear as helpful as possible. Finally, as Hughes had complained of some of the American economists, the situation with foreigners was much worse: since they did not have security clearances, they could not provide comparative analyses to other industries, detect omissions, or even offer suggestions to final reports.⁵⁷⁴ It all added up to a potential for less objectivity and less expert review as the committee generated reports.

The first point of business performed by the new organization had been to assign its own name as "The Advisory Committee on Bombardment"—a title it maintained throughout the four months of gathering and producing reports on the Western Axis. According to their official history, however, it was not until the committee members completed their final report for General Arnold on 8 March 1943, that they officially changed their name to the Committee of Operations Analysts.⁵⁷⁵ They had likely intended this as the original name, adopted in the presence of Major General Fairchild, to convey a limited scope and purpose. This would have helped the civilian analysts to ameliorate

⁵⁷⁴ Hughes, *Memoirs: Chapter VIII, 1941-1945*, 1957, 11.

⁵⁷⁵ Some historians have dropped the COA out of the picture of intelligence organizations altogether because of the misnomer in its title as operations analysis. Its analysts were, in fact, performing core intelligence functions throughout the organization's two-year tenure. See: Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 7, 44.

tensions with other Air Staff offices by seeming less expansionist.

By the following April, when they produced their final Western Axis report, however, they'd grown sensitive to avoid stepping on Eighth Air Force planners' toes and instead conveyed a broader—and less obtrusive—purpose as they shifted their focus to the Far East.⁵⁷⁶ As discussed later, Eighth Air Force planners were not eager to be advised on bombardment by Washington. Perceived instead as a handful of Arnold's generalist advisors, a Committee of Operations Analysts would have seemed less threatening.

The preponderance of the committee's Ivy League-educated participants internalized a superiority complex toward military leaders, at least insofar as scholarly prowess. Even as a uniformed member initially junior to most of the Air Staff (including Sorensen), Perera admitted witnessing from his Harvard days that "the military were treated by the intellectuals as second-class citizens inhabiting a limited world of their own."⁵⁷⁷ The COA's core members saw themselves as an organization that could tackle any problem they might find in the military's limited world, especially those of their boss, "Hap" Arnold. To Perera, Arnold "was in no sense a thoughtful, precise thinker, but a doer."⁵⁷⁸ They aimed to earn and maintain their favor with Arnold, which would give them greater autonomy and influence over AAF actions. Arnold's favor could at

⁵⁷⁶ Ibid., appendix, tabs 6-21. Although Perera claims the committee members voted to rename themselves the Committee of Operations Analysts when they submitted their final report, the title appears in the interim report they submitted to Arnold on 23 December 1942, just prior to their London trip. The official history doesn't offer a reason for the title change.

⁵⁷⁷ Perera, *Memoirs: Washington and War Years*, 1973, 41-A.

⁵⁷⁸ Ibid., 55-D.

least ensure the committee would survive the remainder of the war, as it would also grant them due regard from Arnold's subordinate generals, especially Eaker, who knew better than to swipe at Arnold's pet projects.⁵⁷⁹

The COA members sprung with zeal into their impossible implied task of thoroughly dissecting German industry in a little over a month. A side-effect of the time crunch they faced was that the committee members had to make priority decisions quickly in order to manage their time and the scope of their task, which spilled over into target priorities. When committing their positions in writing, however, the COA members carefully maneuvered to downplay this necessary evil. The analysts' approach came across in the form of subtle contradictions, as if offering Arnold a choice of passages in hopes that he might find something he liked. For example, with a nod toward its own impartiality and thoroughness, the COA purported to be "well advanced in a general Survey of Western Axis industry...as a safeguard against omission," then revealed in the same memorandum that it had honed in on "industries which have seemed to it the most promising...aircraft, oil, transportation, electric power, coke, and rubber."⁵⁸⁰ Without yet completing its broad survey, evaluating the bombers'

⁵⁷⁹ Arnold's seemingly endless diversions of Eighth Air Force bombers in 1943 was source of serious concern to Eaker, but they also often disagreed on everything from maintenance practices to personnel moves. COAs effort's probably added one more frustration for Eaker. Though Eaker rarely opposed Arnold directly, when he did so, he tried to choose his words and his battles carefully. Despite his subordinate tone, Eaker probably crossed the line on 12 July 1943 and arguably never quite recovered: "One of my greatest concerns is the fact that I have so frequently of late been placed in the position where it might appear that I was opposing an idea which originated in Washington and which from the information available there, seemed to be sound." See: Maj Gen Ira C. Eaker, *Letter, Eaker to Arnold*, Manuscript Division, Eaker Papers, Box 16, (Washington, DC: Library of Congress, 12 June 1943).

⁵⁸⁰ Byron E. Gates, *Memorandum, Analysis of Bombardment Objectives in Axis Europe*, War Department, (Maxwell AFB, AL: AFHRA, 23 December 1942), #118.161, IRIS 110571, 1.

potential to locate or even to reach their targets, or projecting Eighth Air Force capacity, the analysts had set de facto priorities by virtue of which industries they selected first and about which they acquired the most information.

A tacit contradiction arose over bombing-policy recommendations. COA leadership planted a seed in an early update to Arnold that served to undercut a mindset of continuous air-campaign assessment: “It is clear that results are cumulative and that a master plan, once adopted, should be adhered to with relentless determination.”⁵⁸¹ They wanted their recommendations to have a chance to succeed. It was also clear from the start that most industries would require many targets to be destroyed, in most cases including repeat attacks on the same areas. This language survived into their final report four months later. In the final report, however, the COA analysts also added a recommendation for “continuing evaluation of the effectiveness of air attack on enemy industrial and economic objectives in all theaters,” with an express purpose: “for the information of the appropriate authority charged with the allocation of air strength.”⁵⁸² This last piece, following their trip to England, echoed Eaker’s wishes to limit General Arnold’s impetuous control of all AAF aircraft.

The idea behind the evaluation add-on was to have enough patience to stick with the plan until evidence could prove or dispute its effectiveness. Such

⁵⁸¹ Ibid., 2.

⁵⁸² Committee of Operations Analysts, *Report of Committee of Operations Analysts with Respect to Economic Targets Within the Western Axis*, War Department, Tab 22, (Maxwell AFB, AL: AFHRA, #118.02v2, IRIS 110403, 2.

evaluations (or air-campaign assessments) might also inform whether each theater was appropriately resourced. Although it is unlikely the COA analysts had considered it at the time, assessments might also show whether or not the theater commander was following the plan. Unfortunately, no entity picked up the ball for ongoing assessment for several more months.

ACTS of Air Intolerance

Colonel Ed Sorensen, a reluctant pilot-turned-intelligencer with a particularly vocal and forceful personality, also maneuvered into COA meetings from his duties as Arnold's A-2 (Chief of Air Intelligence). Sorensen had graduated from the Tactical School in 1936 and served as its Commandant at Maxwell field until just prior to assuming duties as Assistant Chief of Staff for Intelligence in July 1941.⁵⁸³ His advocacy of emerging bombing theory was as aggressive, confident, and informed as any from the school, though he took views that deviated from the norm and his tact engaging with senior leaders left him sideways with Eaker and outcast from the inner circle of ACTS graduates.⁵⁸⁴

In early January 1943, as the COA were preparing their first round of sub-committee reports, Sorensen sent a letter to Brigadier General Laurence Kuter—then departing his tour as a bombardment wing commander in England, offering “some advance information on what we [the COA] are

⁵⁸³ Finney, *History of the Air Corps Tactical School, 1920-1940*, 113.

⁵⁸⁴ All of the participants (Sorensen, Eaker, Kuter, Hansell, and Stratemeyer) in the trail of correspondence that follows were ACTS graduates or instructors.

attempting to do... for quicker action in case we ask you for certain pictures or other data by cable or by mail.”⁵⁸⁵ Sorensen acknowledged that Eighth Air Force was likely developing plans of its own, but that the COA would eventually send a team forward “to compare notes,” adding “that the better plan would be recognized by our people.”⁵⁸⁶ If there was a diplomatic way to suggest that a committee in Washington would be intruding on a theater commander’s targeting plans, Sorensen hadn’t found it.

Moreover, Sorensen expressed views that were unusually pragmatic to toward the joint environment for a former ACTS instructor. He insisted upon several controversial observations in his letter, including: that “any plan must have the concurrence of Ground and Naval forces”; that the “initial or air phase proper” was preliminary rather than in lieu of an eventual ground invasion, during which it would be necessary to destroy “transportation structure...in the protection of a bridgehead for an invasion force”; and that arguments he’d heard from group commanders returning from theater that gross bombing inaccuracies had been due to unexpected enemy anti-air resistance (both fighters and flak) were “not well founded,” because “none of the units which have operated in the U.K. thus far had reached a satisfactory degree of peacetime bombing training.”⁵⁸⁷ In other words, Sorensen decided from a continent away that enemy resistance wasn’t the primary issue with their bombing performance; training was.

⁵⁸⁵ Sorensen, *Letter, Sorensen to Kuter*, 3 January 1943, 4.

⁵⁸⁶ *Ibid.*, 3-4.

⁵⁸⁷ *Ibid.*, 3-5.

Not only was Sorensen's approach inflammatory, but his ideas may also have ignited a firestorm with Eaker, who shared his group commander's frustrations "to see their little force dwindling," as he'd expressed to his friend, Major General George Stratemeyer, a few weeks later.⁵⁸⁸ Eaker was trying to win the war, and while he claimed that he was open to advice from Washington, particularly if it came from a peer that he respected like George Stratemeyer, what Eaker really wanted was replacement crews and the bomb groups he'd been promised.

Laurence Kuter, who was apparently underwhelmed by Sorensen's prose, did little with the correspondence until handing off wing command to Haywood Hansell with a brief note: "This baby [Sorensen's letter] is now in your hands... It is my personal belief that you should not simply give this paper to Ira Eaker, but must discuss it with him and build some foundation upon which he may accept it. Ira is not impressed by Ed Sorensen's views."⁵⁸⁹ If Kuter had begun to socialize Sorensen's contrarian viewpoints with Eaker, he clearly had not made much headway.

Hansell responded to Sorensen a couple weeks later, reassuring Sorensen that he need not feel apprehension about "unwanted meddling with [Eaker's] affairs... so long as the approach is tactful and through the highest channels." Additionally, Hansell recommended that Sorensen steer his committee toward

⁵⁸⁸ Maj Gen Ira C. Eaker, *Letter, Eaker to Arnold*, (Maxwell AFB, AL: AFHRA, 30 January 1943), #168.491v1, IRIS 123263.

⁵⁸⁹ Laurence S. Kuter, *Letter, Kuter to Hansell*, in *MS 6, Hansell Papers*, (USAF Academy, CO: Clark Special Collections Branch, 28 January 1943), Series 2, Box 2, Notebook 1.

rather than against AWPD-42 (Hansell had evidently already convinced Eaker of its merits), but “do not harp too much upon small precision targets,” Hansell continued. “We find they are hard to hit, particularly in the face of heavy [anti-aircraft] fire and determined fighter opposition.”⁵⁹⁰ Hansell recognized that hitting targets in combat was proving far more difficult than expected, especially as the missions were planned—“so much like the old days of the Air Corps Tactical School,” as Hansell reminisced with Fairchild in another letter the same day.⁵⁹¹

George Stratemeyer (then Arnold’s 2-star Chief of the Air Staff), finally weighed in directly with Eaker in attempt to settle the dust-up: “He is just so intent on precision bombing like all of us are that when, in his mind, the bombing isn’t good, or heavy bombers aren’t used properly,” Stratemeyer explained of Sorensen, “I guess he can’t help but sound off.”⁵⁹² The ACTS graduates maintained their strong opinions and their open dialogue, but they still had a pecking order that seemed to have as much to do with tactical credibility and old relationships as rank. By any measure, Sorensen had emerged from under Arnold’s wing to represent the Air Staff’s increasing role in air intelligence, and the forceful impression he gave to his senior officers in England had cost him their respect. Sorensen and Eaker did not see eye to eye,

⁵⁹⁰ Brig Gen Haywood S. Hansell, *Letter, Hansell to Sorensen*, in *MS 6, Hansell Papers*, (USAF Academy, CO: Special Collections Branch, 11 February 1943), Series 2, Box 2, Notebook 1.

⁵⁹¹ Brig Gen Haywood S. Hansell, *Letter, Hansell to Fairchild*, in *MS 6, Hansell Papers*, (USAF Academy, CO: Special Collections Branch, 11 February 1943), Series 2, Box 2, Notebook 1.

⁵⁹² Maj Gen George E. Stratemeyer, *Personal Letter to Ira Eaker*, HQ AAF, (Washington, DC: AFHSO, 23 March 1943).

and relationships were not going well for Sorensen in Washington, either.

Ostensibly responsible as Arnold's A-2 for steering all of the AAF's intelligence functions and special reports, Sorensen was the one most proximally snubbed by Arnold's decision to place the COA under a division other than the A-2. This arrangement also led to unresolved bad blood between Sorensen and Perera, who noted that Sorensen "bitterly resented" the COA's role as "a sort of super reviewing authority."⁵⁹³ As Sorensen struggled to defend A-2 influence, he stumbled into a difficult task with the COA as well.

As the only of the committee's core participants with a background in bombing principles, Sorensen led the subcommittee on bombing probabilities. This was the one area of military specialization for which no amount of previous experience could compensate for practical knowledge of bombing. Among this subcommittee's considerations were:

*Estimated probable error, the state of training, the effect of combat conditions, the height from which bombing was carried out, the percentage of assurance of securing a hit on a given spot postulated, the number of abortive sorties..., the method of dropping bombs whether in train or otherwise, the ballistics of the bombs used, the selection of aiming points and the blast effects of the bombs themselves.*⁵⁹⁴

Outputs from Sorensen's subcommittee were vital to the COA's ultimate task of determining a timeline for the dislocation German industry, although these outputs informed the work of all other subcommittees as well.⁵⁹⁵ According to

⁵⁹³ Perera, *Memoirs: Washington and War Years*, 1973, 119.

⁵⁹⁴ Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 19.

⁵⁹⁵ The exact wording of Arnold's initial charge to Gates was noteworthy because COA analysts tended to fixate on the time requirement: "Have the group of operational analysts under your

historian Stephen McFarland, During Sorensen's time instructing at ACTS, he'd "analyzed 40,000 bomb drops and concluded that 'any categorical answer to the question how many airplanes must be dispatched to obtain a reasonable chance of destroying an objective is of no practical value because of the many factors that must be considered in each case.'"⁵⁹⁶ This was precisely the task he now broached along with COA analysts. Sorensen's conundrum was that any uncertainties or errors factoring into his equations could drastically influence the force-sizing requirements and expected operational when applied across entire industries. Put otherwise, none of the industrial intelligence had any meaning to an air-campaign plan unless it was mated with realistic assumptions about bombing.

New tactics at St. Nazaire. No air commander during the entire war was perhaps more in tune with validating assumptions, selecting metrics, or driving for efficiency than was Curtis LeMay. His appreciation for the ORS began during his own brief tenure as a group commander. LeMay was tired of returning his 305th Bombardment Group to the submarine pens at St. Nazaire, because they couldn't manage to put enough bombs on target, much less do much damage with the bombs that they hit. In fact, the British Air Ministry's

jurisdiction prepare and submit a report to me analyzing the rate of progressive deterioration that should be anticipated in the German war effort as a result of the increasing air operations we are prepared to employ against its sustaining forces. This study should result in as accurate an estimate as can be arrived at as to the date when this dislocation will have progressed to a point as to permit a successful invasion of Western Europe."Arnold, *Memorandum, Research and Analysis to Fix Earliest Practicable Date for Invasion of Western Europe*, 22 Dec 1942.

⁵⁹⁶ McFarland, *America's Pursuit*, 98.

intelligence section began to push toward anti-submarine patrols vice bombing the land-based targets: “The most rapid, effective and permanent means of reducing the submarine menace is considered to be direct sinkings by surface and air attack,” they wrote, adding, “certainly the effort required to attain a similar result by bombing of bases and building yards alone will be quite disproportionate to the results.”⁵⁹⁷ This advice did not sit well with the AAF and had not yet gained traction with the Combined Chiefs. The AAF had flaunted the argument that its long-legged heavy bombers could perform coastal defense; but a wartime backfire appeared imminent.

The AAF was already operating its anti-submarine command with assets syphoned off from its bombing campaign. In good faith, the AAF stood up the 1st Antisubmarine Squadron in England in November 1942. By the end of December, the squadron possessed six B-24Ds, but could only claim one U-boat “probably sunk” of two total sightings for that entire month.⁵⁹⁸ The Allies lost 75 vessels world-wide in December, 15 of which were participating in Atlantic convoys.⁵⁹⁹ There was much yet to be done to stop the U-boats, but the bomber Airmen preferred attacking shore-based facilities because they would maintain flexible control of their own forces in the event.

Meanwhile, LeMay was bull-headed about improving his results, so he tried

⁵⁹⁷ Air Intelligence Section, *Analysis of Results of USAAF Bombing Attacks on Submarine Bases in France, during November, 1942*, in *An Evaluation of the Air Effort Against Submarines (To January 1, 1943)*, Air Ministry, (Maxwell AFB, AL: AFHRA, 7 January 1943), #142.042-6, IRIS 115249, 2.

⁵⁹⁸ Antisubmarine Command, *Monthly Summary*, USAAF, (Maxwell AFB, AL: AFHRA, January 1943), #142.042-6, IRIS 115249, 4.

⁵⁹⁹ *Ibid.*, 2.

to calculate everything he could imagine. He worked out the numbers using an ROTC artillery manual and came to the conclusion that enemy fighters were a more significant threat than was flak, so he held his crews to a tight defensive formation to mass their machine-gun firepower against the pouncing Luftwaffe.⁶⁰⁰ He also believed maintaining formation integrity would improve bombing accuracy; this would shrink the bombing pattern as well as compensate for variations in experience and ability. In other words, a tighter bomb pattern meant the bombs would fall in a more precise cluster, but if the whole formation bombed using the skills of the best navigator and bombardier in the group, then the whole load of bombs would be more accurate as well.⁶⁰¹

On 23 November 1942, LeMay had led his Group through Eighth Air Force's fifth attack on St. Nazaire in just two weeks, and he insisted the entire group maintain his new "multi-level box" formation straight and level from the Initial Point (IP) through the target.⁶⁰² "We were going to put some bombs on the target," LeMay contended, "anyone in his right mind knew you couldn't shoot a qualifying score by zigzagging around every ten seconds."⁶⁰³ No aircraft were lost to flak and only two to enemy aircraft. Tallying all efforts through this raid, photo-interpreters noted "considerable damage has been caused to facilities and property surrounding the main basin," but there was nothing catastrophic, and earlier reports of a port closure due to damage to lock gates

⁶⁰⁰ McFarland, *America's Pursuit*, 170; Parton, *Air Force Spoken Here*, 237.

⁶⁰¹ McArthur, *Operations Analysis*, 32.

⁶⁰² *Ibid.*, 31.

⁶⁰³ Warren Kozak, *LeMay: The Life and Wars of General Curtis LeMay* (Washington, DC: Regener Pub., 2009), 104-107.

were refuted by reconnaissance.⁶⁰⁴ The most that could be attributed to the damage on the submarine-pen roof at St. Nazaire was a “diversion to Lorient [another submarine base] of the craft normally based at the former.”⁶⁰⁵ The Germans quickly repaired the damage, so the bombers returned again on 3 January.

This time, the Mighty Eighth sent an entire division. All eighty-five bombers led by LeMay’s group employed his bombing-on-leader tactic and put nearly 25 percent of the 107 bombs that hit the port area within 1,000’ of the target—far better than previous attempts.⁶⁰⁶ In addition to a number of destroyed buildings, bomb-damage assessments showed “sixteen or more bombs have fallen on the railway lines causing severe damage over an area of approximately 14 acres,” a floating dock and sea-wall were damaged, and “the U-boat pens have been hit at least one, possibly 3 times... There is a 16-foot crater in the roof.”⁶⁰⁷ If this was the best Eighth Air Force could muster, it was not going to be enough. Nevertheless, the accuracy improvement alone was enough to celebrate.

⁶⁰⁴ AC/AS Intelligence, *Attacks of U-Boat Bases in Northern France by the USAAF*, in *An Evaluation of the Air Effort Against Submarines (To January 1, 1943)*, USAAF, (Maxwell AFB, AL: AFHRA, 8 March 1943), #142.042-6, IRIS 115249.

⁶⁰⁵ Air Intelligence Section, *Analysis of Results of USAAF Bombing Attacks on Submarine Bases in France, during November, 1942*, 7 January 1943.

⁶⁰⁶ McArthur, *Operations Analysis*, 32. Craven and Cate, *Torch to Pointblank*, 250.

⁶⁰⁷ Air Intelligence Section, *Analysis of Results of USAAF Bombing Attacks on Submarine Bases in France, during November, 1942*, 7 January 1943. Of note, the CIU later correlated the titles of their reports to the raid date vice the date of the reconnaissance flight. In this case, the report addresses the raid of 3 January.

A Tale of Bombs and Fuses

Despite challenges Brig Gen Sorensen had encountered chairing COA's Probabilities and Force sub-committee back in Washington, there was at least one favorable offshoot to his work with a considerable positive outcome for the war. This offshoot to the Eighth Air Force ORS had nothing to do with the Sorensen's flawed bombing-accuracy assumptions, but of a personal connection. On 14 December 1942, Sorensen's sub-committee, then comprised of pilots, intelligence officers, a lawyer, a businessman, a mathematician, and a physicist, gained a much-needed "expert on explosives," in Dr. John Burchard, Director of the National Defense Research Committee's (NDRC) Structural Offense and Defense/Effects of Impact and Explosion Division.⁶⁰⁸ COA relied heavily on Burchard's expertise to answer questions about the force required to destroy targets forwarded from each of the industrial subcommittees; and interestingly, Burchard appeared to favor attacks on the German electrical power system in spite of Sorensen's recommendation against them.⁶⁰⁹ Four months later, when Harlan pressed Eaker to make a recruitment trip on behalf of the ORS, he paid a visit to Burchard's division at Princeton University, where Burchard was teaching architects and engineers a two-month course in

⁶⁰⁸ Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 10.

⁶⁰⁹ *Meeting Minutes*, 15 December 1942, 9; *Meeting Minutes*, War Department, (Maxwell AFB, AL: AFHRA, 18 December 1942), #118.151-1, IRIS 110545, 13; The COA's Guido Perera states in his memoir that the committee's civilians preferred to take bomb-damage assumptions from Dr. Burchard of the Office of Scientific Research and Development (OSRD) than from the ACTS graduates such as Sorensen, but that "unfortunately, there was no similar source of assistance with respect to bombing accuracy." See: Perera, *Memoirs: Washington and War Years*, 1973, 88-82, 88-83.

ballistics and bomb damage.⁶¹⁰ Based on his Operations Analysis experience with the AAF, Burchard dispatched two of his students to work with Harlan's ORS; one of whom, Bissell Alderman, was a graduate and assistant professor of Architecture at MIT; the other, Charles U. Kring, was a structural engineer.⁶¹¹ They arrived the following month in England, where they founded the ORS's Bombs and Fuses subsection.⁶¹²

Architects and structural engineers who consulted Eighth Air Force offered strategic bombing advice anathema to their own training. While Burchard attempted to "reverse their peacetime practices and use their knowledge to destroy buildings rather than build them," their instincts remained.⁶¹³ Alderman for one, was part of a legacy more deeply rooted than his own career. He was also the son of a prominent Massachusetts architect; his father designed or improved more than 14 churches and chapels in the Holyoke area alone, in addition to a multitude of schools and other buildings.⁶¹⁴ Professional architects like Alderman were trained to respect buildings built by others, especially those intended for religious services or envisioned for posterity. Ruskin's Seven Lamps of Architecture, written in Alderman's father's era,

⁶¹⁰ Bissell Alderman, *Report for Colonel Leach on the History and Development of the Bombs and Fuzes Subsection of the Operational Analysis Section*, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, 10 April 1945), #520.3033, IRIS 219645, 2.

⁶¹¹ McArthur, *Operations Analysis in the U.S. Army Eighth Air Force in World War II*, 39.

⁶¹² As Harlan saw it, the Bombs and Fuzes subsection's purpose developed over time into four tasks: Choice of Weapons for Particular Targets; Analysis of Photographic Reconnaissance Unit coverage for weapons effectiveness lessons learned; Studies of Theoretical and Experimental Data; Estimates of Weapon Requirements. See: Harlan, *The Operational Research Section at the Eighth Air Force*, 18 July 1944, 7-8.

⁶¹³ McArthur, *Operations Analysis*, 39.

⁶¹⁴ John Hoyt Lockwood, *Western Massachusetts, A History, 1636-1925.*, 3 vols., vol. 3 (New York, NY & Chicago, IL: Lewis Historical Publ. Co., 1926).

captures well this sentiment toward buildings:

*The dead still have their right in them; that which they labored for, the praise of achievement or the expression of religious feeling, or whatsoever else it might be which in those buildings they intended to be permanent, we have no right to obliterate...It may hereafter be a subject of sorrow, or a cause of injury, to millions, that we have consulted our present convenience by casting down such buildings as we choose to dispense with.*⁶¹⁵

Alderman never alludes to this cognitive dissonance in his history of the Bombs and Fuses subsection, which spans his own work there throughout the war, but it is evident in his philosophy toward bomb selection and his attitude toward senior commanders. For example, Alderman speaks disparagingly about General Longfellow, whom he declares was among the “big bomb enthusiasts,” while he praises General O. A. Anderson for his discretion: “He wanted to use the smallest weapon...providing it would be the most effective.”⁶¹⁶ Alderman had undoubtedly picked up his assumptions of bomb effects where ACTS had left off: smaller bombs were better if you could carry more of them. American bombers in the European Theater, while they may have dropped a lot of bombs on unintended locations and on targets-of-opportunity, did not tend to over-kill their targets, if they killed their targets at all.

⁶¹⁵ John Ruskin, *The Seven Lamps of Architecture* (London, England: Chiswick Press, 1880), 197.

⁶¹⁶ Of note, both Anderson and Longfellow were ACTS graduates from the classes of 1937 and 1936, respectively. The ACTS pedigree in no way protected a General from “Hap” Arnold’s fury. Arnold insisted Eaker remove Longfellow from VIII Bomber Command in April 1943. See: Maj Gen Barney M. Giles, *Letter, Arnold to Eaker*, (Washington, DC: NARA, 11 June 1943), AAG 312.1-G, Operations Letters, RG 18; Alderman, *Report for Colonel Leach on the History and Development of the Bombs and Fuzes Subsection of the Operational Analysis Section*, 10 April 1945, 5, 18. Finney, *History of the Air Corps Tactical School, 1920-1940*, 116,127; McArthur, *Operations Analysis*, 101.

In fact, the futile attacks on submarine pens helped precipitate the ORS's work in weapon effects and Harlan's subsequent hunt to find experts. The CIU's photo-interpreters focused on where the bombs landed and what they struck, but there was a dearth of proficiency in determining what the bombs actually did. As a result, calculations of industrial and economic impacts by organizations that depended upon the interpretation reports could be wildly skewed. For example, Eighth Air Force relied on Raid Assessments Reports by analysts from the British Ministry of Home Security (MHS).⁶¹⁷ They produced reports oriented toward estimating production losses and expected repair timelines, but as the ORS researchers found, the MHS analysts seemed to struggle with bomb-damage analysis and their reports "were never published until long after the raids had lost all interest," if they were completed at all.⁶¹⁸

To help fix these challenges and to advocate for American perspectives, Harlan's intent was to station one (or more) of his new bomb experts permanently with British MHS. However, if they sent Alderman and Kring over to the Princes Risborough headquarters of MHS, they would have found

⁶¹⁷ According to a COA memorandum, the Ministry of Home Security R.E.8. (Research and experiments Department, section 8) was yet another intelligence-related organization composed of "architects, physicists, photographic interpreters, and some economists." Their functions were: "(a) assessment of the results of German air attacks on Great Britain; (b) pre-raid assessment of probabilities of British and American raids upon German targets; (c) post-raid assessment of damage and economic effects thereof of British and American raids; (d) assessment of relative efficacy of weapons." Their reports allegedly circulated to Colonel Hughes, EOU's Chandler Morse, and to General Arnold via his A-2, but COA was not receiving them prior to July 1943. See: Col Guido R. Perera, *Memorandum for Brig Gen Gates*, War Department, (Maxwell AFB, AL: AFHRA, 15 July 1943), #118.111, IRIS 110543, 4-5. According to an Air Force history, "By August 1943, fifteen Americans were assigned to R.E.8." See: Kreis, *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II*, 138.

⁶¹⁸ Alderman, *Report for Colonel Leach on the History and Development of the Bombs and Fuzes Subsection of the Operational Analysis Section*, 10 April 1945, 3.

themselves pulled into full-time routine work with no time to conduct specialized studies, which they preferred.⁶¹⁹

The new members of the Bomb and Fuzes branch preferred not to prioritize a liaison mission with the British because they decided it was “more important to follow very closely the developments at our headquarters.”⁶²⁰ The team affixed as its customer Eighth Air Force leadership, not the MHS, and the small team of three preferred to work together with no one within their subsection in charge. The branch continued to exert unusual autonomy in determining its own priorities throughout its early period. “We were more interested in the behavior of the individual weapons on certain targets,” Alderman offered, “than we were in summarizing the results of all the attacks on all targets.”⁶²¹

Unfortunately, they could not inspect American bombing damage with their own eyes until after D-day. They had been able to inspect the effects of German bombs on British targets, which helped them formulate important assumptions, but they were unable to independently verify their conclusions. For example, they shortened their recommended fuze delays from .025 seconds to .01 seconds (meaning the bombs would travel less distance once contacting a roof or other surface before detonating); this they believed would project more blast into building structures and deflect more fragmentation downward into the less-shielded tops of machinery.⁶²² Without seeing the results of American

⁶¹⁹ Arps, *Report: Operational Analysis Section*, 1 June 1945, 72.

⁶²⁰ Alderman, *Report for Colonel Leach on the History and Development of the Bombs and Fuzes Subsection of the Operational Analysis Section*, 10 April 1945, 3.

⁶²¹ *Ibid.*, 4.

⁶²² *Ibid.*, 5.

bombing themselves, however, they relied almost exclusively on photographic evidence, reports from other intelligence organizations (also largely dependent on photographic evidence), expectations based upon their observations of German bombs, and their own past experience as architects and engineers.

Reliance upon post-strike photographs and their past experiences drove them away from early observations of building contents toward the structures themselves—damage that could be seen via reconnaissance. This was problematic because, for most industries, the structures that housed them did not produce the widgets of war; the machines, pumps, pipes, equipment, and electrical power did. Where they lacked defensible data or expertise in industry or explosives, they made assumptions and relied instead on their knowledge of construction to build their credibility.

Architects understand that buildings can be supported in ways that fool the untrained eye of a casual spectator. This knowledge of hidden supports and distributed forces was a trick of their trade and they transferred it to the task of destruction. Again, The Seven Lamps of Architecture shed light on this perspective:

*For the weight of a roof is a circumstance of which the spectator generally has no idea, and the provisions for it, consequently, circumstances whose necessity or adaptation he could not understand. It is no deceit, therefore, when the weight to be borne is necessarily unknown, to conceal also the means of bearing it leaving only to be perceived so much of the support as is indeed adequate to the weight supposed.*⁶²³

Instead of solving the challenges of destroying machinery inside buildings, a

⁶²³ Ruskin, *The Seven Lamps of Architecture*, 31.

task for which they lacked the expertise, reliable pre-strike intelligence products, and post-strike feedback, they preferred to solve the puzzles of optimizing attacks on structures themselves—a task for which their observations of German bombs helped.

Post-strike images gave them more reliable feedback on structural attacks, so they could prove what they'd learned. In this sense, both their past experiences and desire to demonstrate outcomes led them astray and cuffed their analyses. For example, in their reports, they classified damage as: “STRUCTURAL Damage, including the destruction of trusses, beams, columns and so forth; and SUPERFICIAL damage including the stripping of roof cover and skylights and damage to secondary structural members such as roof purlins [capitalization in original].”⁶²⁴ Anticipated bomb damage to contents—that which really mattered for industrial production—was omitted. In this sense, the mathematicians and scientists chose metrics and analytical methods that served only to exacerbate the tendency already shown by photo-interpreters to overestimate damage to building contents.

Credibility, however obtained, fueled an agenda for incendiary bombs and building destruction. The door was open for their inputs, partly because their operational bosses felt unchained to existing Army technical publications, provided they had the ammunition to deviate. When the Bombs and Fuzes section expressly refuted War Department Training Circular TC-50, the only

⁶²⁴ Alderman, *Report for Colonel Leach on the History and Development of the Bombs and Fuzes Subsection of the Operational Analysis Section*, 10 April 1945, 10.

existing publication governing bomb selection, they met little resistance. “This I think was probably because we had been built up as ‘experts’ by Mr. Harlan, Col Sims, and a few others,” Alderman confessed, “and, possibly, to some extent by ourselves.”⁶²⁵ Along with credibility, came a responsibility to make well-informed recommendations.

Lacking opportunity to objectively test and confirm their positions, they resorted to hunting for proof to garner aircrew support. This occurred when the operations analysts attempted to adapt the British preference for incendiary bombs, which were ideal for RAF area attacks, more prominently into American plans. “A large part of our efforts were [sic] spent in convincing them [the aircrew] of the effectiveness of IBs [incendiary bombs] and in searching for data to prove our beliefs,” revealed one operations analyst.⁶²⁶ American aircrew resisted dropping incendiary bombs because incendiaries were notoriously inaccurate, which did not sit well with the idea of being graded on their raid results. The aircrew also believed they were taking precise aim to destroy factories, not to burn large urban areas. Operations researchers eventually proposed the idea of mixing the two bomb types on each bomber, which added even more bomb-loading time and aiming complexity to a job that was difficult enough already.⁶²⁷ Perhaps most importantly, in the words of an exasperated researcher, the aircrew “could not see that the dropping of incendiaries

⁶²⁵ Ibid., 6.

⁶²⁶ Ibid., 8.

⁶²⁷ Arps, *Report: Operational Analysis Section*, 1 June 1945, 77.

produced any results.”⁶²⁸ Fires that burned long after the bombers evaded away from the flack and fighters near their targets did not leave the crews with the same sense of satisfaction they received when they saw the explosions themselves.

The Bombs and Fuzes subsection’s niche purpose and reliance upon other intelligence organizations drove a unique brand of competitiveness. In order to select weapon types, it depended upon Eighth Air Force’s A-2 division, whom the ORS researchers found to be incompetent. In some cases, “target folder material was pathetically inadequate,” or required corrections, while in other tasks they found the A-2 was unbearably slow:

*We were...constantly being blamed for delays which were not due so much to the time that we required for our selections but more to the time required of the Intelligence Officers in getting out the folders, in organizing their data, and in writing down target names, target code numbers, the coordinates of the aiming points (which we selected in most cases), size of force, and the bombs and fuzes.*⁶²⁹

With the EOU, the Bombs and Fuses subsection had a decidedly better relationship, though members maintained a discerning eye toward their products. “Since we found mistakes from time to time in their structural analyses and measurements,” Alderman noted, “we always made our own independent analyses of the target structural characteristics, dimensions, vulnerabilities, and relied on the EOU studies for their interpretation of the

⁶²⁸ The mathematicians finally overcame objections to mixed-loading incendiaries with high-explosive bombs by producing improved bombing tables for bombardiers and optimizing loading tables for Ordnance and Chemical warfare sections. Ibid., 77-78.

⁶²⁹ Alderman, *Report for Colonel Leach on the History and Development of the Bombs and Fuzes Subsection of the Operational Analysis Section*, 10 April 1945, 14-15, 17.

uses of contents of the target buildings and for their estimates of the priorities of the target buildings.”⁶³⁰ Interestingly, Alderman makes the EOU economists out to be “industrial experts,” which they weren’t, though it amplified the EOU economists’ tendency to portray themselves as experts-on-demand.

The Sheen of Success at Vegesack

When given the opportunity, the ORS researchers leapt at the chance to prove LeMay was right. A few weeks of data at the end of 1942 showed they could back up LeMay’s assertions about formation-bombing accuracy, so if they successfully convinced the entire Command to switch to the bomb-on-leader technique, then they would share in the credit. The opportunity was delayed because Haywood Hansell, then acting commander of VIII Bomber Command, refused to act until General Newton Longfellow’s return. Longfellow finally directed LeMay’s bomb-on-leader technique for every Group in their 18 March mission on the Bremer Vulcan submarine yard at Vegesack, near Bremen. Though it may have been the aircrew whose lives were in jeopardy, the ORS members felt enormous pressure with this mission. They had weighed in on bombing procedure, and their “entire reputation and future were at stake,” according one ORS member.⁶³¹

Preliminary raid results suggested extraordinary accuracy, relatively speaking. The average bomb scores across all groups, 97 aircraft dropping 270

⁶³⁰ Ibid., 14.

⁶³¹ Arps, *Report: Operational Analysis Section*, 1 June 1945, 46.

tons of bombs, was 26.1 percent inside the 1,000' circle, making it the Mighty Eighth's best accuracy performance of the first half of 1943.⁶³² LeMay's 305th dropped an astonishing 76 percent of its bombs within the 1,000' circle.⁶³³ Just two days later, the ORS produced a report recommending: "(1) that all groups be instructed to drop their bombs on the lead ship; (2) that the aiming points for the lead ship be selected with a view to placing the formation pattern most effectively over the target area; and (3) that every effort commensurate with defensive needs be made to reduce the length of the bomb pattern of existing formations."⁶³⁴ They were going to take the credit for tightening up bombing accuracy, and they doubled down on their success by winning a policy change.

Interestingly, an ORS history makes no mention of aircrew use of the B-17's C-1 Automatic Flight-Control Equipment (AFCE) on the Vegesack mission. The C-1 was essentially a mechanical autopilot that coupled the aircraft's flight controls to the bombardier's target-aiming solution on his Norden Bombsight. The idea was to get the aircraft as stable as possible, so that, as one former Eighth Air Force Group Commander wrote, "when the bombardier takes over the ship for the run on the target he is in command," both in terms of his direction to the crew as well as his literal control of the aircraft.⁶³⁵ However, it was a complicated and finicky arrangement of servos, gyros, and extra cables

⁶³² Headquarters Eighth Air Force, *Bombing Accuracy*, in *Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: First Phase*, (Maxwell AFB, AL: AFHRA, July 1943), #168.61-10, IRIS 124347.

⁶³³ Craven and Cate, *Torch to Pointblank*, 343.

⁶³⁴ Arps, *Report: Operational Analysis Section*, 1 June 1945, 46-47.

⁶³⁵ Brig Gen Frank A. Armstrong, "Air Discipline," *Air Force: Official Service Journal of the U.S. Army Air Forces*. 28, no. 11 (1943): 6.

that were clamped onto the normal flight-control linkages; it took 19 manual steps, including a ten-minute warm-up period, just to engage the system.⁶³⁶ That was if the system worked properly. It depended upon a time-consuming preflight, tricky troubleshooting, and sensitive airborne fine-tuning—especially under combat conditions. The system proved unreliable on early combat sorties from England, so crews lost confidence in it while engineers from Honeywell worked out the kinks.⁶³⁷

Eaker was well-aware of the C-1's difficulties and efforts to fix them. The Army's director of Bombardment wrote him to praise its performance at Vegesack:

Because of the bad reputation that the old automatic flight control equipment has developed, it is most necessary at this time that all possible action be taken to indoctrinate personnel, by lectures and demonstrations, in the present effectiveness of this equipment. As you know, recent modifications have materially increased the usefulness of the C-1 pilot. At present, it functions with a satisfactory degree of dependability at all operating altitudes and does not require such a high degree of expert maintenance and air adjustment. Recent experiments conducted in this country indicate that bombing errors can be reduced by as much as 30 percent to 40 percent by the use of this equipment...

*We have known for some time that large bombing errors of units in combat have been caused to a large extent by poor piloting technique.*⁶³⁸ [emphasis in original]

Engineering teams corrected autopilot glitches just prior to the Vegesack

⁶³⁶ Minneapolis-Honeywell Regulator Company, *Here's How: Operation of the C-1 Autopilot*, ed. Aeronautical Division (Minneapolis, MN: Minneapolis-Honeywell, 1944), 4-9.

⁶³⁷ Lt Col James H. Straubel, "Cross Country," *Air force: Official Service Journal of the U.S. Army Air Forces*. 26, no. 10 (1942): 1.

⁶³⁸ Brig Gen Harper Eubank, *Letter, Harper to Eaker*, Manuscript Division, Eaker Papers, Box 16, (Washington, DC: Library of Congress, 31 March 1943).

mission, and the 305th's lead ship employed the C-1, which coupled well with LeMay's guidance not to maneuver on the bomb run.⁶³⁹ In the final analysis, it was not clear how much of the bombing accuracy attained at Vegesack was due to LeMay's techniques, the ORS's recommendations, improvements to the C-1 auto-pilot system, or even the 305th's crews' increasing familiarity with the target area after returning on multiple occasions. Perhaps it was all of the above.

While various teams shared in the Vegesack mission's apparent success, one team's performance decidedly did not. For bomb-damage assessment, Vegesack proved among the more pronounced failures for photo-interpreters. Reports categorized the raid damage as "extremely heavy," emphasizing complete destruction of the power house and several other important structures, in addition to a capsized U-boat several others potentially damaged.⁶⁴⁰ The interpreters assumed that the apparent increase in accuracy, since so many bombs fell inside the target area, correlated to a commensurate increase in effective damage, and there was a lot of damage for them to see, but the challenge for the interpreters was to help convey what the apparent damage meant.⁶⁴¹

Conservative judgment was overruled by optimistic views—they wanted to

⁶³⁹ Craven and Cate, *Torch to Pointblank*, 343.

⁶⁴⁰ AC/AS Intelligence, *The Strategic Aerial Bombardment of Germany - Submarines*, USAAF, 2, (Maxwell AFB, AL: AFHRA, 15 September 1943), #142.042-11, IRIS 115259.

⁶⁴¹ As one measure of bombing effectiveness, the Vegesack raid caused by far the greatest monetary cost to the plant. Post-war records showed the plant claimed RM 4,365,470 vice a cumulative RM 352,575 for all prior raids. See: United States Strategic Bombing Survey, *Bremer Vulcan, Vegesack, Germany*, 17.

see destruction—so they were easily fooled by damaged camouflage. They also assumed that visible damage to buildings would equate to long-term loss of production. As a result, CIU's inputs to Eighth Air Force's mission reports were exaggerated and German recuperative capacity was equally underestimated. Neither the interpreters nor Eaker yet knew that the Arnold's A-2 would report that the total impact for all raids on Vegesack would be to delay the U-boats completed by July 1 by "an estimated average of 2 weeks."⁶⁴²

Because other sources of intelligence were either highly compartmentalized or not yet adequately incorporated, the CIU interpreters failed to receive adequate and timely feedback. ULTRA decrypts of German communications traffic, for example, had been funneled to a single individual at Medmenham, and kept from the eyes of photo-interpreters: "In some cases, intelligence was withheld from the interpretation unit, on the grounds that it was too dangerous to share certain information," reflected one photo-interpreter, "thus depriving the interpreters of material vital to the success of their work."⁶⁴³ There was no meaningful way to confirm the accuracy of the CIU's assessments by Eaker's leadership team, Harlan's ORS, or Hughes' target planners with the EOU; the

⁶⁴² AC/AS Intelligence, *The Strategic Aerial Bombardment of Germany - Submarines*, 15 September 1943. Although the information was certainly not available at the time, a post-war review of Vegesack shipyard records by the USSBS team revealed evidence in striking contrast to the photo-interpreters' raid estimates: "The damage suffered by boats on ways was slight, because most of the bombs that hit the ways either broke open with resulting low order detonations or penetrated below the concrete and were dissipated underground. The damage apparent to the camouflage over the submarines caused the damage to them to be overestimated from air cover. Actually only a few fragment holes resulted... Records show that productive activity was resumed at the yard after one week, and that in six weeks, normal activity was being carried on." See: United States Strategic Bombing Survey, *Bremer Vulcan, Vegesack, Germany*, 111-112.

⁶⁴³ Powys-Lybbe, *Eye of Intelligence*, 35.

latter were in position to trust what they received. In the meantime, the most important intelligence customer in Washington seemed to be “Hap” Arnold, who needed to see little more than the “pictures of your strike at Vegesack” for him to conclude, “the results of that magnificent show are certainly encouraging to those of us who are convinced of the soundness of high altitude daylight precision bombing. Keep it up and we will yet convince the skeptics.”⁶⁴⁴ It seemed everyone was selling their own take on the ideas represented in the photos, including Arnold.

Eaker Saves Casablanca

While Eighth Air Force continued to batter unsuccessfully at U-boat targets, Arnold’s Committee of Operations Analysts forged ahead, adding more subcommittees and increasing its research scope as it ran out of time to prepare Arnold for the Casablanca Conference. Although a dozen or more subcommittee reports were in progress, Arnold would have only two for his trip: a two-page interim update offering little but a few preliminary observations, and a tentative memorandum that, unsurprisingly, suggested, “the Axis oil position, especially as regards its aviation gasoline, is closely balanced and may become critical.”⁶⁴⁵ Of course, Arnold had known this when

⁶⁴⁴ H. H. Arnold, *Letter, Arnold to Eaker*, War Department, (Held by AFHSO: NA, 19 April 1943), AAG 312.1-F, Operations Letters, RG 18.

⁶⁴⁵ Committee of Operations Analysts, *Analysis of Bombardment Objectives in Western Europe*, War Department, Tab 6, (Maxwell AFB, AL: AFHRA, 8 March 1943), #118.02v2, IRIS 110403. Also: Committee of Operations Analysts, *Western Axis Oil Industry as Bombardment Target*, War Department, Tab 7, (Maxwell AFB, AL: AFHRA, 8 March 1943), #118.02v2, IRIS 110403.

he ordered the HALPRO raid on Ploesti six months earlier.

What mattered most to America's airmen leading into the first phase of the Combined Bomber Offensive weren't the details discussed at the Casablanca Conference or of the directive released thereafter, but rather the ambiguity and lack of coordination in both. As to grand strategy, in January of 1943, little was yet resolved since Arcadia. The series of battles in the Atlantic and in Africa were not yet culminated, Italy was still hanging on, and Russian resilience was far from certain.⁶⁴⁶ The Airmen wanted the flexibility to pursue their bombing doctrine as they continued to build up force.

Discussions at Casablanca neither reopened the Germany-First debate nor altered the Allied subtext for an eventual cross-Channel invasion, though no date was set. The question at hand was what to do with strategic bombers and who would control them.⁶⁴⁷ Roosevelt did his part by deflecting pressure from Churchill to consolidate the AAF's bombers under RAF control, but he offered little resistance to giving up on daylight bombing.⁶⁴⁸ He left the counter-arguments to the Airmen.

As a subordinate general to Arnold, Eaker would not have been present, except that Arnold had sent for him after it became apparent that American air strategy was at risk and the entire American entourage—Arnold included—had been handily out-classed in preparation.⁶⁴⁹ "They swarmed upon us like

⁶⁴⁶ R. J. Overy, *The Air War, 1939-1945*, Cornerstones of Military History (1980; repr., Washington, DC: Potomac Books, Inc., 2005), 73.

⁶⁴⁷ Craven and Cate, *Torch to Pointblank*, 300.

⁶⁴⁸ Herman S. Wolk, "Decision at Casablanca," *Air Force Magazine* 86, no. 1 (2003): 81.

⁶⁴⁹ Hansell, *The Strategic Air War Against Germany and Japan: A Memoir*, 69.

locusts with a plentiful supply of planners and various other assistants with prepared plans to ensure that they not only accomplished their purpose but did so in stride,” groaned General Albert Wedemeyer, in attendance from Marshall’s Operations Planning Division. He added, “from a worm’s eye viewpoint it was apparent that we were confronted by generations and generations of experience in committee work and in rationalizing points of view.”⁶⁵⁰

If anyone could gin up facts in short order to support arguments for daylight strategic bombing, Eaker could. Given the opportunity for a private meeting with Churchill, Eaker regaled the Prime Minister with four concise arguments: 1) a switch to night bombing could increase losses because American crews weren’t equipped or trained for it; 2) day bombing could destroy targets unserviceable by night area bombing; 3) 24-hour pressure of day-and-night bombing would guide the RAF “by fires set by day,” and ensure “the devils will get no rest”; and 4) day bombing would force the Luftwaffe to fight.⁶⁵¹ Eaker’s argument prevailed and the AAF would stick to its doctrine, its training, its equipment as designed, and its own chain of command. Target priorities, however, were yet another issue.

The Casablanca Directive. It was conveniently vague. Rather than resolving most points of conflict between the Allies, the directive simply lumped

⁶⁵⁰ Personal letter, Wedemeyer to Handy, 22 January 1943; quoted in: Maurice Matloff, *Strategic Planning for Coalition Warfare, 1943-1944* (Washington, DC: Office of the Chief of Military History, Dept. of the Army, 1959), 107.

⁶⁵¹ Wolk, "Decision at Casablanca," 81. Craven and Cate, *Torch to Pointblank*, 2: 302.

the various perspectives together. With a tip to the targeting proclivities of both countries' air forces, the Combined Chiefs defined their objective for Allied bombing in theater as "the progressive destruction and dislocation of the German military, industrial and economic system, and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened."⁶⁵² The Americans could hone their focus on the German economy, while the British would emphasize morale. The distinction wasn't clear-cut but the two approaches could be complementary and served by the same order.

Target priorities were the sticking point. Airpower was free—at least until a date could be determined—from pressure for direct support to a ground invasion. However, the British Admiralty maintained extraordinary pressure on both air forces to step up their efforts in the anti-submarine campaign. The Eighth Air Force had already launched twelve raids on U-boats bases on the Bay of Biscay between October and the January conference, in addition to five more by the RAF against Lorient in the northwest of France.⁶⁵³

However, if perceptions of their success could keep them tied to the submarine targets, then the early attacks backfired. The AAF's own A-2 maintained a positive outlook on most types of attack, while the British Admiralty spun the bomb-damage estimates with as much positive impact as it

⁶⁵² Ira Eaker, *The Bomber Offensive From the United Kingdom (undated draft)*, Combined Chiefs of Staff, (Maxwell AFB, AL: AFHRA, ca. April 1943), #168.61-10, IRIS 124347.

⁶⁵³ Assistant Chief of Air Staff (A-2), *Air Estimate, The Submarine Situation in Europe, Part I*, USAAF, (Maxwell AFB, AL: AFHRA, 12 February 1943), #142.042-5, IRIS 115248, 9.

could. As to the former, for example, an A-2 report suggested that attacks on the pens themselves did not seem profitable, but “there are certain European targets which if heavily and consistently bombed would so seriously interrupt and demoralize the U-boat organization that the number of submarines operating in the North and South Atlantic would be considerably reduced”; this included continued attacks on the Bay of Biscay bases.⁶⁵⁴

The Admiralty supported the A-2 position with a tenuous evaluation that begged for increased bombing intensity. Royal Navy Captain E.C.B. Mobray argued that changes in port activities, dry dock operations, and movement of subs between the Biscay bases showed signs of cumulative effects.⁶⁵⁵ He was backed by a 20 November 1942 Admiralty intelligence report: “The U-boat bases are showing signs of disorganization which must be attributed to these raids,” the report claimed. “If the series of attacks on these U-boats is sustained...the cumulative effort will considerably effect the whole U-boat campaign.”⁶⁵⁶

Pressure didn’t come from only the Admiralty. Based on his frustrations the previous summer, Eisenhower was also sensitive to losses at sea. “Each week brought us records of additional ships sunk or damaged by enemy U-boats, ships that were included in our programs for the transport of troops, equipment, and supplies,” he lamented, adding “each sinking causes revisions

⁶⁵⁴ Ibid., 2.

⁶⁵⁵ Ibid., 9.

⁶⁵⁶ Ibid., 8.

in operational and tactical plans.”⁶⁵⁷ Even VIII Bomber Command’s analysts appeared swept up by the sentiment of the cooperative Allied and joint effort. Quoted in the A-2 report, the analysts argued “British and American naval and air opinions are in agreement that these operations, although they have been few and light, have done material damage to the submarine war effort in this theater, have enhanced Allied morale, and done corresponding damage to the Axis morale.”⁶⁵⁸ If any real evidence of progress existed beyond the anecdotal boost in morale, no one seemed to be looking for it or considering it necessary.

Transportation and oil fell even lower in the initial target list. The directive did offer some latitude to deviate from the proposed priorities, but only temporarily. “The above priority may be varied from time to time according to the developments in the strategical [sic] situation,” read the directive.⁶⁵⁹ Arnold encouraged Eaker to press toward the targets of his choice, whenever the directive’s nominal target choices were “interfered with by weather.”⁶⁶⁰ Weather was a problem for visual bombing on more days than not during the winter. During this early part of the campaign, however, attempts to strike deeper into Germany meant tangling in the air with the Luftwaffe’s day-fighter force. Eaker found the fight he was looking for, but Haywood Hansell, as one of Eaker’s wing commanders, would argue just a couple weeks later that “the single most

⁶⁵⁷ Eisenhower, *Crusade in Europe*, 85.

⁶⁵⁸ Assistant Chief of Air Staff (A-2), *Air Estimate, The Submarine Situation in Europe, Part I*, 12 February 1943, 10.

⁶⁵⁹ Eaker, *The Bomber Offensive From the United Kingdom (undated draft)*, ca. April 1943.

⁶⁶⁰ H. H. Arnold, *Personal letter, Lt Gen H.H. Arnold to Maj Gen I.C. Eaker*, Headquarters Allied Air Force, (Maxwell AFB, AL: AFHRA, 24 January 1943), #168.61-10, IRIS 124347.

important single factor facing us today is that of combat crew replacements,” adding, “the loss rate from fighters has been pretty severe... They literally fly right through our formations.”⁶⁶¹ The Eighth Air Force command echelon already seemed more concerned with losses than with their bombing effectiveness.

Travelling salesmen with excess baggage. While the Allied leaders sparred at Casablanca, a few COA analysts ventured to England on their own. They’d recognized that their assumptions regarding operational bombing capabilities, especially as pertained to Sorensen’s committee, might create friction with Eighth Air Force. This type of friction that arises from competition between similarly charged organizations might lead Eighth Air Force to retaliate and undermine the COA’s credibility, or even to threaten its survival by rejecting its inputs outright. From the committee’s perspective, it would be best to resolve potential disputes before publishing the final reports, and it would best to do it in person.

Despite Sorensen’s leadership role on the committee, as well as his close relationship with Brig Gen Kuter, a fellow ACTS instructor then commanding Eaker’s First Bombardment Wing (immediately prior to Hansell), he did not participate in the trip. Sorensen was aware his personality seemed to cause more harm than good. “I would, of course, be glad to come over,” Sorensen wrote to Kuter, “but since I am obviously not in good standing here and probably not with General Spaatz [who had turned Eighth Air Force Command

⁶⁶¹ Hansell, *Letter, Hansell to Fairchild*, 11 February 1943, 1.

over to Eaker in the ensuing weeks], I doubt the advisability of it.”⁶⁶² Fairchild also refused the trip, which left the COA’s temporary Colonels Perera and Leach along with two civilians to fend for themselves without a regular-officer insider to help them establish trust.

In London, the COA travelling team discovered another intelligence organization, the EOU, was already actively picking targets for Eighth Air Force. The official COA history notes that Eaker’s senior staff “believed it advisable for target information matters to be handled in England rather than by A-2 in Washington.”⁶⁶³ This was probably an understatement. The COA analysts treaded lightly, seeking common ground and rationale for co-existence. After a two-and-a-half-hour meeting with Hughes and EOU members, they discovered their approaches were nearly identical except that Eighth Air Force had emphasized that “integration of RAF and USAAF activities must be a constant major consideration” as pertained to intelligence, target selection, and synchronization of the missions themselves; they then agreed on a common framework for industrial analysis:

- 1) *The indispensability of the product to the enemy war economy;*
- 2) *The enemy position as to current production, capacity for production and stocks on hand;*
- 3) *The enemy requirements for the product for various degrees of activity;*
- 4) *The possibility of substitution for the product;*
- 5) *The number, distribution and vulnerability of vital installations;*
- 6) *The practicability of destruction of such installations with*

⁶⁶² Sorensen, *Letter, Sorensen to Kuter*, 3 January 1943.

⁶⁶³ Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 32.

- forces expectable;*
7) *The recuperative possibilities of the industry;*
8) *The lag time between the destruction of installations and the desired effect upon the enemy effort.*⁶⁶⁴

Of course, this list created more questions than could be answered in detail about every industry.

COA members would have an uphill battle to prove their worth to General Eaker (by then back in London from Casablanca) and Lt Col Hughes, though they disarmed immediate apprehensions by openly sharing and explaining their preliminary recommendations, working with the EOU rather than bypassing it (especially as pertained to engaging with the British MEW), and calming Eaker's concerns by committing their intended process to paper before they departed back to Washington.⁶⁶⁵ They'd seemed surprised by Eaker's cordial demeanor despite a tipoff to expect a "decidedly cool" reception.⁶⁶⁶ Leach knew of Eaker, and had anticipated resistance, particularly if Eaker had sniffed that their plan hadn't been clearly thought out. "He is not an 'oh, hell, I can do whatever it is' officer," Leach said of Eaker during a COA meeting before the team's departure, "he is a thoughtful, analytical mind."⁶⁶⁷ Of course, Eaker would not have overtly treated this team sent by his superior disrespectfully, as he was duly reverent with correspondence or actions he thought might get back to Washington.

⁶⁶⁴ Col Guido R. Perera, *Memorandum for Maj Gen Eaker*, War Department, (Maxwell AFB, AL: AFHRA, 30 January 1943), #118.1511, IRIS 110569.

⁶⁶⁵ Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 33-37.

⁶⁶⁶ *Ibid.*, 33.

⁶⁶⁷ *Meeting Minutes*, 18 December 1942, 2.

Besides, Eaker was choosing his battles carefully with Arnold and already laying on a guilt trip for stealing his P-38s to Africa. "That decision..." Eaker wrote to Arnold that same week, "is going to mean the loss of many bombers and their fine crews."⁶⁶⁸ Eaker, along with Newton Longfellow (then-Commanding General, VIII Bomber Command), clarified his take on the Eighth's operational assumptions to the COA team. These included a near-term range limitation of 400 miles (which he attributed to current B-17 range with a "full load"), requirement for a month of training for new crews, expectations for 70 percent of theater aircraft operational (this proved too high), and the necessity to "saturate the defense by dispatching forces of not less than 300 aircraft."⁶⁶⁹ This was useful data for the COA team members to bring back to Washington, though it was clear they would not be able to keep in tune with such dynamic operational considerations from thousands of miles away. Despite the overall positive tone of the visit, Eaker followed up with several concerns he addressed directly to Perera:

...that the analysis of prospective targets be done by agencies best equipped to do it and closest to the sources of information; that we do not set up another agency to do work already being done by existing agencies; that we do not harass over-worked British organizations with additional requests for information, duplicating work already being done, or calling in slightly

⁶⁶⁸ Maj Gen Ira C. Eaker, *Letter, Eaker to Arnold*, Manuscript Division, Eaker Papers, Box 16, (Washington, DC: Library of Congress, 30 January 1943).

⁶⁶⁹ As previously mentioned, Eaker clearly understood fighter-escort ranges, but his these did not appear to be important factors to his plans since his assumption was that large bomber formations did not depend primarily upon escort. See: Perera, *Memoirs: Washington and War Years*, 1973, 108-109; Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 38. Also, Col Guido R. Perera, *Memorandum of Conference with Major General I. C. Eaker*, in *Meeting at Widewings (COA History Tab 18)*, Committee of Operations Analysts, (Maxwell AFB, AL: AFHRA, 4 February 1943), #118.02v2, IRIS 110403, 2.

*different form, for Intelligence work already being prepared.*⁶⁷⁰

In short, Eaker told them to do whatever Arnold had asked them to do, as long as they stayed out of his hair and didn't muddle up any of his existing intelligence routines or relationships.

A number of meetings with other intelligence organizations in London helped the COA members socialize their preliminary findings and feel out their own relationships with the established players. For example, Mr. Lawrence, Director of Ministry of Economic Warfare's Objective Department, leapt at the COA members' recommendation to target ball bearings, and he also seemed supportive of attacking grinding wheels. Ball bearings would "form extremely vulnerable targets to incendiary attack," he thought, adding that "effective attack on all ball bearing plants would be felt almost immediately."⁶⁷¹ The MEW had less information on grinding wheels, as Lawrence admitted, they'd only conducted preliminary studies on the abrasives industry (if at all).⁶⁷² This type of target "lay lower in the industrial process," Lawrence felt, but "its

⁶⁷⁰ Maj Gen Ira C. Eaker, *Letter, Eaker to Perera; Subject: Response to Memorandum of 30 January 1943*, War Department, (Maxwell AFB, AL: AFHRA, 3 February 1943), #118.1511, IRIS 110569.

⁶⁷¹ The Objectives Department, according to Uta Hohn, "had the function of providing advice on bombing targets for the strategic offensive against the enemy and occupied territories." See: Hohn, "The Bomber's Baedeker - Target Book for Strategic Bombing in the Economic Warfare against German Towns 1943-45," 214. Col Guido R. Perera, Lt Col W. B. Leach, and Fowler Hamilton, *Memorandum of Conference with Mr. O. L. Lawrence, Chief of Objectives Department, Ministry of Economic Warfare*, in *COA History (Tab 14)*, Committee of Operations Analysts, (Maxwell AFB, AL: AFHRA, 2 February 1943), #118.02v2, IRIS 110403, 2.

⁶⁷² Interestingly, Levine's research suggests, "During 1941 the Ministry of Economic Warfare had realized that the enemy was dependent on ball bearings, production of which was overwhelming concentrated at Schweinfurt," but it would seem MEW dropped the idea of striking at Schweinfurt until after COA's experience with Mr. Lawrence. See: Levine, *The Strategic Bombing of Germany, 1940-1945*, 38.

effectiveness would be felt within a reasonably short period,” although investigations had yet to show favorable evidence as to “concentration of the industry or as to its recuperative powers.”⁶⁷³ Grinding wheels had to be heated in the production process, Lawrence “was suspicious, however, of any statement that kilns were difficult to replace.”⁶⁷⁴ All of these factors mattered to industrial-target selection, and much of a target’s value toward dislocating the enemy economy depended upon how the enemy might respond—the most difficult factor to determine.

In the MEW, the COA members had clearly found another intelligence organization set on pursuing quick victory through air power. However, MEW’s economists placed a higher premium on targets that were highly vulnerable and hard to repair. Unfortunately, these variables were often difficult to prove with available intelligence. As such, they formed the central arguments on many future debates. In some cases, opinions would dominate the facts.

Operations Analysts Feed the Eaker Plan

By the third week of March, the COA’s core members completed and cosigned their final report on the Western Axis, then submitted it to General Fairchild. In his final review, Fairchild insisted on deleting the single paragraph that had actually estimated German industrial dislocation for Arnold. A force of 500 heavy bombers, they projected,

⁶⁷³ Perera, Leach, and Hamilton, *Memorandum of Conference with Mr. O. L. Lawrence, Chief of Objectives Department, Ministry of Economic Warfare*, 2 February 1943, 3.

⁶⁷⁴ Ibid.

*free for the bombing of industrial targets for a period of eight months, the effect would be to impair very gravely the capacity of the Western Axis to resist; and if a force of 1,000 such planes could be maintained, equally free for a similar period, the result might be to cripple the Western Axis war effort.*⁶⁷⁵

With this statement, the COA members' months of research culminated in an assertion that the AAF could not risk committing to paper. Perhaps there was no need to suggest that strategic bombing could enable a cake walk of an invasion by January of 1944 because the Army would not be ready by that time anyway. Why risk an unnecessary claim? Moreover, even if the AAF's leaders hoped to end the war before a ground invasion was possible, to propose such a feat would undermine the Combined Chief's plans and their build-up program, thereby drawing criticism the research could not support. Perhaps Fairchild sensed there was no chance of consistently generating raids with 1,000 bombers in 1943 or he doubted the accuracy assumptions. If the timeline assertion did not pan out with the committee's credibility on the line, then the rest of their report would lose its clout. In any case, the AAF's generals wanted victory through airpower as soon as they could get it, but they knew they were best off not yet committing to a date.

In addition to its list of targets and rationale, the remainder of the report offered insight into the team members' desire to establish their own enduring purpose. First, they attempted to cement their credibility with Arnold by emphasizing collaboration with diverse entities in Washington: "The Committee

⁶⁷⁵ Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 43.

has had the assistance and hearty cooperation of A-2, G-2, the Board of Economic Warfare, the Office of Strategic Services, the War Production Board, other government agencies, and the best qualified experts in private industry,” they touted.⁶⁷⁶ In reality, this list was a reflection of the COA’s own composition from the start, though the individual members had reached back to their parent organizations. The report also highlighted collaboration with the influential actors they’d met in England, including “Eighth Air Force staff, the Royal Air Force, the Air Ministry, the Economic Warfare Division of the American Embassy and the British Ministry of Economic Warfare,” although many of their meetings were more diplomatic than substantial.⁶⁷⁷ Perhaps even more important to the COA members than learning which intelligence organizations in England had which preferences, it could now show it had quickly established peer relationships with the many intelligence organizations sharing a stake in air-campaign targeting. The COA proved its opinions mattered and succeeded, at least outwardly, in establishing partners rather than foes.

Second, the COA showed regard for Eaker’s Eighth Air Force. On paper, Eighth Air Force was the subordinate air command to European Theater of Operations, United States Army (ETOUSA—at that time led by Lieutenant General Frank Andrews), not AAF headquarters, although Arnold’s extraordinary influence was no secret. COA analysts had been reticent to

⁶⁷⁶ Committee of Operations Analysts, *Report of Committee of Operations Analysts with Respect to Economic Targets Within the Western Axis*, 1.

⁶⁷⁷ Ibid.

declare target priorities on their final report, ostensibly for security reasons, although they later awkwardly recommended, “that the current selection of particular targets be left to the responsible authorities in England, subject only to such directions as may be called for by broad strategic considerations.”⁶⁷⁸ They’d left their target selections in priority order but removed the labels, making their final recommendations less contentious. The COA treaded delicately in the space between the limits—both official and unofficial—of General Arnold’s authority and the wishes of the Command actually responsible for carrying out its recommendations. While Arnold devoured the report’s appetizing front matter, competing intelligence organizations criticized its shortcomings.

A competition of criticism. A look at the internal responses by these other organizations, particularly the British MEW and the American EOU, reflects their respective organizations’ behavior and helps to dissect the reasons behind the targeting preferences of all three groups before assessing their impact on the air campaign. The MEW Deputy Director General, Mr. Geoffrey Vickers—a former British infantry Colonel and “an almost dangerously brilliant lawyer”—penned a critique of the COA analysts’ reports to Air Chief Marshall Sir Charles Portal.⁶⁷⁹ Vickers vehemently defended the MEW’s army of intelligence bureaucrats, who collectively sought a reputation for amassing all

⁶⁷⁸ Ibid., 2.

⁶⁷⁹ Margaret Blunden, “Geoffrey Vickers - An Intellectual Journey,” in *The Vickers Papers*, ed. Open Systems Group (London: Harper & Row, 1984), 27; Cited in: Davies, “Geoffrey Vickers and Lessons from the Ministry of Economic Warfare for Cold War Defence Intelligence,” 810.

relevant details for Germany's economic collapse. To MEW economists, the idea that a handful of American Johnny-come-lately analysts would outdo them from Washington, was unthinkable.

Further, Vickers' defensive posture also reflected his own insecurities about leading an enormous intelligence organization with no previous experience of his own.⁶⁸⁰ He had to save face that the plan for the Combined Bomber Offensive would be based largely on COA rather than MEW inputs, or he'd risk being discredited from within his own organization. Despite these factors, British senior military and civilian leadership enticed all forms of American support, so any excessively disparaging comments might have met with a fierce rebuke from above. In fact, according to the COA history, Air Chief Marshal Portal later submitted only glowing praise to Arnold on behalf of the British Air Ministry despite the content of Vickers' report.⁶⁸¹

In his collegial-yet-supercilious review, Vickers took the opportunity to reinforce the MEW's preferred reputation for deeper-level analysis by gently besmirching the COA's analytical depth and factual credibility. He argued that much of the COA's work constituted a "somewhat superficial examination of

⁶⁸⁰ Peter Davies argues, "as a serviceman with no background in intelligence or Whitehall, a self-employed lawyer lacking professional qualifications in economics, and without management experience of an organization of several hundred staff, he was hardly the go-to candidate to fill such a senior civilian post." See: Davies, "Geoffrey Vickers and Lessons from the Ministry of Economic Warfare for Cold War Defence Intelligence," 811.

⁶⁸¹ Portal did praise COA's "very valuable report," which he noted was produced in collaboration with MEW, but the rest of his favorable comments were actually intended as compliments for Eaker's plan not the COA's report. See: Air Chief Marshal Sir Charles Portal, *Enclosure 'A', Plan for the Combined Bomber Offensive from the United Kingdom*, Whitehall Air Ministry, (Maxwell AFB, AL: AFHRA, 15 April 1943), #118.04W, IRIS 110530. Also: Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 45-45a.

the enemy's position," and problems related to "a certain divergence of opinion between us on questions of fact."⁶⁸² Vickers cast doubt on COA sources. Nevertheless, Vickers voiced no substantial concerns over the COA's highest five priority targets—Aircraft, ball bearings, petroleum, non-ferrous metals, and synthetic rubber—while he rejected outright the COA analysts' final two recommended categories, transportation and submarine yards, as "subject to a very substantial time-lag."⁶⁸³ Although the MEW economists maintained a greater focus on inducing economic collapse (as opposed to imposing military materiel shortages) than any other intelligence organization, they also sought to attack industrial bottlenecks.

With the exception of ball bearings, however, the MEW pushed for different bottlenecks in a variety of industries, as if preferring to place independent bets. For example, MEW economists proclaimed a "less optimistic" stance on grinding wheels; pushed to target "internal combustion engine components and accessories" rather than assembly plants for motor transport and aircraft; and argued that aircraft production might be impacted best by attacking propeller factories.⁶⁸⁴ The MEW followed up Vickers' assertions with detailed commentary in a separate report of its own. After all, the MEW's organizational prestige depended not particularly on nominating targets, but in producing

⁶⁸² C. G. Vickers, *Memorandum, (untitled) MEW views on the document entitled 'Report of the Committee of Operations Analysis: March 8th 1943'*, in *Personal Collection of Gen Henry H. Arnold part 3 of 6*, Ministry of Economic Warfare, (Maxwell AFB, AL: AFHRA, 3 April 1943), MICFILM 28253, IRIS 2053776, 1.

⁶⁸³ *Ibid.*, 2.

⁶⁸⁴ *Ibid.*

superior economic reports.

It is worth noting that MEW economists were enthusiastic about targeting petroleum and sought to increase the number of synthetic oil plants on the COA's target list; there was "no question that the destruction of either the 13 Bergius plants or the leading Romanian refineries at any time in the next twelve months would have a critical, and perhaps decisive, effect on the enemy's war effort," Vickers claimed.⁶⁸⁵ By comparison, the COA's draft oil-targeting conclusions had been considerably muted, noting only that "loss of production would make almost inescapable some curtailment in direct military consumption of oil."⁶⁸⁶ Oil was a worthy target to the COA members, as its depletion would help dry up the roaring engines of both the Luftwaffe and the Wehrmacht, but results would take some time. In their final report, the COA members noted it might take only four months for Germany to feel "full impact of their destruction," despite the fact that they were heavily constructed.⁶⁸⁷ The COA members also gravitated to the idea that so much Axis oil seemed to originate in so few locations, giving to it the quality of a bottleneck, albeit not as attractive as ball bearings.

The EOU bites back. Economist Charles Kindleberger took a different tack

⁶⁸⁵ Ministry of Economic Warfare, *Memorandum, Detailed Commentary on 'Report of the Committee of Operations Analysis: March 8th 1943'*, in *Personal Collection of Gen Henry H. Arnold part 3 of 6*, (Maxwell AFB, AL: AFHRA, 4 April 1943), MICFILM 28253, IRIS 2053776.

⁶⁸⁶ Dr. Edward S. Mason, *Memorandum, Proposed Selection on European Industrial Targets*, Committee of Operations Analysts, (Maxwell AFB, AL: AFHRA, 19 January 1943), #118.04W, IRIS 110530.

⁶⁸⁷ Committee of Operations Analysts, *Report of Committee of Operations Analysts with Respect to Economic Targets Within the Western Axis*, 8 March 1943, leaflet 3.

as he drafted the EOU response to COA for Colonel Hughes. Kindleberger's approach, adopting the pugnacious character typical of the EOU economists, attacked the style and consistency of the COA analysts' reports in addition to their substance: "The reports have been written by a variety of people of differing talents," he argued, "and from various points of view."⁶⁸⁸ Despite the detailed background provided in some COA industrial studies, Kindleberger ridiculed them as "focused mainly on the industry in the abstract without relating potential destruction to military operations."⁶⁸⁹ Toward the few reports he commended, Kindleberger genuflected with veiled self-praise, noting they were "written from a viewpoint practically identical with that developed here...with persistent attention to 'depth', and to the actual possibilities of affecting the enemy military capabilities within a reasonable period of time."⁶⁹⁰ Kindleberger did not share Vickers' penchant for dampening the extremes of his assessment, which also broadly reflected the EOU's attitude toward its competitors as the air campaign later reached crescendo.

Matters of tact aside, Kindleberger fingered his opponent's fatal flaw. The COA's experts-for-hire consistently struggled to connect their knowledge to bombing outcomes. The committee's ad hoc meeting format had put each industrial expert into a position to convince the uninitiated of the merits of his particular industry as a potential target. In that environment, persuasiveness

⁶⁸⁸ Kindleberger, *Memorandum for Colonel R.D. Hughes, Subcommittee Reports to the Committee of Operational Analysts*, 7 April 1943, 1.

⁶⁸⁹ Ibid.

⁶⁹⁰ Ibid.

could be more important than data since the other members lacked the expertise to critically evaluate the supporting evidence.

Further, this approach meant a target system could be rejected if its advocate failed to represent it well or had latched onto either a flawed assumption or erroneous conclusion. However, an industry with the appearance of a more complete puzzle and a stronger advocate would come out on top whether or not it was truly vulnerable to airpower. Kindleberger added, “the reports prepared by industrial experts tend to suffer from a lack of perspective and objectivity – each industrial expert naturally thinks of his own field as a prime objective. On the other hand, the papers prepared by economists are apt to have less detailed technical information.”⁶⁹¹ Some COA experts may not have had enough research experience or sufficient time to ensure consistency across all of their subcommittee reports, but the result was to give the impression that they’d stacked the deck to favor the industries they’d identified from the very start.

In sum, the COA members had framed their initial understanding of the problem months earlier—to create a “pattern of destruction” to the German war machine based on “analysis of industrial, utility, and military bottlenecks.”⁶⁹² They never deviated from this approach and they focused on trying to achieve victory through airpower as quickly as possible. For this reason, the COA analysts tended to place heavy bets on obscure shortcuts such as ball-

⁶⁹¹ Ibid., 2.

⁶⁹² Committee of Operations Analysts, *Outline of Proposed Study*, War Department, (Maxwell AFB, AL: AFHRA, Ca. 4 December 1942), #118.201-2, IRIS 110584, 1.

bearings, grinding wheels, non-ferrous metals, and optical glass rather than the “progressive deterioration” of systemic industries such as coal, electricity, and rail traffic.⁶⁹³ None of these three systems made the COA’s top eight despite the fact that rail and electricity had been the highest priorities in AWPD-1 after only the German Air Force.⁶⁹⁴ If systemic effects against these larger target types could not be assured by a small force of bombers, the COA analysts dropped them in priority or discarded them altogether.⁶⁹⁵ For example, their transportation report maintained that “limited and scattered attacks upon transport targets are of little consequence because the recuperative powers and flexibility of the transport system permits rapid and successful readjustments in transport operations.”⁶⁹⁶ The COA provided Arnold what they thought he wanted, a list of short-cut targets destructible as quickly as possible by the

⁶⁹³ Arnold, *Memorandum, Research and Analysis to Fix Earliest Practicable Date for Invasion of Western Europe*, 22 Dec 1942. Also of note, optical precision instruments and optical glass were equivocal as bottlenecks. 70% of optical glass for military purposes was produced in the town of Jena, and 80% of optical precision instruments were produced in only two plants. Although the analysts noted in their final report “the effects of the destruction of these two targets will not become apparent in the Axis war effort for a considerable time, probably years,” both were nevertheless included in the recommended list. See: Committee of Operations Analysts, *Report of Committee of Operations Analysts with Respect to Economic Targets Within the Western Axis*, 8 March 1943, Tab 15.

⁶⁹⁴ Hansell, *The Air Plan that Defeated Hitler*, 163.

⁶⁹⁵ The Air Force’s historians later make the case using the USSBS report on German Transportation that the transportation campaign was unnecessarily delayed. The point here is that COA had not oriented to supporting transportation targets other than locomotives from the beginning. See: Wesley Frank Craven and James Lea Cate, eds., *The Army Air Forces in World War II*, vol. 3, *Europe: Argument to V-E Day, January 1944 to May 1945* (Washington, DC: Office of Air Force History, 1983), 798; While COA makes the case in preliminary reports that transportation attacks would not be decisive, any such attacks would have to be “concentrated against railroad motive power,” which is how they justify giving it sixth priority. See: Ralph J. Watkins, *Feasibility of Air Attack on European Axis Transport*, in *COA History (Tab 14)*, Committee of Operations Analysts, (Maxwell AFB, AL: AFHRA, 21 January 1943), #118.04-4 V.1, IRIS 110407, 2.

⁶⁹⁶ Watkins, *Feasibility of Air Attack on European Axis Transport*, 21 January 1943, 1.

least force of bombers. Ball bearings served as an incomparable choice, topped on their list by German fighters only to enable air superiority. With their top choices made, the COA offered plenty of pessimistic speculation to rule out larger target systems.

Similar rationale clouded their judgment on coal and the coking industry as well, both in terms of attacking the sources and the transportation thereof. The COA analysts felt that German civilian coal requirements could be reduced to a miniscule fraction of their pre-war usage, leaving the industry with excess capacity, especially if Germany curtailed its exports.⁶⁹⁷ Coal was a target area that COA-subcommittee experts struggled to sync with realistic bombing capability and industrial vulnerability. As one COA expert reported in a pivotal committee meeting, “If we could deprive them of [coal], we could accomplish a great deal, but no one knew how we could do that, except indirectly.”⁶⁹⁸ They also balked at coal for a perceived lack of enough bombers: “Coke and coal tar products are very attractive in that they bring a single aspect on many industries,” an industrial expert reported, adding, “but you have hundreds of installations. About 25, however, do supply about half of the output, but to get further proportions, you have to get a very large number of coke ovens. They don’t give too much hope.”⁶⁹⁹ Experts without hope do not make very good advocates.

⁶⁹⁷ Ibid., 20.

⁶⁹⁸ *Meeting Minutes*, 15 December 1942.

⁶⁹⁹ *Meeting Minutes*, in *Oil and Chemicals*, War Department, (Maxwell AFB, AL: AFHRA, 23 December 1942), #118.151-1, IRIS 110545.

Before Arnold could even pitch the COA report to the Joint Chiefs, Colonel Cabell—newly-promoted and re-assigned to Arnold’s advisory council—energized the COA members to plan a motion-picture film to accompany their report.⁷⁰⁰ The analysts jumped into the propaganda project and produced a full script in just a couple of days. The film would sell the top three COA-recommended targets with their indisputable footage and facts. To a scene of bombers, bombs, and a burning aircraft factory, the narrator would pitch that the venerable Focke-Wulf 190 and Messerschmidt 109:

*...form two-thirds of German fighter strength. Cut down their numbers and Allied effectiveness in the air would sharply increase with fewer losses of planes and personnel, fewer planes grounded for repairs, [and] greater bomb loads in place of ammunition, all resulting in heavier blows at German industry... Paving the way for less costly invasion.*⁷⁰¹

Implied by this argument was that the battle for air superiority—not the battle against submarines—was the key to efficient victory. Although an unintentional irony, a Navy film crew, ignorant of the argument behind their efforts, would shoot the footage.⁷⁰²

The pitch for oil was no less embellished. To a backdrop portraying the German War Machine, a narrator would read: “Her planes grounded... Her

⁷⁰⁰ Byron E. Gates, *Memorandum for Sorensen, Motion pictures to supplement Committee report*, War Department, (Maxwell AFB, AL: AFHRA, 26 March 1943), #118.04A-5, IRIS 110428.

⁷⁰¹ Committee of Operations Analysts, *Script*, War Department, (Maxwell AFB, AL: AFHRA, 1 April 1943), #118.04A-5, IRIS 110428, report 3: 3.

⁷⁰² According to COA’s Dr. Mason, the OSS would shoot the film using their camera crew who happened to be Navy. That the crew was not AAF was a convenient coincidence for some of the COA members who were concerned that a uniformed AAF officer overseeing film production in a ball bearing plant might give away their plans. See: *Meeting Minutes*, War Department, (Maxwell AFB, AL: AFHRA, #118.151-11, IRIS 110558, 1.

panzers immobilized... Germany could not ensure such a famine of fuel.”⁷⁰³

Finally, the pitch for ball bearings would be the film’s visual *coup de grâce*: A diagram would show that the bombers’ range could reach all recommended factories from England, and depict a destroyed factory along with “a great fleet of bombers coming out of the clouds,” as the narrator boasted:

*Destruction means wide industrial stoppage—no bearings for aircraft engines—no bearings for locomotives—or auto-engines—ordnance—machine tools. Special precision tools take months to build—Recovery would take as long. Anti-friction bearing factories are essential to the German industrial strength—and they are all vulnerable...*⁷⁰⁴

Whether or not the Committee of Operations Analysts were impartial to the preferences of AAF doctrine, they were certainly partial to their own analysis and eager to market their conclusions.

Without waiting for the film, Arnold approved the report and dispatched Colonel Cabell to carry it to England along with a personal letter to General Frank Andrews—his friend, rival, and subordinate alike—ordering him to study its contents: “I am enthusiastic about the possibilities of using this report of an impartial group of analysts as a means of presenting to the Combined as well as the Joint Chiefs of staff the concept that Airmen have known for years to be sound,” Arnold confessed.⁷⁰⁵ He then begged Andrews for “particular attention to the ball-bearing industries, because its [sic] destruction would virtually paralyze all German industry, and secondly because it may well be within our

⁷⁰³ Committee of Operations Analysts, *Script*, 1 April 1943, report 2: 7.

⁷⁰⁴ *Ibid.*, report 1: 7.

⁷⁰⁵ Arnold, *Letter, Arnold to Andrews*, 24 March 1943.

capacity to destroy this industry with the size Air Force that we happen to have in the United Kingdom in 1943.”⁷⁰⁶ If the COA analysts were selling air intelligence, then Arnold was buying it wholesale. Ball bearings seemed like the perfect efficiency in a target system because attacks on them would serve as a short cut to securing objectives on other industries. Arnold added, “If we could destroy the ball-bearing industry, it would be unnecessary to destroy airplane or airplane engine manufacturing establishments, or, for that matter, the submarine manufacturing installations, for in a very short time their operations would be vitally affected.”⁷⁰⁷ He’d injected the COA report directly into the European Theater with his cordial influence on Andrews, and he used it to keep his micro-managerial thumb pressed firmly on Eaker.⁷⁰⁸

⁷⁰⁶ Ibid.

⁷⁰⁷ Ibid.

⁷⁰⁸ Despite the COA’s acquiescence to Eighth Air Force not to expressly establish target priorities, the report nevertheless included the list in unlabelled priority order and bumped ball-bearings up to second, behind only the German Aircraft Industry. As published, the priorities reflected the forcefulness and persuasiveness of the committee chairs. See: Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 44.

Chapter Six: Eaker's Imperfect Pitch

*We know that the selection of the most vital targets must come as a result of thorough analysis. We know that the strength of our fighting force will always be relatively limited. We must, therefore, apply it to those specially selected and vital targets which give the greatest return. We cannot afford to apply it where, or in such a manner that, the return is not eminently worth the cost. We know that there is room for doubt as to whether friend or enemy is worn down faster by bombing unless it is applied with precision against vital objectives...*⁷⁰⁹

—Gen H. H. Arnold in letter to Maj Gen I. C. Eaker, 10 April 1943

What Arnold sought from his task to Andrews, even though the request had been carefully worded so as to appear flexible, was for theater-air commanders to validate the COA report and his own estimate of the required bomber force. Arnold's intent for Andrews was more political than it was scientific, because Arnold would not permit his generals in Europe to request more bombers than he could give them. Assumptions about the necessary size of the operational bomber force would be critical. Cabell, who'd drafted Arnold's letter for him, had written: "it must be within our capabilities to provide the force recommended," and the minimum size of that "operationally efficient" force would be 1200 bombers.⁷¹⁰ The planners assumed a dispatched force of 300 bombers could make "deep penetrations" into Germany, while a minimum of 200 could "provide self-protection and at the same time carry out worthwhile

⁷⁰⁹ H. H. Arnold, *Letter, Arnold to Eaker*, War Department, (Held by AFHSO: NA, 10 April 1943), AAG 312.1-E, Operations Letters, RG 18; Cited in: Assistant Chief of Air Staff (A-2), *The Ploesti Mission of 1 August 1943*, June 1944, vii.

⁷¹⁰ Arnold, *Letter, Arnold to Andrews*, 24 March 1943. The letter is marked at the top "prepared by Advisory Council," which indicated Cabell's role.

destruction” into Germany, as long as a fifty bombers with fighter escort were available to provide a diversion attack to draw off the German Air Force.⁷¹¹ The other key assumption, as eventually briefed by Eaker himself, was that “experience in the Theater to date indicates that at least 800 airplanes must be in Theater to dispatch 300 bombers on operations.”⁷¹² This meant just over 37 percent of every bomber Arnold could put on English soil would fly in any given raid. The difference then, between 800 and 1200 as the size of the bomber force in Theater, was more about the rate of operations—the essential metric to Arnold—than the size of the bomber force per raid. Sustaining those operations with good results was Eaker’s problem, but first he needed to develop the plan.

Cabell was now in position, after having drafted Arnold’s letter to Eaker and carried the mail himself, to remain in England and participate on Eaker’s review team. The COA report, including the size of the force required to destroy the targets, had been based on a brash assumption by Sorensen’s committee that 50 percent of all bombs—“sighted and released”—from 25,000 feet would land within 1,000 feet of the target.⁷¹³ Time would tell if this calculation would prove true, but Eaker would first develop and brief his own plan for the Combined Bomber Offensive before he could decide how to evaluate it.

Upon receiving direction from Andrews, Eaker assembled a team, including

⁷¹¹ Maj Gen Ira C. Eaker, *Presentation of Combined Bomber Operations - United Kingdom*, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, ca. April 1943), #168.61-10, IRIS 124347, 6.

⁷¹² *Ibid.*, 7.

⁷¹³ Edgar P. Sorensen, *Memorandum, The Method of Computing Sortie Requirements*, War Department, (Maxwell AFB, AL: AFHRA, 20 March 1943), #118.04-9A, IRIS 110433, 1.

two of his subordinate Wing Commanders (Hansell and Anderson) and his senior air planners, (Hughes and Agan) along with Cabell. They would study the COA report and craft its findings into a Theater-level air plan.⁷¹⁴ Eaker's plan was not to be a gross departure from previous guidance, but the data behind the COA report gave him plausible rationale to make the change he most wanted, which was to get his bombers focused back onto the Luftwaffe. His plan now included German Air Force targets as an "Intermediate Objective," which he contrived to mean even higher priority than the "Principal Objectives." Eaker argued, "if the growth of the German fighter strength is not arrested quickly, it may become literally impossible to carry out the destruction planned and thus to create the conditions necessary for ultimate decisive action by our combined forces on the Continent."⁷¹⁵ Eaker knew that battling through the German single-engine fighters, incidental to raids on the U-boat industry, was an ineffective way to deplete their numbers.

The COA report opted out of a choice between targeting airframe-assembly or aircraft-engine plants, by simply listing all of them, although neither had been enough to satisfy Eaker. Advocating another slice at the Luftwaffe's front-line strength, Eaker wanted to add airfields as well as repair depots and aircraft-storage facilities to the target lists—especially since weather was no longer written into the directive as a viable excuse for manipulating the

⁷¹⁴ Maj Gen Ira C. Eaker, *Letter of Instructions*, Eighth Air Force, (Maxwell AFB, AL: AFHRA, 2 April 1943), #168.61-10, IRIS 124347.

⁷¹⁵ Eaker, *Presentation of Combined Bomber Operations - United Kingdom*, ca. April 1943, 4.

priorities.⁷¹⁶ Hughes, as the intelligence officer and a junior member of the team, remained uncharacteristically mum until he attempted to steer Eaker from adding aircraft-repair depots into the plan based on his own inaccurate assumption that Air Chief Marshal Portal would not approve. Hughes may have preferred to avoid taking on the hassle of convincing the British Air Ministry and RAF leadership of the add-on targets in addition to the extra work for his shop to planning them, but more likely he was echoing the EOU members' sentiments from a memorandum he'd just received from the EOU's Kindleberger, which purported to cover "the various lines of investigation" into attacking the German aircraft industry.⁷¹⁷ They'd concluded that "the airframe industry suffered from the disadvantage of containing few vulnerable or even highly specialized installations," and that aircraft engines were more likely to be the "limiting factor."⁷¹⁸ They hadn't considered the import of airfields or repair facilities at all, though their logic would have ruled them out. In any case, Eaker overrode the recommendation, and Hughes redeemed himself by rattling off the repair-depot locations at Antwerp, Paris, and Romilly-sur-Seine as possible targets.⁷¹⁹

The intelligence organizations most oriented toward inflicting economic collapse saw little value in airfields and repair facilities, even if these targets

⁷¹⁶ *Notes on Meeting with General Eaker*, Eighth Air Force, (Maxwell AFB, AL: AFHRA, 5 April 1943), #168.61-10, IRIS 124347.

⁷¹⁷ Memorandum, Kindleberger to Hughes, 15 March 1943; cited in: Rostow, *Rostow Report*, ca. 30 April 1945, 66-70, quote on 72.

⁷¹⁸ *Ibid.*, 72.

⁷¹⁹ *Notes on Meeting with General Eaker*, 5 April 1943.

were essential enablers to keeping the Luftwaffe out of the fight. Targeting the aircraft industry proved a contentious challenge, not only because there were differing opinions about how to attrit the Luftwaffe, but because the Reich creatively modified its production locations and practices throughout the war.⁷²⁰ Eaker was dogged in pursuing these targets while disinterested intelligence organizations struggled to provide the feedback he really needed on the attacks. Despite the absence of aircraft repair facilities in the COA report, Eaker's Mighty Eighth raided all of the locations Hughes had mentioned by the first week of September and another that Hughes had overlooked (discussed in Chapter 7).

Eaker also sought to leverage a recent boost in bombing accuracy to lend credibility to his plan. "General Arnold wants to know what percent we can destroy of the targets we must hit, based on experience, with examples to prove our statements," Eaker had said to his team, "[I] do not think we should use theoretical statements such as mil error in stating bombing accuracy. We should use photographs of Vegesack, Renault, etc., as examples and accentuate our increase in bombing accuracy."⁷²¹ Eaker did not need the photographs to predict the industrial impact of the raids as much as he needed

⁷²⁰ Eaker's goal was in part enabled by none other than Flight Officer Constance Babington-Smith at Medmenham's CIU. With a one-off compliment outside their own organization, the EOU credits her for bringing "craftsmanship, enthusiasm, and a creative imagination to the analysis", which sharpened "photographic interpretation of both aircraft types and the aircraft industry" just as it became most necessary for the CBO. Aircraft targets became increasingly difficult to find as they dispersed and moved underground. See: Rostow, *Rostow Report*, ca. 30 April 1945, 62.

⁷²¹ *Notes on Meeting with General Eaker*, 5 April 1943.

them to project a psychological impact on his audience—in this case, Arnold then the rest of the Combined Chiefs.

With his references to Vegesack and Renault, Eaker was cherry-picking two of the better accuracy performances and using the photographs to tell a convincing story of bombing accuracy and likely future success. Bomb-plot reports for the 4 April raid on Renault (a factory in Paris attacked the day prior to his planning meeting) showed 15.3 percent of bombs within 1,000' of the target, which just beat the 14.9 percent average for all raids from January through March.⁷²² Moreover, the ORS bombing-accuracy reports showed Eaker that four consecutive raids between 8 March and 22 March (including Vegesack) had attained an average of 21 percent in the 1000'-circle, while the previous four had averaged just over 10 percent. Eaker wanted to impress his boss and the ORS data apparently suggested an exceptional learning curve for his organization, doubling its earlier accuracy performance.

Unfortunately, the ORS research later showed that for the rest of April through June, between the time of Eaker's first planning meeting and final signature on the Pointblank Directive, Eighth Air Force could not sustain a new accuracy standard. Of the 19 assessable raids after Vegesack and Renault, only 9.9 percent of the total bombs dropped fell within 1,000'; only a single raid out-performed the 20 percent mark for bombs inside 1,000', and 8 raids had yielded all bombs outside of 2,000'.⁷²³ Visual-bombing accuracy, at least by the

⁷²² Eighth Air Force, *Bombing Accuracy*, July 1943.

⁷²³ Ibid.

1000'-circle metric, had found its plateau at 10 percent.

An intelligence short circuit. Eaker's outspoken inclination for additional aircraft-industry targets and emphasis on recent accuracy gains were no more contentious than an argument that went unspoken. "Possum" Hansell, as First Bombardment Wing commander who had two years earlier participated on AWPB-1, assumed the chairman position for Eaker's planning team. Then unaware of the COA's organizational tendencies, Hansell was perplexed that Arnold's analysts omitted electrical power as a target system:

Electrical power, in second place in AWPB-1 and fourth place in AWPB-42, was dropped in the Combined Bomber Offensive and replaced by the German ball-bearing industry. This was done because COA apparently considered the system to be beyond the capability of the forces that could be made available. We believed this conclusion was a mistake but felt compelled to go along with it. We wondered if the COA had unearthed new information, unknown to us, which changed the importance or vulnerability of German electric power.⁷²⁴

Unbeknownst to Hansell, the pivotal moment may have occurred five months prior in one of COA's meeting held 21 December 1942. Captain James T. Lowe (not a career officer, but a PhD "specialist in diplomatic history") presented interim findings of the electrical power subcommittee to the core committee members.⁷²⁵ The subcommittee members had correctly noted "an

⁷²⁴ Hansell, *The Air Plan that Defeated Hitler*, 162. After the war, Hansell publically pulled no punches in criticizing the COA for discounting electricity for reasons that had plagued the COA's judgement all along. "COA violated a cardinal principle by dismissing a vital target system as beyond the capacity of the force," Hansell later argued in a speech to the Air War College, "This was not their proper province. It should have been the military operational people who evaluated the capacity." See: Hansell, *Lecture to Air War College: "The Development of the United States Concept of Bombardment Operations"*, 16 February 1951, 27. For perspective from the Air Force's historians on this example of an omitted target system and others, see: Craven and Cate, *Torch to Pointblank*, 362.

⁷²⁵ Hansell, *The Strategic Air War Against Germany and Japan: A Memoir*, 23.

obvious fact, that electric power is highly important to an industrial economy,” but they grossly underestimated its susceptibility to attack as they equally overestimated the number of targets necessary to cripple the system and its potential for recuperation. “If you attack the system, you would have to get 244 targets,” Lowe’s team suggested, and “the number of bombs necessary to get at one target revealed the need for six direct hits on a power station.”⁷²⁶ Modelling their assumptions after a study of Pennsylvania’s Duequesne power plant with pessimistic Air Ministry data, they had unscientifically ruled out attacks on heavy turbines and generators. They were discouraged that generators seemed heavily constructed and were often shielded by concrete walls. Even though they’d correctly identified that generators could take months to repair, they had not accounted for an operating generator’s sensitivity to shock (discussed below).

Instead, the subcommittee’s engineers focused on boilers, which they thought would be easier to attack, though also more easily repaired. The COA analysts rushed to a decision from the inconclusive report. With no further investigation—or even a recommendation for follow-on study—the committee determined any “attempt to destroy the overall electrical industry is out of the question.”⁷²⁷ They directed the electrical subcommittee to give the system only a regional look as it fell precipitously lower in priority to other potential systems. COA analysts sought a reputation for conclusive results, so they

⁷²⁶ *Meeting Minutes* War Department, (Maxwell AFB, AL: AFHRA, 21 December 1942), #118.151-1, IRIS 110545, 11.

⁷²⁷ *Ibid.*, 11-12.

quickly jettisoned targets that might not ensure quick victory.

Interestingly, the input to drop the system originated not from one of the COA industrial experts or engineers, but from Colonel Sorensen, and the other members accepted his vociferous but uninformed opinion. Sorensen's exact words, as transcribed, were illustrative: "If we could conclude in this committee that an overall attempt to destroy the overall electrical industry is out of the question, to support that we will need perhaps only two or three charts of the type already made up and a discussion of the matter to show how extensive it is... We should proceed to consider the electrical industry only from the regional point of view."⁷²⁸ Good ideas needed to be marketed and sold, but so too did the misinformed ones. That discussion ended consideration of the electrical system, and Hansell, who was in position as planning committee chairman, lacked the confidence to question the intelligence and bring it back up.⁷²⁹

Given what he knew at the time and since Eaker's plan had to receive Combined Chiefs' approval, Hansell and his planning team dared not move

⁷²⁸ Sorensen's exact words, as transcribed, were: "If we could conclude in this committee that an overall attempt to destroy the overall electrical industry is out of the question, to support that we will need perhaps only two or three charts of the type already made up and a discussion of the matter to show how extensive it is... We should proceed to consider the electrical industry only from the regional point of view." Ibid., 12-13.

⁷²⁹ The United States Strategic Bombing Survey later concluded quite the opposite from the committee's enduring recommendation. The German electrical power system rather proved an ideal target, and disruption often resulted from inadvertent damage intended for other targets: "The vulnerability of the German electric utilities system arises from the lack of any reserve capacity, the relative ease with which electric generating and transmission equipment can be seriously damaged, the relative difficulty of repairing bomb damage or replacement of destroyed facilities and the concentration of electric power production in a relatively small number of plants." See: United States Strategic Bombing Survey, *German Electric Utilities Industry Report*, in No. 205, Utilities Division, (Washington, DC: USSBS, 1947), 2.

submarine bases below second on their final plan. At third priority, Eaker's team swapped ball-bearings in for transportation targets—as they had been listed in the Casablanca Directive, acknowledging Arnold's request. Petroleum remained at fourth. Finally, Eaker's team dropped grinding wheels and non-ferrous metals—the other two obvious *panacea targets* on COA's list—from their new plan altogether.⁷³⁰ Perhaps Hansell only felt comfortable deviating so far from AWPD-42, so one high-priority outside bet on this new intelligence organization was enough.

Eaker Faces Feedback

Air Chief Marshal Arthur Harris' feedback on Eaker's plan showed a depth to his strategic and political thought not often credited to his character. To the major aims of Eaker's plan, he extended his full support. After all, Harris held command over roughly half of the bombing forces necessary to enact its purported devastation, but it was Eaker who would shoulder the burden of convincing the military and political leadership—on both sides of the Atlantic—to give both air forces a chance to consolidate their aims under a more formal construct.

Harris' two areas of concern, however mild they may have seemed, were prophetic. Harris detested the arguably absurd sense of precision with which Eaker had prescribed a year's worth of highly specific targets, as if to suggest

⁷³⁰ Eaker, *Presentation: Plan for Combined Bomber Offensive From the United Kingdom*, 29 April 1943. Also, Committee of Operations Analysts, *Report of Committee of Operations Analysts with Respect to Economic Targets Within the Western Axis*, 8 March 1943, foldout 1.

the plan obtained a perfect grasp of the enemy. "The plan as it stands may prove somewhat inelastic," Harris' reasoned, adding, "in practice, it could and would be modified as necessary to meet developments in the general situation and to accord with new information as to the effect of past attacks on different types of objectives."⁷³¹ Harris knew Eaker's plan was based largely on speculation, and the Germans would undoubtedly respond. Harris seemed to value the importance of on-going assessments, whether or not he would choose to accept them. The plan would have to change and this was a point he felt was worth highlighting.

Harris also mocked the primacy Eaker's plan afforded to attacks on submarine bases. Harris wouldn't object if Eaker wanted to spend his day-bombing force continuing to wail away fruitlessly at concrete submarine pens, but he had no intention of trying to crack into them with his night-bombing force. Finally, Harris revealed his sense of airpower and the magnitude of the political situation in which both he and Eaker found themselves: "There is no difficulty in achieving our object at minimum cost in life, material, and effort," Harris avowed. "There is difficulty only in convincing those in whose hands lies the power to grasp this opportunity."⁷³² For Harris, the assured success of the Combined Bomber Offensive had less to do with the Germans or their industries and everything to do with receiving the permission and the

⁷³¹ Air Chief Marshal Sir Arthur T. Harris, *Personal letter to Eaker*, in *Personal Collection of Gen Henry H. Arnold part 3 of 6*, Headquarters Bomber Command, (Maxwell AFB, AL: AFHRA, 15 April 1943), MICFILM 28253, IRIS 2053776, 1.

⁷³² *Ibid.*, 2.

equipment to unleash hell—first on the Luftwaffe, then on the moral backbone of the German *Vaterland*. The air intelligence organizations were not the only ones selling their agendas.

Eaker's amended plan was completed and approved by both Andrews and Air Chief Marshal Sir Charles Portal by mid-April 1943. Eaker's adept briefing skills "without notes and with compelling command of his subject" certainly mattered, but there was also work behind the scenes that helped it flow back uphill smoothly.⁷³³ The EOU economists, ever struggling to get out from behind Hughes' curtain and onto the main stage, would not be shut out of the credits. As they recorded of Eaker's plan in their history, they'd played "a hand in shaping the basic analysis and to some extent its final form," though they conceded it was Hughes who bore the "brunt of the laborious salesmanship at higher levels."⁷³⁴ Andrews had been a fan from the start. He sought to temper Arnold's relentless drive for dispersed raids and constant pressure with operational flexibility. "An intensive, continuous search should be maintained for a critical system," he suggested to Eaker, "so that at any time a part of the German economic structure becomes critical we can strike it with increased effort."⁷³⁵ As Harris had also recognized, there was a balance to be struck between presenting a plan detailed in its analysis, but not so much so that it appeared over-committed to its predictions. Andrews wanted to ensure that

⁷³³ Parton, *Air Force Spoken Here*, 253.

⁷³⁴ Rostow, *Rostow Report*, ca. 30 April 1945, 60.

⁷³⁵ *Notes on Meeting with General Andrews*, Eighth Air Force, (Maxwell AFB, AL: AFHRA, 8 April 1943), #168.61-10, IRIS 124347.

more lucrative target systems were not overlooked once the plan was set in motion.

Eaker's final brief, in April of 1943, of his plan for the Combined Bomber Offensive to the Joint Chiefs, lent additional credibility to the argument that he and Arnold intentionally leveraged the COA's credibility more so than their actual expertise. Despite the fact that much of the COA's research had been accomplished by officers with wartime commissions (i.e. Colonels Perera and Leach) as well as by the A-2 and G-2 officers who'd joined the team, Eaker curiously credited only the COA's "eminent civilian authorities" in his opening remarks to the Joint Chiefs.⁷³⁶ Eaker shamelessly plugged the COA analysts' business, academic, and inter-agency credentials as well as their external coordination with the Board of Economic Warfare, OSS, Air Ministry, War Department G-2, War Production Board, Ministry of Economic Warfare, and others. If Eaker recognized the Air Staff had been branded as biased in senior defense circles, then his effort to establish credibility for his plan by emphasizing only the role fulfilled by civilian consultants was likely deliberate and politically charged. No intimations of the Air Staff, no matter how valuable their contributions might have been, would help to wheedle a thumbs-up from leaders outside of the air arm.

Overflying tough questions. Despite the ease with which Eaker earned approval for his plan, the closed-door question-and-answer period following his

⁷³⁶ Eaker, *Suggested Commentary... for The Combined Bomber Offensive From the United Kingdom*, ca. 16 April 1943, 1.

brief to the Joint Chiefs foreshadowed several elements that begged future adjustments. General Marshall had the foresight to press Eaker on his fighter-escort requirements. Eaker's talking points included excruciating detail of the German fighter force and his plans to curb its production. Not even once, however, did his script include a mention of Allied pursuit aircraft with respect to his plan's requirements. Eaker maintained utmost confidence in the venerable Flying Fortress, despite the crippling losses he'd already taken.⁷³⁷ In fact, the only range Eaker had described in his entire brief, including all four three-month phases, was a 400-mile limit on penetration during the second phase. This was peculiar because he'd declared, the "German fighter force must be kept depleted" for subsequent phases and targets that would require deeper penetration.⁷³⁸ Eaker believed he could culminate the German Air Force without an escort that could reach Berlin as he retorted to Marshall that the only he escort needed was the P-47 with its 400-mile range.

Eaker also put extraordinary faith in blind-bombing techniques enabled by the advent of onboard radar, which afforded the ability to map the ground and aim at targets through the weather. With adequate forces, Eaker felt he could squeeze up to ten missions per month out of his bombardment wings, even during the worst months of the often-overcast North Atlantic winters. "The weather would actually be an aid rather than a hindrance," he argued, "in view of new devices which have been developed for bomber aircraft which act as

⁷³⁷ Ibid., 17 pps.

⁷³⁸ Eaker, *Presentation: Plan for Combined Bomber Offensive From the United Kingdom*, 29 April 1943.

leaders.”⁷³⁹ Bad weather was no problem for bombing accuracy, he thought, but it could help reduce the attrition numbers on his bombers as they would be obscured from the Luftwaffe and from flak.

Finally, Admiral Ernest King, then-Chief of Naval Operations, pushed to expose any possibilities that Eaker might try to wriggle his bombers away from the battle against submarines. King’s exchange with Eaker continued the trend of passive aggressive manipulation between the Navy and the AAF. Just a couple months earlier, General Fairchild had easily dredged up the expertise of eager Navy officers willing to participate on the COA’s subcommittee on submarine targets, but the sailors could not obtain permission from the top of their sea service.⁷⁴⁰ Despite the best intentions of mid-level officers, Navy brass could not risk being co-opted into in a joint report that might condemn the feasibility of air attacks on submarine bases. However truthful such studies might have been, it was safer for the Navy’s interests not to play. They wanted the air component supporting their mission.

King, who’d inherited the “sparkling eye and animated countenance” of his father’s middle name—Clydesdale—trained his gaze on Eaker.⁷⁴¹ “U.S. officers

⁷³⁹ Ibid.

⁷⁴⁰ Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 40.

⁷⁴¹ One of King’s own daughters allegedly quipped of the short-fuzed admiral, “he is the most even-tempered man in the Navy. He is always in a rage.” Perhaps the comparison isn’t fair to the horse. See: Eric Larrabee, *Commander in Chief: Franklin Delano Roosevelt, His Lieutenants, and Their War*, 1st Touchstone ed. (New York: Simon & Schuster, 1988), 155; “The Clydesdale Horse--Dialogue,” *The Farmers’ Cabinet and American Herd-Book* V, no. 1 (15 August 1840): 25; For a broader characterization of King’s personality, see: Walter R. Borneman, *The Admirals: Nimitz, Halsey, Leahy, and King--The Five-Star Admirals Who Won the War at Sea*, 1st ed. (New York: Little, Brown and Co., 2012), ch. 2.

think they can strike at Submarine bases,” Eaker cowed, but “the British are not in full agreement.”⁷⁴² Eaker had eluded addressing some of the thorniest challenges ahead, but he was going to need informed intelligence, robust assessment, imaginative operations analysis, and a healthy openness to feedback in order to succeed. As it stood, the Joint Chiefs opted to defer final decision until the Allied Combined Chiefs met at the Trident Conference in mid-May.⁷⁴³

Sharpening for Trident. While Eaker and his staff had been busy drafting and selling his proposed version of the CBO plan, Arnold was busy losing patience for lack of quantifiable detail on Eaker’s bombing progress. Damage assessments flowing back to Washington were delayed, lacked depth, and only sporadically benefitted from any correlation to other intelligence sources. Arnold was not able to answer questions he was getting from above and he was beginning to sense that Eaker couldn’t answer them either. Arnold wanted reports with increasing regularity and accuracy—the time for haphazard experimentation was over. Arnold expressed this to Eaker in a 10 April 1943 letter:

It is very natural for many people in high places to note that so many bombs were dropped on a given occasion by units of your striking force. The very natural question is, what was destroyed? Did you hurt the enemy’s ability to wage war? Did you destroy any facility or part of a factory which is directly supporting the war effort? How much damage was done and to what?

We are in a difficult position here when it comes to answering questions of the above character. We get your reports and

⁷⁴² Eaker, *Presentation: Plan for Combined Bomber Offensive From the United Kingdom*, 29 April 1943.

⁷⁴³ Parton, *Air Force Spoken Here*, 253.

pictures ultimately, but they are rather long delayed. We also are handicapped here in making an assessment of damage which will satisfy your people because as you have told us, pictures alone do not give all of the evidence. Additional information comes from espionage or other sources. We appreciate the fact that information from espionage or other such sources is not immediately available.

It will help us a great deal in defending your operations and in building up a correct picture of the results being accomplished if you make a special effort to have a summary on the subject gotten back here about every two weeks... This report should cover your bombing operations, including target pictures before and after bombing, and should particularly include your most thorough assessment of damage done to the enemy that can be made in the time allowed.⁷⁴⁴

Another reason for Arnold's request was that time was running out as preparations for the Trident conference of the Combined Chiefs of Staff, a meeting scheduled for the following month in Washington, reached fever pitch. The Washington locale for this follow-on to Casablanca offered the American Joint Chiefs an enhanced opportunity to commit their assistants and planning staffs to preparation, a lesson learned from their relative lack of preparation at Casablanca.⁷⁴⁵

At stake for the European Theater at Trident from President Roosevelt's perspective were two considerations: First, if Allied forces were to emphasize the Mediterranean and take Sicily by August, then American troops would sit idle in Italy until an invasion of Germany became possible in 1944. This was unacceptable to Roosevelt, because "it would have a serious effect on relations with Russia, who was bearing such a disproportionate weight."⁷⁴⁶ These troops

⁷⁴⁴ Arnold, *Letter, Arnold to Eaker*, 10 April 1943.

⁷⁴⁵ Matloff, *Strategic Planning*, 110-111.

⁷⁴⁶ Mtg of the CCS with Roosevelt and Churchill, 2:30pm 12 May 1943; document 29. Quoted

would either need to move to England or to take on another operation in the Mediterranean. This was a key strategic decision because further Mediterranean operations could consume resources necessary for his second consideration: Timing and scope of the potential cross-Channel invasion. Now was the time, he thought that the limited, opportunistic plan known as Sledgehammer or the large-scale operation known as Roundup (later Overlord), “should be decided upon definitely as an operation for the spring of 1944.”⁷⁴⁷ This strategic fork in the road depended to a significant extent upon the success of the forthcoming CBO to negate the Luftwaffe and to forestall any unanticipated or unnecessary increases in the size of Allied invasion forces.

General Marshall’s planners, led by Brig Gen Thomas Handy, had given him an earful during conference preparation that victory through airpower alone could not be assured, so it was necessary to push the President to help shift priorities toward invasion preparation.⁷⁴⁸ The Army staff preferred the larger-scale plan with a definite invasion date. Marshall agreed and emphasized his confidence in airpower to help with invasion preparation along with the need for greater precision in planning for troop movements. “Great faith was being pinned to the results of the bomber offensive,” Marshall said to the Combined Chiefs. “We must be ready to take advantage of these results,” he added, conceding that “the exact results of the air attacks might be

in: William Z. Slany et al., “Foreign Relations of the United States, 1943,” (1970).

⁷⁴⁷ Ibid.

⁷⁴⁸ Also, Ray S. Cline, *Washington Command Post: The Operations Division* (Washington, DC: Office of the Chief of Military History, Dept. of the Army, 1951), 192; Maurice Matloff, *The 90-Division Gamble* (Washington, DC: Center of Military History, U.S. Army, 1990), 70.

problematical, but the availability of tonnage to move troops could be calculated.”⁷⁴⁹

Both Roosevelt and Marshall were tuned to the delicate balance of keeping the Russians in the war by taking just enough pressure off the Eastern Front. However, pulling the Luftwaffe toward the Western Front meant that invasion timing was critical since the Allies needed to muster an adequately sized force and more time to establish air superiority. The figures projected in Eaker’s plan seemed optimistic, but there wasn’t much reason to question them, provided Eighth Air Force did not compete with ground-component priorities, and Eaker could show progress toward controlling the skies over the eventual invasion lodgment on coastal France.

As the Combined Chiefs got around to considering Eaker’s plan, Air Chief Marshal Sir Charles Portal, ostensibly the senior Allied air commander for the CBO, seized the opportunity to drive this point home to the ground commanders. “One of the main features of the air plan outlined by General Eaker was not only its tremendous effect both on production and morale, but also, and perhaps most important, the elimination of the German fighter force,” he argued, adding, “this would have an immense effect on any operations against Germany, whether across the Channel, in the Mediterranean, or on the Russian Front...The longer the destruction of the German fighter force was delayed, the longer would the ultimate defeat of Germany be delayed.”⁷⁵⁰ Air

⁷⁴⁹ 85th mtg of the CCS, 15 May 1943, document 37. Quoted in: Slany et al., "Foreign Relations of the United States, 1943."

⁷⁵⁰ 85th mtg of the CCS, 15 May 1943, document 37. Quoted in: *ibid.*

superiority was a joint problem.

In sum, Trident was a conference of compromise and General Marshall's argument for the large-scale invasion ultimately held sway. 1 May 1944 became the planned date for the enormous Anglo-American cross-Channel invasion, which set into motion the need for an even tighter coupling between the strategy and the resources required for the remainder of the war.⁷⁵¹ Despite its approval "as presented," at the conference, the Pointblank Directive, which officially initiated the "Plan for the Combined Bomber Offensive from the United Kingdom," wasn't published until 10 June 1943.⁷⁵² With its delayed signature and an air commander in Eaker who'd seemed deaf to feedback, dumbfounded by possible escort requirements, and hopeful about blind bombing, so began the Combined Bomber Offensive.

The Devil and the Deep Blue Sea

Between 1 April through 1 July 1943, as Allied generals updated their grand strategy and future bombing priorities, Eaker's Eighth Air Force shifted its weight of effort—at least on paper—to the first phase of the CBO. Eaker's bombers marshalled raids on just 20 days of the three-month period—a tempo that actually exceeded the plan's expectations, as the bombers managed 34 attacks on 30 different locations (many were repeats).⁷⁵³ Of the raids Eaker

⁷⁵¹ Parton, *Air Force Spoken Here*, 263; Matloff, *Strategic Planning*, 130-131.

⁷⁵² Bill Yenne, *Big Week: Six Days that Changed the Course of World War II*, 1st ed. ed., Six Days that Changed the Course of World War II (New York, NY: Berkley Books, 2013), 85.

⁷⁵³ Headquarters Eighth Air Force, *Effort Against Individual Targets*, in *Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: First Phase*, (Maxwell AFB, AL: AFHRA, July 1943), #168.61-10, IRIS 124347.

reported had been projected for this first period, nineteen attacks featured submarine bases and yards, eight were aircraft-storage-and-repair facilities in occupied countries outside of Germany, and one fell on the Focke-Wulf factory (collocated with a submarine yard) at Bremen.⁷⁵⁴ Additionally, Eaker marshalled six attacks on targets outside of the Pointblank Directive's plan for the first phase, including three on airfields, one on the Renault vehicle production facility in Paris (collocated with an aircraft factory), a naval depot, and the synthetic rubber plant at Hüls.⁷⁵⁵ Rounding out the top seven target priorities, Eaker refrained from raiding German oil refineries at all because, as he put it, "these targets were not to be attacked unless Ploesti were successfully attacked."⁷⁵⁶

The apparent reason for Eaker's hesitance to focus on oil early was, first, that the Ruhr refineries were deeper than the "relatively shallow penetration" he'd planned for the first phase of the CBO.⁷⁵⁷ He would be ready, based upon the plan, to strike either the oil targets in the Ruhr or even deeper to hit the ball-bearing factories at Schweinfurt, but he preferred to wait on both target areas. As Eaker understood it, the more bombers he could send per raid, the proportionally lower losses he would take because of the improved defenses of larger formations, which would also exact greater damage on the targets per raid.

⁷⁵⁴ Ibid.

⁷⁵⁵ Ibid.

⁷⁵⁶ Ibid.

⁷⁵⁷ Eaker, *Presentation of Combined Bomber Operations - United Kingdom*, ca. April 1943, 8.

Eaker also knew that once he initiated an attack on a new target system deeper into Germany, he'd need to sustain the attack in order to increase pressure on that industry. If he had to follow up too often or too soon on heavily defended targets with too small of a bomber force, then he might not achieve his desire to build up the larger force required for later phases. In his brief on Pointblank to the Combined Chiefs, Eaker stated of a possible attack by the MAAF on Ploesti, "we will be forced to operate against the Ruhr refineries in order to exploit the advantage achieved in Romania."⁷⁵⁸ That Ploesti had not yet been attacked by MAAF by July was a boon as far as Eaker was concerned, because he could focus on holding to his plan and building up his forces.

As for the Schweinfurt ball-bearing factories, Eaker claimed in his June report, "adequate force for this still lacking"; then in July, the mission was "postponed until longer nights make it possible for RAF to supplement our day attack with a heavy night attack."⁷⁵⁹ Eaker had reiterated the COA's (and Arnold's) fanaticism about ball bearings in the Pointblank Plan, noting in it that the "critical condition of the ball bearing industry in Germany is startling," and "outstandingly vulnerable to attack," but his concerns about attacking too early were even more pronounced for this target system.⁷⁶⁰ He'd briefed to the Combined Chiefs, "it would be most unwise to attempt it until we are perfectly

⁷⁵⁸ Ibid.

⁷⁵⁹ Headquarters Eighth Air Force, *Summary by Target Category*, in *Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: First Phase*, (Maxwell AFB, AL: AFHRA, 1 August 1943), #168.61-10, IRIS 124347. *ibid.*

⁷⁶⁰ Eaker, *The Bomber Offensive From the United Kingdom (undated draft)*, ca. April 1943.

sure we have enough force to destroy the objective in a single operation,” adding prophetically, “any attempt to repeat such an attack will meet with very bitter opposition.”⁷⁶¹ Eaker sought ideal circumstances before he’d undertake the risk to his force of an attack on Schweinfurt; not only did he insist upon sending a formation larger than he could muster by July, but he also wanted the RAF to attack the same night in hopes of hitting this ideal target with a perfect one-and-done raid. The COA offered a victory short-cut, Arnold had indorsed it, and Eaker was seemingly pushing it off for just the right moment.

Keelhauled at Kiel and Hüls. As to day-to-day target selection, Eaker followed the EOU’s recommendations to Hughes, as he seemed content to attack submarine yards for much of the Spring, if only for training and respite from the more costly raids into Germany.⁷⁶² In June, however, Eaker would venture back into Germany; his 4th Wing was walloped when 22 of the 60 bombers that fought their way to the target failed to return from the submarine yards at Kiel, and another 16 were lost the following week in a raid Eaker’s assessors had otherwise declared successful against the rubber factories at Hüls.⁷⁶³ Eaker’s bombers let loose 243 1,000-pound and 1,202 500-pound general-purpose bombs in this first large-scale daylight raid of this air campaign against Germany’s Ruhr valley.⁷⁶⁴

⁷⁶¹ Eaker, *Presentation of Combined Bomber Operations - United Kingdom*, ca. April 1943, 8.

⁷⁶² Parton, *Air Force Spoken Here*, 283-284.

⁷⁶³ Craven and Cate, *Torch to Pointblank*, 670-671.

⁷⁶⁴ Central Interpretation Unit, *Preliminary Interpretation Report No. S.A.359*, in *Attack on Synthetic Rubber Plant Hüls on 22.6.43*, Medmenham RAF Station, (Maxwell AFB, AL: AFHRA, 24 June 1943), #520.365.

The Kiel raid was a disaster for both operations and intelligence. The VIII Bomber Command operations officer reported that the 4th Bombardment Wing “was subjected to the heaviest enemy fighter attack any of our forces have ever been subjected to on any raid,” which was probably not hyperbole, but it might have been anticipated, because Eighth Air Force planned the mission with no fighter escort.⁷⁶⁵ Concerns over intense engagements with enemy fighters dominated the post-mission reports. In fact, the 94th Bombardment Group Intelligence Officer became so bogged down in paperwork supporting the gunners’ 41 kill claims that he was still submitting forms for the Wing Commander’s reconsideration “from the standpoint of morale,” over a month later.⁷⁶⁶ If the Intelligence Officer thought he could defend a war-weary Staff Sergeant’s combat record with a photograph discovered later and an interview with another tail gunner, he was going to take the time to make the argument.

As for BDA, not a single bomber managed to return with a usable photograph, and most crews hadn’t observed their own bombs, due to a combination of navigation issues, undercast weather, enemy opposition, and formation disarray.⁷⁶⁷ The lack of debrief data did not leave much for the

⁷⁶⁵ S-3 VIII Bomber Command, A-3 Section, *Comments on Report of Raid on Bremen and Kiel - 13 June 1943*, in *Tactical Mission Report, Field Order No. 174*, (Maxwell AFB, AL: AFHRA, 25 June 1943), #520.332, IRIS 221569. Brigadier General F. L. Anderson, *Tactical Report of Mission, Kiel, 13 June 1943*, 4th Bombardment Wing Headquarters, (Maxwell AFB, AL: AFHRA, 19 June 1943), #520.332, IRIS 221569, 2.

⁷⁶⁶ 94th Bombardment Group Intelligence Officer, *Memorandum for Commanding General, 4th Bombardment Wing, Subject: Resubmission of Claim for Encounter with E/A*, Captain Joseph G. Butterworth, (Maxwell AFB, AL: AFHRA, 15 July 1943), #527.332, IRIS 230239. Headquarters 4th Bombardment Wing, *Summary of Operations, Target: Kiel*, (Maxwell AFB, AL: AFHRA, 13 June 1943), #520.332, IRIS 221569.

⁷⁶⁷ Anderson, *Tactical Report of Mission, Kiel, 13 June 1943*, 19 June 1943, 1-3.

Group S-2s to piece together. For example, the best the 94th Bombardment Group Intelligence Officer could determine from crew interrogations was “approximately 10 bombs were observed bursting just south of the Kiel canal – observation somewhat limited due to enemy activity.”⁷⁶⁸ Since no photographic evidence could support a favorable assessment, the Wing’s report instead relied on alternative intelligence methods such as bomb plots “based purely on verbal reports” and an unsourced claim that “German broadcasts after the mission indicated that the damage done by our bombs was very extensive.”⁷⁶⁹ If there was evidence of positive mission impact hiding somewhere, the intelligence officers found it, and the Wing Commander put it in his report.

A post-mission photo-reconnaissance assessment for Kiel was disappointing but reasonable given the circumstances. Photo-interpreters detected only slight damage in images taken the following week. Bombs had demolished a few small sheds and a couple of commercial buildings, but there was no damage of note to the Kiel shipyard or any submarines.⁷⁷⁰ Sapping any remnants of positivity from the previous reports, Eighth Air Force Operations Analysts determined several weeks later that two consecutive raids on Kiel, including this one in June that resulted in 236 aircrew casualties, had failed to produce a single bomb within 2,000 feet of the aiming-point.⁷⁷¹

⁷⁶⁸ S-2 94th Bombardment Group, *Teletype Report, Mission 13 June 1943*, 3rd Air Division, (Maxwell AFB, AL: AFHRA, 14 June 1943), #527.332, IRIS 230239, 4.

⁷⁶⁹ Anderson, *Tactical Report of Mission, Kiel, 13 June 1943*, 19 June 1943, 3.

⁷⁷⁰ Central Interpretation Unit, *Immediate Interpretation Report No. K.1587*, in *Damage Assessment*, Medmenham RAF Station, (Maxwell AFB, AL: AFHRA, 22 June 1943), #520.365.

⁷⁷¹ Headquarters 4th Bombardment Wing, *Summary of Operations, Target: Kiel*, 13 June 1943. A-3 Assistant Chief of Staff, *Bombing Accuracy*, in *Notebooks for Gen Devers and Gen Eaker*,

The “battle of Kiel,” as Brigadier General Fred Anderson saw it, was noteworthy because it left an ACTS-graduate and combat wing commander scraping for intelligence that could justify his wing’s desperate effort as he clung—along with Eaker—to the positive.⁷⁷² After suggesting his crews had probably shot down more than double the figure they’d actually claimed and citing the high end of intelligence estimates of enemy fighters encountered, Anderson argued:

*Almost all bombs dropped were dropped on the target area with what is believed to be considerable damage to enemy installations... the reckless and futile attacks by German fighters indicates a desperate but vain attempt to stop the Daylight Bombing of their war installations. This suicidal defense by the German fighter force will quickly attrite the one opposing factor of any consequence to our heavy bombardment force.*⁷⁷³

By the time reality and more detailed analysis set in, missions like this one could be weeks or even months in the past, well after commanders had already internalized their observations from immediate reports, and they moved on. In this case, not even two weeks later, Fred Anderson was promoted to Major General and succeeded his boss, General Longfellow, at VIII Bomber Command.⁷⁷⁴ Kiel was a disastrous raid that, if analyzed patiently along with accurate and timely post-raid intelligence, might have shocked the Generals out of their mindset of bomber supremacy or at least opened discussions to

(Maxwell AFB, AL: AFHRA, 30 August 1943), #168.61-2, IRIS 124339.

⁷⁷² Finney, *History of the Air Corps Tactical School, 1920-1940*, 127.

⁷⁷³ Anderson, *Tactical Report of Mission, Kiel, 13 June 1943*, 19 June 1943, 8.

⁷⁷⁴ Stephen Lee McFarland and Wesley Phillips Newton, *To Command the Sky: The Battle for Air Superiority Over Germany, 1942-1944* (Tuscaloosa, AL: The University of Alabama Press, 2006), 109.

loosen their control of escort fighters. Instead, it was just another airborne duel for Eighth Air Force and the Luftwaffe. But Eaker appreciated and rewarded Anderson's optimism.

Follow up attacks—the penalty for failed raids—weren't much better. The 305th Bomb Group S-2 portrayed the positive side despite his aircrew's challenges in another Kiel raid in July:

*Bombing results were extremely difficult to observe due to heavy smoke screen, smoke from previous bombings, and dense haze. The main concentration of our bombs landed to the right of the covered basin... Scattered hits were seen on slips around the covered basin. Sighting was extremely difficult and lead bombardiers did a very good job of finding the target.*⁷⁷⁵

The Group S-2's use of *our bombs* certainly conveyed unit-level teamwork in Curtis LeMay's former outfit. Unfortunately, there was a big difference between finding the target and actually damaging it. This S-2 may have overstepped the First Bombardment Wing's S-2 training manual, which had instructed him, "there is much combat intelligence which S-2s are expected to collect, assemble, and report on. But it is never their function to evaluate such items as tactics."⁷⁷⁶ While S-2s might have contributed valuable insights into the mission's tactical employment, in this case another form of intelligence contradicted his impression of the bombardier's Norden-Bombsight work. ULTRA intercepts indicated "negligible damage" as far as the German Naval

⁷⁷⁵ S-2 305th Bombardment Group, *Teletype Report, Section 'A' to Commanding General 1st Bomb Wing*, War Department, (Maxwell AFB, AL: AFHRA, 30 July 1943), #525.332B, IRIS 228298.

⁷⁷⁶ United States Strategic Bombing Survey, *Blohm and Voss Shipyards, Hamburg Germany*, in *Plant Report No. 51*, Physical Damage Division, (Maxwell AFB, AL: AFHRA, 8 October 1945), #137.311-51, IRIS 113462, sec 5.

situation was concerned, and the Kiel U-boat yard persisted as an elusive target.⁷⁷⁷

Smoke screens and burning rubber. The mission to Hüls was an altogether different episode. A combination of 1st and 4th Wing bombers would pound the Buna rubber plant at Hüls in two waves, aided by a smaller diversionary force to lure enemy fighters over the North Sea.⁷⁷⁸ While the rubber industry ostensibly fell below oil and ball bearings in priority, the plant's location west of the Rhine offered a target of reasonable penetration into Germany, dependent upon fighter-escort support on the ingress and egress routes.

A new target area and a new type of target added additional impetus to pre-raid intelligence reports. The target-intelligence portion of the mission briefing kicked off with a motivational statement to the crews: "Your target today is vitally essential to the successful prosecution of the war by the enemy. In order to keep its mobile units on the move it must have rubber... This plant has never been bombed before, there are no craters, and it is responsible for 17 1/2 percent of the German annual output of chemical products."⁷⁷⁹ Crews undoubtedly felt some trepidation, but the intelligence marketing the mission's

⁷⁷⁷ National Security Agency and Central Security Service, *ULTRA: History of U.S. Strategic Air Force Europe vs. German Air Force*, vol. SRH-013 (Washington, D.C.: Held by AFHSO, June 1945), 82.

⁷⁷⁸ Headquarters VIII Bomber Command, *Bomber Command Narrative of Operations, Day Operation - 22 June, 1943*, (Maxwell AFB, AL: AFHRA, 29 June 1943), #520.332, IRIS 221571, 1.

⁷⁷⁹ Headquarters 94th Bombardment Group, *Mission briefing notes*, in *Bombing Annex, Mission #10, Hüls*, (Maxwell AFB, AL: AFHRA, 22 June 1943), #527.332, IRIS 230240.

value to the war effort would give them confidence in their day' purpose. In addition to forecasts of spotty cloud decks, reports also suggested that the plant's important facilities were meticulously camouflaged, so sighting the target for accurate visual bombing could pose difficulties.⁷⁸⁰

During the mission, typical operational challenges ensued. Ineffective communications by VIII Bomber Command ended up delaying the diversionary force by an hour, rendering it irrelevant. Further, an unusual number of aborted aircraft, including both the leader and deputy leader of the 94th Bomb Group, led to confusion since the briefing had not covered that contingency. General Armstrong reported that the bombing otherwise went as briefed.⁷⁸¹ However, post-mission damage reports for the H÷ls raid would give a smokier impression.

After the lead group botched its aiming, the successive seven bomb groups serviced the target in a compressed five-minute period. Crews of the trailing groups within each Wing tended to express confidence that some group—if not their own—had hit the target, as the plant became increasingly obscured by smoke. For example, the 305th Bomb Group S-2, whose group flew in the middle of the pack, reported “bombing results were particularly good. Large

⁷⁸⁰ Ibid.

⁷⁸¹ Brig Gen Frank A. Armstrong, *Report of Operations, H÷ls, 22 June 1943 to Commanding General, VIII Bomber Command*, 1st Bombardment Wing Headquarters, (Maxwell AFB, AL: AFHRA, 28 June 1943), #520.332, IRIS 221571; Colonel Curtis E. LeMay, *Tactical Reports of Mission, H÷ls, Germany, 22 June 1943 to Commanding General, VIII Bomber Command*, 4th Bombardment Wing Headquarters, (Maxwell AFB, AL: AFHRA, 29 June 1943), #520.332, IRIS 221571.

fires were seen in the area.”⁷⁸² However, the S-2 for the 306th Bomb Group, which had tagged along just behind the 305th, amplified his own group’s questionable success by accentuating the previous groups’: “From all reports it would appear that the bombing of this group was only fair with hits in the extreme north end of the target area. Preceding group scored direct hits in the center of target,” he noted.⁷⁸³

The trend only continued from there. The S-2 for the group flying tail-end Charlie did not specify his group’s results at all, as if it no longer mattered: “Large fire and heavy smoke observed over target. Fighter support spelled out letters ‘U.S.’ with vapor trails. Morale of our crews high after raid.”⁷⁸⁴ This tendency was not missed by the scrupulous and forthright Colonel Curtis LeMay, then commanding the 4th Bombardment Wing. Of his crews’ performance, whose spirited efforts comprised the final three groups across the target, LeMay reported the following up the chain:

*All bombardiers on this mission were convinced they had made a good run on the target. This is doubtful, however, in view of the cloud conditions shown in the photographs and of the elaborate camouflaging known to exist in the target area. The cloud conditions were further aggravated by the smoke developing from the previous Wing’s hits, which shows again that if one Wing or Group has been successful in bombing the target, the groups immediately following may be seriously handicapped.*⁷⁸⁵

⁷⁸² S-2 305th Bombardment Group, *Teletype Report, Mission 22 June 1943*, War Department, (Maxwell AFB, AL: AFHRA, 22 June 1943), #525.332B, IRIS 228285.

⁷⁸³ S-2 306th Bombardment Group, *Teletype Report, Mission 22 June 1943*, War Department, (Maxwell AFB, AL: AFHRA, 22 June 1943), #525.332B, IRIS 228285, 1.

⁷⁸⁴ S-2 94th Bombardment Group, *Teletype Report, Mission 22 June 1943*, (Maxwell AFB, AL: AFHRA, 22 June 1943), #527.332, IRIS 230240, 2.

⁷⁸⁵ LeMay, *Tactical Reports of Mission, Hls, Germany, 22 June 1943 to Commanding General, VIII Bomber Command*, 29 June 1943, 6.

For LeMay, every bomb mattered, and so did the intelligence. He expected perfection of every crew and every intelligence officer as he showed little patience for ignorant performance or blustery reports. He made a habit of reviewing the pre- and post-mission intelligence carefully.



Figure 1. Smoke over the Hüls Synthetic Rubber Plant, 22 July 1943. (Reprinted from Central Interpretation Unit, "Preliminary Interpretation Report No. S.A.359," 24 June 1943, annotated photo No.5.)



Figure 2. BDA Photograph of raid on Hüls. Smoke and steam from the plant frustrated the BDA process. (Reprinted from Central Interpretation Unit, "Preliminary Interpretation Report No. S.A.359," 24 June 1943, annotated photo No.4.)

As it turned out, the 305th Bomb Group's photo-interpretation officer's report and bombardier's plot showed 104 of the group's 180 500-pound bombs as hitting the target, although less than 20 appeared within 1,000 feet of the aiming-point, 15 fell in a field short of the target, and 10 could not be located at all.⁷⁸⁶ The entire pattern appeared offset about 1,000 feet to the left of planned track, but the far-right edge of the bomb pattern had hit dead on the aiming-point. This was all that mattered to the Group's lead bombardier, who

⁷⁸⁶ S-2 305th Bombardment Group, *Photo & Bomb Plotting Report*, 1st Lt Franklin E. Smith, (Maxwell AFB, AL: AFHRA, 22 June 1943), #520.332, IRIS 221571; Headquarters 305th Bombardment Group, *Inclosure "J", Group Bombing Plot and Report*, in *Narrative Report of Operations*, *Field Order No. 153-A*, (Maxwell AFB, AL: AFHRA, 22 June 1943), #520.332, IRIS 221571.

claimed “observers reported bombs hitting directly on the aiming point, the pattern being exceptionally good. This was later confirmed by photographs.”⁷⁸⁷ Crews participating in each raid were motivated not to return to that target, so they were inclined to share others’ credit or exaggerate their feats if it helped to prove overall mission success. Their group intelligence officer’s reports reflected sympathetic optimism. Insofar as crews cared about their accuracy, it only took a few good bombs to validate a mission and boost morale, so the rest of the bombs didn’t matter. For group-level intelligence officers, if bomb bursts could be located in the target area and appeared to hit at least something of perceived value (typically based on pre-raid target intelligence), then there was no reason to question the group’s accuracy or the bombardier’s claims.

⁷⁸⁷ Headquarters 305th Bombardment Group, *Description of Bombing Approach and Dropping Procedure, Mission of 22 June 1943*, Capt Bruce A. Gardner, (Maxwell AFB, AL: AFHRA, 22 June 1943), #520.332, IRIS 221571.

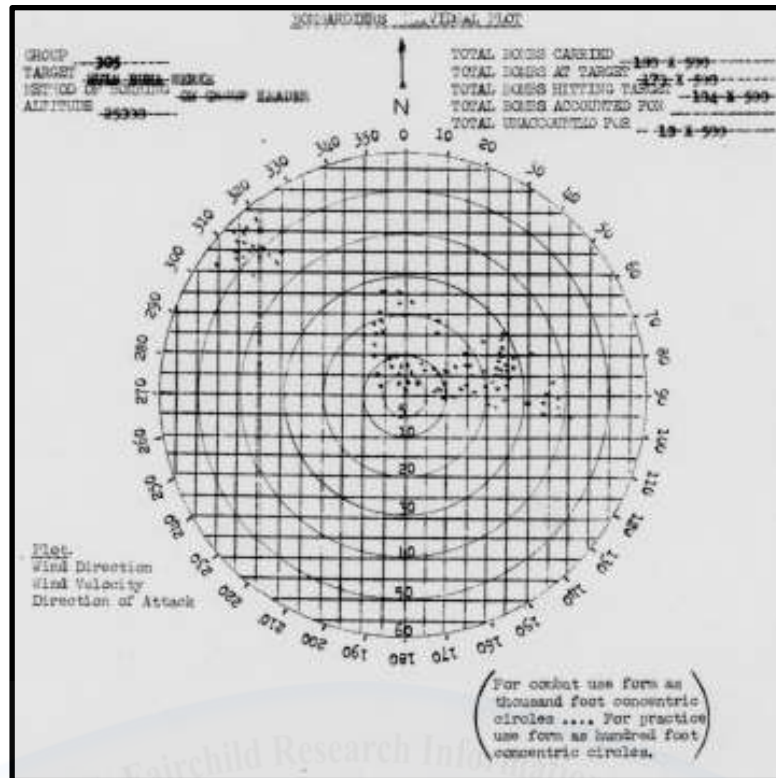


Figure 3. 305th Bomb Group Bombardier's Individual Plot.

(Reprinted from Headquarters 305th Bombardment Group, enclosure "J", Group Bombing Plot and Report, in Narrative Report of Operations, Field Order No. 153-A, (Maxwell AFB, AL: AFHRA, 22 June 1943), #520.332, IRIS 221571.)

Interpretation reports by Medmenham's CIU streamed in two days later carrying a similarly optimistic sense. The CIU's seasoned experts verified the 305th Bombardment Group's claims as they added additional confidence with their review of the entire mission. Preliminary photo-interpretation from the bombers' on-board cameras showed a significant concentration of bombs in the target area from both waves of bombers, including hits on "the main power plant, chemical plants, acetylene plants, and other vital installations."⁷⁸⁸ A Spitfire from RAF 542 Squadron tore overhead a month later, capturing

⁷⁸⁸ Central Interpretation Unit, *Preliminary Interpretation Report No. S.A.359*, 24 June 1943.

outstanding reconnaissance photos at high noon on clear day. The CIU interpreted the high-quality photos and remarked, “a high proportion of the bombs dropped fell within the target,” adding to show consequence, “considerable damage is seen throughout the plant.”⁷⁸⁹ The presence of such value judgements in the interpretation reports is intriguing. *High* compared to what? *Considerable* relative to what? What expectations did the photo-interpreters have in mind, and with whom were they coordinated?

If judged on the ORS’s accuracy standards alone, the Hüls raid might have been considered a failure. Only 50 bombs—less than 4 percent of the total expended—fell within 1,000 feet of the aiming-point, and less than 12 percent fell within 2,000 feet.⁷⁹⁰ By these measures, the raid had failed to meet expectations by an order of magnitude short of those previously set by Brigadier General Sorensen’s probabilities-committee report. However, accuracy issues were inconsequential for this target. Misses over 2,000 feet still had a fair chance of striking essential elements of a target as large as this 541-acre rubber plant.⁷⁹¹ The 1,000’-foot standard developed by the Operations-Research Section’s mathematicians simply did not account for the size and shape of the target.⁷⁹² As it turned out, the bombs dotted a broad swath over

⁷⁸⁹ Central Interpretation Unit, *Interpretation Report No. K.1618*, in *Damage Assessment*, Medmenham RAF Station, (Maxwell AFB, AL: AFHRA, 1 August 1943), #520.365.

⁷⁹⁰ Eighth Air Force, *Bombing Accuracy*, July 1943.

⁷⁹¹ Per the USSBS, “The plant is laid out on a very spacious scale, both war time contingencies and normal fire hazards having been taken into consideration in its planning. It covers a roughly rectangular area of 541 acres, of which about 10 percent is built up.” It was ideal as an area target for a multi-wing attack with a dispersed bomb pattern. See: United States Strategic Bombing Survey, *Huels Synthetic Rubber Plant*, in *No. 128*, Oil Division, (Washington, DC: USSBS, 1947), 16.

⁷⁹² Mathematician G. Baley Price described the ORS process for determining pattern-center

“an area 4.2 miles long and 2.8 miles wide, including a strip about 80 yards wide diagonally through the plant.”⁷⁹³ In this case, quantity compensated for accuracy, and the results appeared to be devastating.

Hüls was a mess. The Germans accounted for nearly every bomb dropped on the previously undisturbed manufacturing community. Although they’d found “386 bombs landed within the plant confines,” approximately 10 percent of them had failed to explode, adding insult to the task of safely clearing debris.⁷⁹⁴ The bombs inflicted human injuries as well. According to plant records, 186 workers perished, and another 1,000 were wounded, primarily due to delays in air raid sirens, inadequate shelter space, and the fact that two bombs unpredictably managed to hit the air-raid shelters.⁷⁹⁵ The Germans were determined not to let this happen again.

Damage to the plant did not remain long. Unbeknownst to the target analysts and photo-interpreters, the Reich considered the Hüls plant vital to its

errors and assessing accuracy from bomb plots. They did not account for target size and shape--only accuracy from the aiming-point. While their process suited their purpose, it is important to consider that accuracy and bomb damage may not correlate as closely for area targets as they do for point targets. Only the bombers' cameras could differentiate which aircraft dropped which bombs. This mattered for accuracy evaluations, but post-strike reconnaissance by the PRU proved more important for assessing the overall effectiveness of the raid. See: G. Baley Price, *A Mathematician Describes His Work as an Operations Analyst with the Eighth Air Force*, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, Winter 1945-1946), #520.310-7, IRIS 220161, 9-12. 8 AF Operational Research Section did acknowledge the importance of optimizing bomb spacing and pattern size for area targets versus “small precision targets,” though this concept was not factored into accuracy assessments. See: Operational Research Section, *Memorandum on Salvo and Intervalometer Releases*, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, 16 September 1944), #520.310v.7, IRIS 220142, 3-8.

⁷⁹³ United States Strategic Bombing Survey, *Huels Synthetic Rubber Plant*, 1947, 33.

⁷⁹⁴ Ibid.

⁷⁹⁵ Ibid., 43.

war economy and prioritized repairs; the plant resumed partial operation after about 40 days, and surveyors later noted, “full production of rubber was reached in six months.”⁷⁹⁶ The Germans also responded by limiting “all traffic behind the front (military and civilian) to a maximum speed of 17 miles per hour in order to save tires.”⁷⁹⁷ If intelligence analysts were aware that the speed restriction was a useful indicator that the Reich was desperate to control its rubber expenditure, then the insight did not appear to inform decision-making for follow-on attacks. But the willingness of the Reich to take such drastic measures also showed it had administrative tools available to ration stocks and limit the impact of the bombs.

Intelligence reports from Arnold’s A-2 staff varied their tune as the summer of 1943 progressed. Captain James Lowe (also a COA participant) submitted an update on the Rubber industry 10 days after the Hüls raid. Interestingly, he was cognizant but undeterred that he was not yet in possession of even preliminary photo-intelligence from this first major attack on the industry. Adding no further explanation, he assumed “total destruction,” and touted, “the loss of this plant for 12 months, which is the time estimated to get it back into production, means that Germany will be deprived of 25,000 to 50,000 tons of synthetic rubber in 1943-1944.”⁷⁹⁸ This was another overly optimistic assertion, especially given the Eighth’s track record up until that point. The Air

⁷⁹⁶ Ibid., 1, 74.

⁷⁹⁷ Ibid., 44.

⁷⁹⁸ Captain James T. Lowe, *Memorandum for General Sorensen, Western Axis Rubber Position 1943*, Committee of Operations Analysts, (Maxwell AFB, AL: AFHRA, 2 July 1943), #187.2, REEL B1997, 2.

Staff, removed by thousands of miles from the nose-searing stench of burning rubber at Hüls, had not considered how the Germans might react.

While Lowe overestimated the bombers' capability to destroy the plant, he compounded the error by underestimating the Germans' recuperative ability. He concluded the Germans would not meet their rubber production requirements by 25 percent into 1944—even without further attack on the Hüls plant as available rubber stocks depleted.⁷⁹⁹ In the case of Lowe's report, it would seem his series of flawed assumptions resulted in the right conclusion from the standpoint of air-campaign strategy, which was not to bother with further attacks on the rubber industry. Lowe added a takeaway to the report, based more on instinct than any evidence he provided, that rubber shortages would not lead to any reduction in German fighting strength, merely "a marked deterioration in both the quantity and quality of rubber tires and other rubberized equipment."⁸⁰⁰ How could Eaker justify the price to his own forces if the result might be merely a nuisance to the enemy? As it were, Lowe did not have enough information to assess that the Hüls plant recovered at break-neck speed, as Germany's excess-rubber stocks were already down to only about a month.⁸⁰¹ Despite Lowe's argument, if the rubber industry was an important target, not just a costly sideshow to attacks on the aircraft industry, then further attacks were necessary and urgent—not only on other rubber plants but on the Hüls plant as well.

⁷⁹⁹ Ibid.

⁸⁰⁰ Ibid.

⁸⁰¹ United States Strategic Bombing Survey, *Huels Synthetic Rubber Plant*, 1947, 4.

Arnold's A-2 (still Brigadier General Sorensen) attempted to make this point in September as he fought to re-energize rubber-industry attacks. Sorensen was, at that time, also serving as the senior military member in COA meetings regarding Japanese industries, including rubber, which was undoubtedly on his mind.⁸⁰² Sorensen argued, "further attacks on other rubber plants may be expected to yield dividends in the form of actual curtailment of essential uses, but only if made before the effects of the Hüls raid have worn off."⁸⁰³ He, along with Lowe, had been part of the committee that pushed the rubber industry as a priority target since 1942. Sorensen's argument proved too late to influence Eaker. The 22 June raid by Eighth Air Force was the last planned attack on Hüls for 18 months and the rubber industry—vulnerable as it may have been—was never seriously threatened for the remainder of the war.⁸⁰⁴

Despite the raid's positive results and some inconsistent encouragement to exploit its success, Eighth Air Force leadership did not emphasize the rubber industry for good reason. Indeed, additional attacks may have kept the plant out of operation or forced the Germans to commit further resources into the

⁸⁰² *Meeting Minutes*, War Department, (Maxwell AFB, AL: AFHRA, 18 September 1943), #118.151-5B, IRIS 110551, 1.

⁸⁰³ Assistant Chief of Air Staff (A-2), *An Appraisal of Accomplishments and Potentialities*, in *The Strategic Aerial Bombardment of Europe*, USAAF, 1, (Maxwell AFB, AL: AFHRA, 10 September 1943), #142.042-11v1, IRIS 115255, 25.

⁸⁰⁴ This was one instance where the USSBS authors may have violated their imperative to conduct an "impartial and expert study," or they otherwise exposed a degree of ignorance of air-campaign strategy through their harsh criticism, as the survey team later cited far more than simply failures to evaluate aspects of the production process at Hüls: "It is apparent that erroneous basic intelligence on the German rubber situation resulted in wrong decisions regarding the importance of the synthetic rubber plants as a vital industry, and also their inter-relationship with other vital industries. They offered an effective target system, easily identified, vulnerable, and slow to repair." See: United States Strategic Bombing Survey, *Huels Synthetic Rubber Plant*, 1947, 33, 75.

rubber industry that were more useful elsewhere. But as Lowe aptly noted, such attacks were unlikely to have any appreciable impact on the German armed forces. Attacks on rubber may have increased in utility later in the war as the Eighth's bombing capacity increased. However, in the fall of 1943, as the Combined Chiefs shuddered over the thought of conducting a cross-Channel invasion without a guarantee of air superiority, other targets had to come first.

Gunships and Negative Aims

If Eaker was going to sustain his planned six missions per month, he knew he needed to decrease the cost of each raid (along with his hopes for increased reinforcements from Arnold).⁸⁰⁵ Long-range fighters were not yet available, and he still believed in the defensive primacy of the bomber, so he'd anxiously awaited testing in the European theater for the YB-40—a B-17 modified exclusively as a gunship to protect bomber formations. Eaker had dispatched 11 YB-40s along with his 1st Division on their raid on Hülse. The gun-ship bombers contributed to claims of 26 kills and another 18 probable kills by bombers against German fighters, and they all reportedly overflowed the target area, although not necessarily in tight formation.⁸⁰⁶ Eaker expected better. On 29 June, he wrote to Major General Barney Giles, who'd taken over as Arnold's Chief of Air Staff, to express his disappointment. "I had great hopes for that airplane," Eaker groaned, "and I was most loath to render a derogatory

⁸⁰⁵ Headquarters Eighth Air Force, *Summary by Target Categories*, in *Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: First Phase*, (Maxwell AFB, AL: AFHRA, 1 July 1943), #168.61-10, IRIS 124347.

⁸⁰⁶ S-2 1st Bombardment Wing, *Teletype Report, Mission 22 June 1943*, War Department, (Maxwell AFB, AL: AFHRA, 22 June 1943), #525.332B, IRIS 228285.

report.”⁸⁰⁷ The plane was too heavy and dirty with the additional drag of machine-gun modifications to hang in formation with the bombers.

Making matters worse, Eaker discovered that his bomber crews did not want to fly the YB-40 because the bombardier position had been removed and the bomb bay filled with bullets. Bomber crews derived their identity from placing steel on target, not solely in spraying their 50-calibers at enemy fighters, so the conversion disrupted their morale. Group intel officers seemed to adopt their aircrews’ sarcasm. An S-2 included in a formal mission report after a raid on the Nitrate Works at Heroya, Norway, that a YB-40 had failed to bomb the target “as it carries no bombs.”⁸⁰⁸ The YB-40 was an idea that seemed brilliant on the drawing board, but struggled in operational and organizational reality.⁸⁰⁹

Eaker’s force was meager, but that the preponderance of effort still oriented toward targeting submarine installations warranted investigation. Were these attacks successful? If so, what did they accomplish? And at what cost?

Assessments emanating from Eaker’s headquarters were optimistic.

Summarizing the attacks on submarine bases, his official report stated, “much physical damage has been done to all of these bases and it is increasingly

⁸⁰⁷ Maj Gen Ira C. Eaker, *Letter, Eaker to Giles*, (Washington, DC: NARA, 29 June 1943), AAG 312.1-H, Operations Letters, RG 18.

⁸⁰⁸ 305th Bombardment Group, *Teletype Report, Section 'A' to Commanding General 1st Bomb Wing*, 30 July 1943, Of note, the S-2 went on to capture his unit’s mission success, relaying that a bomb-bay observer saw a single bomb result in a “large sheet of deep red flame 200 feet square and 201,000 feet high,” and he corroborated their claims of good hits with photographs. Some reports matched sarcasm with hyperbole.

⁸⁰⁹ Eaker continued to include YB-40s on missions throughout his tenure at Eighth Air Force in the fall of 1943.

difficult for the enemy to turn around their submarines on scheduled time,” adding without further evidence, “there is no doubt whatsoever that they have contributed materially to the marked diminution of the U-boat effort and the resultant reduction in our shipping losses.”⁸¹⁰ The report may have seemed hyperbole in Washington, because any direct linkage between visible facility damage and lost U-boat production had yet to be proven (and never was).⁸¹¹ If Eaker truly desired to shift his focus from the U-boats, the spin on these reports did not show it.

Raid after raid, the Luftwaffe took its toll. Eaker started 1 April on pace to build his projected CBO bomber force, but he closed out June with just 806 of an expected 944 bombers for the second phase.⁸¹² This shortage consumed Eaker’s attention. In a sense, Eaker was haplessly caught between *the devil* of the Luftwaffe and *the deep blue sea* of U-boats. He believed that he needed to build up a larger force before he could get further at Germany’s vital industrial centers, much less sustain raids that would help to attrit the Luftwaffe and disrupt the German aircraft industry. However, the unproductive attacks on U-boat targets continued to bleed down his bombers and crews faster than he could build them up. Further, Eaker’s personal desire to sense his air

⁸¹⁰ Eighth Air Force, *Bombing Accuracy*, July 1943, 3.

⁸¹¹ As discussed in further detail below for Blohm and Voss, post-war surveyors at Howaldtswerke found “serious damage was caused by 500-lb and 1,000-lb bombs to principal buildings, but at no time was production stopped or greatly impeded. This can be attributed to the excess amount of structures, stock and equipment possessed by the organization, in relation to the production requirements.” See: United States Strategic Bombing Survey, *Howaldtswerke Shipyards at Hamburg Germany*, in *Plant Report No. 50*, Physical Damage Division, (Maxwell AFB, AL: AFHRA, August 1945), #137.311-50, IRIS 113461, 27.

⁸¹² Eighth Air Force, *Effort Against Individual Targets*, July 1943.

campaign's success crossed with pressure from above to engage in these submarine-industry attacks—still second in the Allies' targeting priority only to aircraft. The resulting conflict left him clinging to the positive bits of feedback he received from his intelligence sources.⁸¹³

By June 1943, however, the EOU economists noted “it was clear that the attacks on production and bases were making no significant contribution to anti-submarine warfare,” so they sought “to remove them [submarine targets] from top priority and to clear the way for attack on the main target systems.”⁸¹⁴ Meanwhile, the economists had gained confidence and information resources, so they added an additional “systematic comparison of the attractiveness of various target systems,”⁸¹⁵ which they would use to push alternative targets.

At about the same time, they drafted a *Handbook of Target Information* and socialized it with analysts back in Washington.⁸¹⁶ The idea was to consider both “the importance to the enemy of each potential target,” as well as “our ability effectively to destroy it.”⁸¹⁷ The upshot was that targets too vast or too difficult to attack would be purged from the economists' analytic grind, even if

⁸¹³ Robert Jervis' explanation of the cognitive dissonance phenomenon is apt to Eaker's mindset: “First, reducing dissonance can involve changing evaluations of alternatives, thus altering desires themselves. Second, selecting and interpreting evidence so as to confirm that one's decision was wise may not conform to one's desires.” In Eaker's case, he is affirming his decision to comply with the futile bombing of submarine bases by latching onto positive assessments thereof, which arguably reduced his dissonance with respect to the alternative--his need to destroy the Luftwaffe. See: Jervis, *Perception and Misperception in International Politics*, 382-383.

⁸¹⁴ Rostow, *Rostow Report*, ca. 30 April 1945, 58.

⁸¹⁵ *Ibid.*, 42.

⁸¹⁶ Chandler Morse, *Letter, Morse to Perera*, Office of Strategic Services, (Maxwell AFB, AL: AFHRA, 22 May 1943), #118.042-2, IRIS 110538.

⁸¹⁷ Enemy Objectives Unit, *Handbook of Target Information*, May 1943, 2.

a target's connection to the German war effort could be immediate and significant such as the electric power grid. The downside was that assumptions about the size, accuracy, and destructive capability of the available bomber force would have to be captured thoughtfully and revisited continuously.

The handbook also included a new target-selection model that could be summarized as: *high wastage + high production = high value*. They argued:

*Equipment like airplanes which are wasted rapidly and in which monthly production is large in relation to strength in combat units, is a more desirable objective of attack than items like range-finders, in which annual production forms only a small increment to total stocks in use.*⁸¹⁸

For example, the Luftwaffe's high demand for a fresh supply of airplanes increased that industry's sensitivity to supply interruptions. This was not true of submarines. Since relatively few submarines were in production at any time and submarine-wastage rates were much lower than for aircraft, submarine bases were less lucrative objectives in terms of near-term benefit for the effort expended. Even if the attacks on submarine yards and bases had been more successful, "the effects will be long delayed."⁸¹⁹ The economists' rationale had side-stepped the ongoing debates over submarine-yard vulnerabilities and equipped them to push harder for attacks on German aircraft-assembly plants.⁸²⁰

⁸¹⁸ Ibid., 3.

⁸¹⁹ Ibid.

⁸²⁰ He expressed to Arnold that he was increasingly concerned about German innovation in air-to-air attacks that could "increase greatly the cost of our bombing," and he sought to increase attacks on fighter factories before "the enemy has discovered a way of making our bombing uneconomical."

Eaker's thinking the following month seemed reflect the economists' viewpoint. He had become particularly interested in attacking aircraft factories while he was concerned about his losses. Eaker expressed to Arnold that he was increasingly concerned about German innovation in air-to-air attacks that could "increase greatly the cost of our bombing," and he sought to increase attacks on fighter factories before "the enemy has discovered a way of making our bombing uneconomical."⁸²¹ Hughes may have been the conduit, but the EOU's economists appeared to have Eaker's ear as they worked out the cost-benefit analysis of his raids.⁸²²

Unfortunately, the economists had assumed away any possibility that the Reich might disperse its aircraft-production industry. That is, until Charles Kindleberger, pushing his argument like a lawyer rather an economist, presented in his own words, "evidence for the jury, together with a suggested verdict," that the Reich had surreptitiously moved FW 190 production from Bremen by June.⁸²³ To make his case, he assembled his evidence into 15 separate lines of reasoning, and backed them with 45 significant intelligence reports and 29 ground-intelligence reports, all involving the same factory over a

⁸²¹ Maj Gen Ira C. Eaker, *Letter, Eaker to Arnold*, Manuscript Division, Eaker Papers, Box 16, (Washington, DC: Library of Congress, 18 July 1943).

⁸²² Meyer and Rowan note an institutionalized tendency for goals, procedures, and policies to be viewed as "analogous to the vocabularies of motive used to account for the activities of individuals." As an example, they offer, "some can say that the engineers will solve a specific problem or that the secretaries will perform certain tasks, without knowing who these engineers or secretaries will be or exactly what they will do." As to the EOU, Eaker received air intelligence marked by standards of efficiency from the economists. See: Meyer and Rowan, "Institutionalized Organizations: Formal Structure as Myth and Ceremony," 349.

⁸²³ Charles Poor Kindleberger, *Letter to Chandler Morse and Phil Coombs*, Office of Strategic Services, (Maxwell AFB, AL: AFHRA, 30 June 1943), #118.04-12, IRIS 110422.

span of 31 months.⁸²⁴ While the quest for research perfection was commendable for its accuracy, an earlier call based on intuition might have conserved considerable resources—at least the 26 AAF bombers and the crewmembers lost when they attacked the Focke-Wulf factory at Bremen two months earlier.⁸²⁵

The economists were likewise not content to fully commit to winning the air-superiority fight first. Without specifically referencing Clausewitz, Rostow admitted, “since the attack on aircraft was essentially a defensive action, designed to achieve a condition favorable to later air and ground exploitation, it was conceived proper to devote some part of our effort to more positive attack affecting other finished armaments.”⁸²⁶ The economists could analyze the kill ratios and cost-benefit of bombers lost to targets struck, but they did not understand air superiority as either a necessary precondition or a positive aim for the air campaign—not just a potential ground campaign, a target that drives enemy behavior and imposes further costs as it allows further offensive action. As a result, the EOU set Eaker’s Eighth up to smash his bombers against the Luftwaffe in attacks against ball-bearing, aircraft-assembly, and vehicle plants, not because these were particularly effective at dislocating the German economy or even winning air superiority (due to plant dispersion), but

⁸²⁴ Enemy Objectives Unit, *F.W. 190 Production at Bremen*, (Maxwell AFB, AL: AFHRA, 30 June 1943), #118.04-12, IRIS 110422, 1, Appendix A, Appendix B.

⁸²⁵ Assistant Chief of Air Staff (A-2), *Bremen (Neuenland): Focke Wulf Plant*, in *Reports of Attacks on Axis Targets in Europe*, USAAF, (Maxwell AFB, AL: AFHRA, 12 September 1943), 142.035-7, IRIS 115060.

⁸²⁶ Rostow, *Rostow Report*, ca. 30 April 1945, 58.

because a mathematical formula seemed to indicate such attacks might have short-term results on German materiel production—provided the enemy behaved as expected. In any case, the economists' underlying logic was straying from that of ACTS doctrine, but it was not yet influential enough to prevent U-boat attacks altogether.

A Firestorm of Post-Mission Assessments

The 25-26 July attack on Hamburg's shipyards served as another case in point of these deceptively futile U-boat attacks. Blohm and Voss was the largest submarine shipyard in Germany (comparable in size to that of Newport News, Virginia) and reportedly produced almost 18 percent of German U-boats.⁸²⁷ The RAF had launched six small, ineffectual attacks on the dockyards and the city area of Hamburg during 1940-41, but this was to be the first large-scale, coordinated day-night *Katastrophe* raid by the RAF and AAF on the city.⁸²⁸ Harris' Bomber Command unleashed "the Hamburg firestorm" with four attacks on the city between 24 July and 2 August, though the concentration portion on Blohm and Voss shipyards fell on the night of 24/25 July by the RAF and the day after by the AAF.⁸²⁹ The first night, Harris' force of 739 bombers dropped more than 349,000 incendiary bombs (a mix of 4- and 30-

⁸²⁷ United States Strategic Bombing Survey, *Blohm and Voss Shipyards, Hamburg, Germany*, ed. Submarine Branch Munitions Division, 2nd ed., No. 94 (Washington, DC: USSBS, 1947), 1.

⁸²⁸ Assistant Chief of Air Staff (A-2), *Hamburg: Blohm and Voss and Howaldts - U-Boat Yards*, in *Reports of Attacks on Axis Targets in Europe*, USAAF, (Maxwell AFB, AL: AFHRA, 12 September 1943), 142.035-7, IRIS 115060; United States Strategic Bombing Survey, *Blohm and Voss Shipyards, Hamburg, Germany*, 19.

⁸²⁹ Richard G. Davis, *Bombing the European Axis Powers: A Historical Digest of the Combined Bomber Offensive, 1939-1945* (Maxwell Air Force Base, AL: Air University Press, 2006), 133.

pounders) on the city, then Eighth Air Force complemented the onslaught with attacks on the port and industrial areas, over the next two days.⁸³⁰ Sixty-eight American bombers dropped 144 tons of bombs on Blohm and Voss on the 25th and 54 bombers dropped another 97 tons from on neighboring Howaldtswerke shipyards on the 26th, using almost entirely 500-pound bombs.⁸³¹

Despite the effort against Blohm and Voss' expansive 145 acres with its 112 structures, raid reports could claim visible damage to only 10 buildings, 2 dry docks, and a few vessels.⁸³² A photo-intelligence officer assigned to the 1st Bombardment Wing acknowledged only four buildings struck, though he noted each of them as "direct hits."⁸³³ Despite the anemic photographic evidence, Arnold's intelligence staff later concluded the combined attacks, along with the other attacks by the RAF against the city itself, had cut production during the period from July to November by about half (only 15 of 29 possible U-boats were produced by the yard).⁸³⁴

⁸³⁰ United States Strategic Bombing Survey, *Blohm and Voss Shipyards, Hamburg Germany*, 8 October 1945, Table 1, attack data, sheet 2.

⁸³¹ Assistant Chief of Air Staff (A-2), *Hamburg: Blohm and Voss and Howaldts - U-Boat Yards*, 12 September 1943; According to USSBS records, the RAF's smaller night raid on 2/3 August also had some direct impacts on Blohm and Voss, though certainly the RAF considered all four of their attacks on Hamburg during this period to have effected German workers. United States Strategic Bombing Survey, *Blohm and Voss Shipyards, Hamburg Germany*, 8 October 1945, Table 1, attack data, sheet 2; United States Strategic Bombing Survey, *Howaldtswerke Shipyards at Hamburg Germany*, August 1945, 22.

⁸³² Assistant Chief of Air Staff (A-2), *Hamburg: Blohm and Voss and Howaldts - U-Boat Yards*, 12 September 1943. United States Strategic Bombing Survey, *Blohm and Voss Shipyards, Hamburg Germany*, 8 October 1945, 4-6.

⁸³³ Headquarters 1st Bombardment Wing, *Immediate Interpretation Report, No. 9a*, in *26 July 1943, Hannover - Hamburg*, 2nd Lt. George Welter, (Maxwell AFB, AL: AFHRA, 27 July 1943), #525.332, IRIS 227589.

⁸³⁴ AC/AS Intelligence, *The Strategic Aerial Bombardment of Germany - Submarines*, 15 September 1943, Tab A.

The British Ministry of Economic Warfare released a report on 12 August 1943, though its report attributed success at Hamburg to the RAF's style of attack. The report conceded that "the amount of active shipping in the port at the time of the first raid is not known," but that "complete evacuation of active shipping" was surely of "the most important" results.⁸³⁵ Turning the focus of success toward the RAF, the MEW economists argued, "although the direct damage sustained by the shipping in port and by port handling facilities is severe, the primary cause of the evacuation probably lies in the complete disorganization of the life of the city, the disruption of local and through communications, the destruction of public utilities, dwelling houses and food stocks necessary for the maintenance of the port community."⁸³⁶ From the point of view of the MEW economists, the key implication of this successful onslaught on Hamburg had nothing to do with U-boats, but to place even "further strain" on the other German ports of Emden and Bremen.⁸³⁷ The MEW sought to reinforce blockade-style victory through economic dislocation, so choking off German sea lines was worthwhile critical focus.

The Committee of Operations Analysts was repulsed at wasting effort against such unprofitable targets and had cast the submarine yards down the list to seventh priority. Just a couple of months earlier, the committee released a report brandishing their conclusion that even if all Axis U-boat production

⁸³⁵ Ministry of Economic Warfare, *M.E.W. Intelligence Weekly*, (London, England: AFHRA, 12 August 1943), #512.607A, IRIS 211130, 3.

⁸³⁶ Ibid.

⁸³⁷ Ibid.

could be reduced 80 percent by 1 October 1943, there would still be 443 of a possible 455 U-boats operating in April of 1944.⁸³⁸ This was because post-production U-boats took seven months for “testing and training” after they left the construction yards, and the pipeline at that time was healthy.⁸³⁹ Thus, attacks on construction yards could not impact near-term numbers of operating U-boats even if the attacks were successful. In short, challenges presented by assessors were threefold: post-raid assessments of submarine shipyards and bases often revealed deceptively enticing damage to irrelevant structures, the effects of bombing upon U-boat production and their associated towns was speculative or due to other factors, and the time frame necessary even for best-case results to mature had rendered the entire endeavor moot.⁸⁴⁰

In summary, the various organizations had offered assessments limited to their own point of view, none of which were particularly focused on air

⁸³⁸ Col Guido R. Perera and Lt Col W. B. Leach, *Memorandum to General Fairchild, Timing of Economic Effect of Attacks Contemplated by Eighth Air Force Plan: Submarines*, Committee of Operations Analysts, Tab 64, (Maxwell AFB, AL: AFHRA, 5 May 1943), #118.04-4 V.1, IRIS 110407, 2.

⁸³⁹ Ibid.

⁸⁴⁰ If production capacity had really dropped so precipitously at Blohm and Voss, it was certainly not a proven result of the AAF’s attack on the shipyard, much less the indirect result of Harris’ de-housing the Hamburg’s workers. Surveyors later found “widespread superficial damage did not cause a stoppage in production” at Blohm and Voss or other similarly robust U-boat production yards. By the Spring of 1943, the Germans had already planned to shift U-boat production into bomb-proof facilities elsewhere; unbeknownst to the Allies, the vulnerable but otherwise “excellent facilities” at Blohm and Voss were to be abandoned, hence the curtailment in production. If the raids could be considered successful, it was due to their second-order effect on enemy strategy, which eventually resulted in less-efficient, but highly resilient, production methods. See: United States Strategic Bombing Survey, *Blohm and Voss Shipyards, Hamburg Germany*, 8 October 1945, 33. United States Strategic Bombing Survey, *Valentin Submarine Assembly Plant, Farge Germany*, in *Plant Report No. 47*, Physical Damage Division, (Maxwell AFB, AL: AFHRA, 26 October 1945), #137.311-47, IRIS 113458, appendix i. Also, United States Strategic Bombing Survey, *Blohm and Voss Shipyards, Hamburg Germany*, 8 October 1945, 32.

superiority first. For Eighth Air Force, the cost of training crews, generating aircraft, and fighting to reach a target only to drop mostly ineffective bombs was too high to justify sustaining the offensive, even given some of the overly optimistic assessments. To get 68 bombers across the target at Blohm and Voss, the devil claimed 15.⁸⁴¹ If Eaker's dilemma between the Luftwaffe and U-boat attacks, along with an increasing proportion of losses with deeper attacks into Germany, had not yet culminated his frustration, perhaps another demand from Washington would.

An abrasive argument. Among the targets necessary to achieve air superiority, grinding wheels was decidedly not one. Nevertheless, Arnold continued to meddle with target selection from Washington, due in part to his impetuous personality and the relentless influence of his advisory council, but also to the COA's swelling stature as his analytical brain trust. Newly emboldened after the Combined Chiefs had signed the final CBO plan, COA analysts weighed in because Hughes (and the EOU) had eliminated attacks on precision grinding-wheel plants from Eaker's plan. As a target system, the grinding-wheel plants had been the COA analysts' fourth priority.⁸⁴² To COA members, whose organization's survival was by then all but assured for the remainder of the war, securing support for their research was a matter of pride.⁸⁴³ An opportunity to force Eaker's hand to attack grinding-wheel plants

⁸⁴¹ Assistant Chief of Air Staff (A-2), *Hamburg: Blohm and Voss and Howaldts - U-Boat Yards*, 12 September 1943.

⁸⁴² Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 50-51.

⁸⁴³ Of note, barely two weeks after COA had submitted its final report on the Western Axis to

would also reinforce the agenda they shared with Arnold to seek out the catastrophic raids; if successful, quick victory could be attributed to the COA's collective genius along with Arnold's omniscient view from Washington—or so they thought.⁸⁴⁴ Unfortunately, as with ball bearings, the analysts' push to attack grinding wheels would perpetuate the tendency in Washington to overestimate the bomber's ability to attack such targets, and to underestimate the Germans' ability to cope.

The committee's lawyers-turned-intelligencers cornered Mr. Isaiah Frank, the single Washington-based OSS abrasives-industry expert who had weighed in with evidence against recommending attacks on grinding wheels. Months prior, Frank had provided a statement, based on "conversations with technical men... It appears that grinding wheel plants do not constitute profitable targets, because, with the exception of the hydraulic presses, the major apparatus can be constructed in about a month."⁸⁴⁵ This view had undercut the committee's argument to bomb this industry because it meant Germany could bounce back too quickly. The committee offered him a chance to change his testimony.

Arnold, he tasked Gates to have them study targets in Italy and Japan, then to "make a continuing study of the Strategic targets located in Germany and occupied Europe." It was clear the committee members now had job security. See: H. H. Arnold, *Memorandum to Assistant Chief of Staff, Management Control, Subject: Analysis of Strategic Targets in Italy*, War Department, Tab 23, (Maxwell AFB, AL: AFHRA, 23 March 1943), #118.02v2, IRIS 110403.

⁸⁴⁴Perera states in COA's official history that Colonel Cabell (from his seat on Arnold's advisory council) asked the committee to reexamine Grinding Wheels after he participated in Eaker's planning discussions. What is remarkable in this episode is the fervor with which the team's civilians acted on the impulse to steer the background research. See: Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 51.

⁸⁴⁵ Isaiah Frank, *Revised Statement on Grinding Wheel Plants and Objectives*, War Department, Tab 19, (Maxwell AFB, AL: AFHRA, 22 January 1943), #118.02v2, IRIS 110403.

As one of the COA's lawyers tells the story, Mr. Frank admitted—under the pressure of interrogation—that he “had never personally contacted the individuals referred to in [his] memorandum,” and that his statement was based on single phone call involving “narrow hypothetical questions” with one expert.⁸⁴⁶ Embarrassed, he recanted his opposition to the target. The subtle inaccuracy in Frank's internal office memorandum may have been inconsequential to the COA's grinding-wheel report itself, but Frank's earlier slip-up provided the committee's lawyers with probable cause to re-attack Eaker with a modified report.

The COA team then re-interviewed other abrasives-industry experts, who unsurprisingly verified the importance of their own industry as “a target of the highest economic priority,” then the committee added for clarity:

*Mr. Frank's question referred to one kiln. If you knock out the dozen or fifteen kilns at a plant like Precision Grinding Wheel Company or the Abrasive Company, it would take three to four months to get them back under the best conditions.*⁸⁴⁷

When it came to expert witnesses, the way questions were asked and to whom they were asked could result in completely different conclusions. In this case, the committee found the expert they sought, and he provided the opinion they expected.

Ignoring written protests from the EOU's Kindleberger, who contended

⁸⁴⁶ Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 51. Also, R. F. Robbins, *Memorandum as to Conversation with Mr. Frank of Office of Strategic Services and his Memo with Reference Thereto*, War Department, Tab 26, (Maxwell AFB, AL: AFHRA, 7 June 1943), #118.02v2, IRIS 110403.

⁸⁴⁷ Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 53.

differences over both vulnerability and recoverability of grinding wheels as targets, the COA ultimately pitched a supplemental report to Arnold, which even the analysts admitted, “did not materially differ from that of the original.”⁸⁴⁸ General Arnold gladly sent Colonels Perera and Leach forward to meet with Eaker on 1 July, bearing a memorandum he’d personally signed. Arnold directed Eaker to acknowledge the committee’s “further study...that there should be a reconsideration of grinding wheel plants as a target.”⁸⁴⁹ This was Arnold’s subtle way of increasing the weight of his thumb on Eaker’s plans.

Eaker was incensed. Just two weeks earlier, Arnold had sent a scathing missive accusing Eaker of mismanaging his force in three areas, specifically: “leaning over backwards trying to get 100 percent perfect planes when 90 percent would do the trick,” that Eaker spent time and manpower modifying aircraft with changes that Arnold did not feel were “absolutely necessary,” and that Eaker arbitrarily held partial crews together such that “when a plane is shot up the whole crew is knocked out.”⁸⁵⁰ Eaker fired back that German fighter tactics “could increase greatly the cost of our bombing,” as he pled with Arnold to stop diverting his bombers from attacking German fighter production.⁸⁵¹ In short, Arnold blamed Eaker for shortfalls in operational

⁸⁴⁸ Ibid.

⁸⁴⁹ H. H. Arnold, *Memorandum for General Eaker: Supplementary Data on Abrasives Industry in Axis Europe*, Manuscript Division, Eaker Papers, Box 16, (Washington, DC: Library of Congress, 1 July 1943).

⁸⁵⁰ H. H. Arnold, *Letter, Arnold to Eaker*, Manuscript Division, Eaker Papers, Box 16, (Washington, DC: Library of Congress, 15 June 1943).

⁸⁵¹ Maj Gen Ira C. Eaker, *Letter, Eaker to Arnold*, Manuscript Division, Eaker Papers, Box 16,

readiness as Eaker's frustrations mounted with the Germans as well as with Arnold.

When Arnold's analysts, Perera and Leach, showed up in Eaker's office and slapped their familiar grinding-wheel intelligence onto his desk, Eaker snapped. To Eaker, these gentlemen represented and facilitated Arnold's impulsive micro-management. First, he held them accountable for diverting his desperately needed bomb groups to support the upcoming Ploesti mission, although the committee members conceded only to helping plan the targets. They were stunned by Eaker's outburst: "Damn it Perera, you are stealing my air force. I don't like it!"⁸⁵² The COA's *modus operandi* had been to press its agenda up to the point of receiving pushback, but never to cross the line. In a draft letter to their champion back on the Air Staff, Brigadier General Gates, they reacted defensively: "He seemed to feel that we were responsible for that project!!!!"⁸⁵³ Eaker wasn't particularly interested in listening to them or in targeting grinding wheels, for that matter. The General retorted that any additional objectives would require resources he didn't have.⁸⁵⁴

(Washington, DC: Library of Congress, 12 July 1943).

⁸⁵² Perera, *Memoirs: Washington and War Years*, 1973, 121.

⁸⁵³ Guido Perera addressed Eaker's frustrations with Colonel Smart and his association of COA with other projects advanced by Arnold's advisory council. All four exclamation points are included in Perera's original. This was an uncharacteristic break from Perera's typically formal writing style of COA's history. Perera, *Memorandum for Brig Gen Gates*, 15 July 1943.

⁸⁵⁴ Of note, post-war analysis by "Possum" Hansell and Albert Speer later criticized Eaker's resistance. Hansell, who'd dismissed grinding wheels in drafting Eaker's plan, reflected, "we operating people in Eighth Air Force... were at fault in passing over this target system"; Albert Speer felt "destruction of these [eight] factories would have halted production for a year." The USSBS was equivocal, arguing that "a concerted attack on the abrasive grinding wheel industry would have called forth a full mobilization of the German economic organization to put counter measures into effect," which would have consumed considerable resources, but mitigated long-term impact on production. In other words, the outcome might have been similar to attacks on

The fact is, these types of machines were difficult to destroy, Eighth Air Force lacked quality intelligence products about the industry, and substitutions were possible.⁸⁵⁵ More importantly, however, it was too little too late to push what seemed another distraction from the more pressing imperative to engage the Luftwaffe, and its planes were killing Eaker's crews by the dozen. Meanwhile, Perera and Leach had cashed in any previous credibility they had established with Eaker with their demanding approach, which seemed to reflect Sorensen's style as Arnold's A-2. Perera and Leach were two lawyers acting like lawyers, not targeting experts.

Eaker craftily resolved the argument by suggesting the RAF might attack the plants with their Mosquito bombers instead. Then he left the COA emissaries, in their own words, "standing by awaiting word to appear and present our case" to the British.⁸⁵⁶ While the various analytical organizations each marketed their own brand of information toward nominating targets, assessing bombing performance, and solving Eaker's (or Arnold's) problems, none had yet offered to look at the progress of his air campaign as a whole. He hadn't asked for it.

the rubber industry—not likely to contribute directly to the air-superiority fight when it was needed most. Criticism aside, Eaker was short on resources to support the gambles that seemed to make sense in Washington. See: Hansell, *The Strategic Air War Against Germany and Japan: A Memoir*, 130-131. United States Strategic Bombing Survey, *The German Abrasives Industry*, ed. Equipment Division, Second ed., No. 51 (Washington, DC: USSBS, 1947), 24-25. Perera, *Memorandum for Maj Gen Eaker*, 30 January 1943.

⁸⁵⁵ Hansell, *The Strategic Air War Against Germany and Japan: A Memoir*, 130-131. United States Strategic Bombing Survey, *The German Abrasives Industry*, 24-25.

⁸⁵⁶ Perera, *Memorandum for Brig Gen Gates*, 15 July 1943. Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 53.

Chapter Seven: “The Appearance of the Bottom of the Barrel”

The appearance of the bottom of the barrel under present conception of requirements of military and civil man-power requirements is beginning to force serious consideration on the strength of the War and Navy Departments and directly on the strength of the Army Air Forces...

...Here in Washington, we have many agencies receiving data on the results of your operations but there is no single office which can answer the general question, ‘What is the overall effectiveness of the combined bomber offensive?’⁸⁵⁷

—Brigadier General L. S. Kuter to Eaker, 6 July 1943

Any Air Force Commander operating against the enemy is primarily concerned with the effect his bombing has on the target he sends a force to destroy. If they destroy that target he will never willingly report the bombing as other than superior...⁸⁵⁸

—Major General Ira C. Eaker, 15 September 1943

As Eaker concluded his first phase of the CBO in June (as he reported, not based on the CCS signature on Pointblank), the War Department finally met with the reality of severe manpower concerns. What seemed separate challenges, those of raising, equipping, and transporting America’s forces, were, in fact, all tied to the limits of available American manpower. The original Victory Plan, as directed by Roosevelt in 1941, had called for an Army of 8.8 million troops, assembled into a bewildering 213 divisions; of these, 61 were to be armored and another 61 of mechanized infantry.⁸⁵⁹ Equipping a force of that

⁸⁵⁷ Laurence S. Kuter, *Personal Letter: Kuter to Eaker*, War Department, (Maxwell AFB, AL: AFHRA, 6 July 1943), #187.1-18, IRIS 135275.

⁸⁵⁸ Eaker, *Letter, Eaker to Giles*, 15 September 1943.

⁸⁵⁹ Gropman, *Mobilizing U.S. Industry in World War II: Myth and Reality*, 41-43.

magnitude was a colossal undertaking. Assumptions underlying these original requirements were the possible collapse of the Soviet counter-offensive, a 273-Group Air Force potentially still locked in an ongoing battle for air superiority, a massive and continued Lend-lease program for America's allies, and the additional manpower necessary "to service its lines of communications extending around the world."⁸⁶⁰ As overstretch became apparent with waxing Congressional interest, Marshall chartered a series of committees to reevaluate the scale of the military program. The American "arsenal of democracy" was proving finite.⁸⁶¹

In April 1943, Colonel William W. Bessell had led a committee to report a "Survey of Current Military Program," which adjusted troop requirements down to match the Presidential-approval level set in 1942 for 8.2 million, and of equal importance, it reduced the number of divisions to 155.⁸⁶² But this wasn't enough. Another committee, chaired by Colonel Ray Maddocks of the Army's Operations Planning Division (OPD), followed up in June with another cut. This time, the Joint Strategic Survey Committee (JSSC), a team of three including Major General Fairchild as the air member, engaged with OPD for a more assertive view of airpower's role: not only would the CBO achieve air superiority by 1944, but it would also relieve pressure on the USSR in the meantime.⁸⁶³

⁸⁶⁰ Matloff, *The 90-Division Gamble*, 366-367.

⁸⁶¹ Maurice Matloff, ed. *United States Army in World War II, Strategic Planning for Coalition Warfare* (Washington, DC: United States Army Center of Military History, 1994), 5.

⁸⁶² An official Army history offers that, in addition to Marshall's committee led by Colonel Bessell, the President appointed an additional committee to review shortages in civilian labor. *Ibid.*, 115-119.

⁸⁶³ Other members of the JSSC were Lt Gen Stanley B. Embick and Vice Admiral Russell

This shift in assumptions, accepted by Marshall, conceded that “the Joint Planners had gone astray in trying to match Allied forces, division for division, with the enemy.”⁸⁶⁴ The Allied airpower advantage, if proven, would reduce the need for parity in ground forces. The Maddocks committee returned to Marshall in June 1943 with three recommendations:

*First, it proposed the reduction of the strength of the Army authorized for 1943 from 8,248,000 to 7,657,000. Second, it called for modification of the current troop basis to provide a balanced force built around eighty-eight divisions, the number already activated... Third, it recommended that the ultimate size of the Army and of the major units in it (air and ground) should be decided at the end of the summer.*⁸⁶⁵

Assessing across the Atlantic. Adjustment of the military program and its underlying assumptions placed new pressure on the CBO as well as the Air Staff. Eaker had not only to accomplish the Pointblank Directive’s intermediate objective of rendering the Luftwaffe impotent, but also to prove his progress before the end of the summer or he might lose the resources to finish the job. The size of Eaker’s bomber force was already contentious even within the air arm. Eaker’s statistical control office reported that Eighth Air Force closed out 30 June with only 806 heavy bombers, just 85 percent of the plan’s required

Wilson, making the brilliant but unimposing Fairchild the junior member. Perera contends the JSSC's functions were: "To study and survey the major basic strategies of the war (past, present and future); to keep the Joint Chiefs of Staff advised on combined basic strategy in the light of developing and predictable situations; to advise the Joint Chiefs of Staff on long-range strategy (combined); to study the strategies possible to be adopted when current plans have become impractical and to advise the Joint Chiefs of Staff in regard thereto." Presumably, Fairchild's role in this group, as perceived by Arnold, was important enough to keep him in Washington throughout the war. See: Perera, *Memoirs: Washington and War Years*, 1973, 75-76; Matloff, *Strategic Planning*, 122.

⁸⁶⁴ Matloff, *The 90-Division Gamble*, 369-370.

⁸⁶⁵ Matloff, *Strategic Planning*, 180.

944.⁸⁶⁶ Just three months into Pointblank, Eighth Air Force was already playing catch up, especially if there was to be any chance of achieving Eaker's desired 1192 bombers by the end of September.⁸⁶⁷ Of course, responsibility for pushing bombers into theater was ostensibly Arnold's problem.

The task to report on the CBO's progress, dated 1 July 1943, fell initially to the AAF in the form of a memorandum to General Arnold from Marshall's staff, including the following:

Determination of the ultimate size of the Army and the major units required (divisions and Air Force groups) ... will depend, to a large extent, on the outcome of the Russo-German operations this summer and the effectiveness of the Combined Bomber Offensive, the trends of which should be sufficiently apparent by early September to warrant a decision...

*[including by the Commanding General, AAF:]
An analysis of the overall effect of the Combined Bomber Offensive on Germany's war potential, and an estimate of its future capabilities.⁸⁶⁸*

The order stirred frenzy on the Air Staff as tasks rained like poorly aimed incendiaries on Arnold's unsuspecting subordinates. The memo had exposed with startling clarity that no one, much less any standing committee or air staff

⁸⁶⁶ Eighth Air Force, *Review of Operational Considerations*, July 1943. Also, Eaker, *Presentation of Combined Bomber Operations - United Kingdom*, ca. April 1943, 10. Interestingly, Arnold sent a memo to the other Joint Chiefs the same day Eaker briefed them requesting 864 bombers by June 30, not the 944 Eaker requested. Although it seems implausible Eaker would simply have disregarded Arnold's change to the plan or that Eaker did not get the memo, Eaker was not listed on the distribution list. See: Commanding General Army Air Forces, *Plan for Combined Bomber Offensive From the United Kingdom*, in *Personal Collection of Gen Henry H. Arnold part 3 of 6*, Joint Chiefs of Staff (277), (Maxwell AFB, AL: AFHRA, 29 April 1943), MICFILM 28253, IRIS 2053776.

⁸⁶⁷ Eaker, *Presentation: Plan for Combined Bomber Offensive From the United Kingdom*, 29 April 1943, 11.

⁸⁶⁸ Colonel O. L. Nelson, *Memorandum for Commanding General, AAF: Revision of the Current Military Program*, War Department, (Maxwell AFB, AL: AFHRA, 1 July 1943), #187.1-18, IRIS 135275.

office, had undertaken a broad air-campaign assessment. Despite Arnold's plea months earlier for recurring data from Eaker, processes inside the staff remained fragmented and myopic as information from Europe seemed to fly into various offices and die where it landed. An organized review of Eaker's reports might have been helpful, but these were deep questions, requiring analysis that could connect the dots from bombs on target to future capabilities of German fielded forces. Eaker had enough challenges with bombing accuracy and aircraft losses.

Brigadier General Kuter (then Arnold's assistant Chief of Staff for Plans and Combat Operations) assumed the lead role on a Special Committee established by the air boss. Kuter, who had instructed at ACTS as a lieutenant when Eaker attended the course as a major, engaged directly with Eaker a few days later. In an attempt to pull the right information from England and to push the analytical effort onto the COA, especially since Colonel Guido Perera happened to be in London at the time, Kuter wrote:

On first glance, it appears to us that the necessary data is available in England in probably greater detail and surely at earlier dates, than it could be available in Washington. We believe that Colonel Perera and Lt Col Barton Leach from this Headquarters who are now with you are well qualified, and with your introduction may have the best contacts to obtain an answer to the question our committee has to solve.

Our broad problem is this: What change, if any, should be made in the troop basis for the United States Army because of the success or failure of the combined bomber offensive against Germany? It is realized that there are a great number of variables in this problem. It is immediately apparent that solutions might vary all the way from giving an open and first priority call on man-power to all essential elements of your offensive against Germany (and conducting a ground invasion

with a very small force at a quite distant date) to halting the expansion of the Air Forces (and forming a large and powerful ground Army to force an invasion at an early date). At this point, our committee has no formula to suggest whereby this question might be answered.⁸⁶⁹

As target-planning challenges had emerged for the CBO nearly a year earlier, questions about assessment again caught the generals responsible for conducting war with a staff ill-prepared to gather and analyze appropriate information—much less inform their strategic decision-making. They didn't even appear to understand how to approach the problem. In their haste to sort out the targeting plan, AAF leadership had not given serious consideration to assessment once the campaign started. While they had clearly approached the targeting problem as an iterative sequence of steps, they had over-looked the interactive nature of their air campaign and their commensurate need to evaluate it on a broad scale in order to monitor its progress, resources, and response from the enemy.

More than just information-gathering or assessments, Kuter needed help conceptualizing the problem. Kuter was a brilliant and highly respected airman, but he was also very busy and he was not planning to meet with his team again for nearly six weeks.⁸⁷⁰ The same day Kuter had reached out to Eaker, a memorandum internal to the Air Staff intelligence division captured the mood of the Washington-based air staff:

At present, no organization in this Headquarters or abroad keeps complete bomb damage records on which to make the following assessments—

⁸⁶⁹ Kuter, *Personal Letter: Kuter to Eaker*, 6 July 1943.

⁸⁷⁰ Ibid.

- a. *The extent to which the industrial installations of the enemy have been structurally damaged;*
 - b. *The production the enemy has lost as the results of such plant destruction;*
 - c. *The effect such lost production has had, is having, or may have on enemy front line strength*
- ...There are a half-dozen or more organizations in this Headquarters doing different parts of this work. At present, their activities are uncoordinated. A similar state of confusion exists abroad.*⁸⁷¹

The work simply wasn't being done. The Air Staff was characteristically over its head and under-equipped, while its leaders shot reactively from the hip.

While temporarily in London, the COA's Perera and Leach received the task from Eaker (presumably before he dismissed them to talk to the RAF about grinding wheels) and attempted to dissect the problem while they began procuring the necessary data from the various forward agencies with relevant reports. Their approach would be straight-forward and tied to basic mission statistics, extent of physical damage, and potential economic impact, relying primarily upon raid reports from the British Ministry of Home Security.⁸⁷² But they also picked up on the nuance demanding a strategic-level view of air superiority embedded in the War Department task, so they decided to include more detail under an "additional accomplishments" subheading: attrition to the German Air Force and "aid to Russian and Mediterranean fronts by diverting fighters from those fronts."⁸⁷³ Marshall's staff, with the phrasing of a single

⁸⁷¹ Captain James T. Lowe, *Memo for General Sorensen; Subject: Bomb Damage Assessments*, War Department, (Maxwell AFB, AL: AFHRA, 6 July 1943), #187.1-18, IRIS 135275.

⁸⁷² Col Guido R. Perera, *Memo for Major General Eaker; Subject: General Kuter's letter of 6th July*, War Department, (Maxwell AFB, AL: AFHRA, 20 July 1943), #187.1-18, IRIS 135275.

⁸⁷³ Ibid.

question, had caused a peculiar non-sequitur for CBO assessment; the War Department was now principally concerned with air superiority for its invasion not the economic objectives of the CBO as officially agreed by the Combined Chiefs of Staff. In other words, insofar as the Army was concerned, the Pointblank Directive's *intermediate objective* was now *the* objective.

The Army and its air arm depended upon each other for planning assumptions based on tangible and reasonable expectations. In this case, a ground force with friendly aircraft overhead could be much smaller and less armored than one facing an air onslaught while attempting to seize ground from another army. The impact of the CBO on the German military, while desirable, would be much more difficult to quantify, harder to prove, longer to develop, and less useful as a planning factor for the Allied military program. In any case, both sides sought to guard their resources, and the Airmen were not truly giving up on victory through airpower.

Adding a layer of irony to the confusion, Perera pointed out to Kuter a vexing problem with the economic-damage reports produced the British MHS. "Due to lack of personnel, these reports unfortunately do not, at this time, cover every raid by the VIII Air Force under the Combined Bomber Offensive plan," wrote Perera.⁸⁷⁴ These were the same reports from the same office that Alderman and Kring of Eighth Air Force's Bombs and Fuses subsection had been hired to support, but they'd subsequently rejected as routine work. In

⁸⁷⁴ Col Guido R. Perera, *Personal Letter to Brigadier General Lawrence Kuter*, War Department, (Maxwell AFB, AL: AFHRA, 22 July 1943), #187.1-18, IRIS 135275.

Alderman's words, "Kring and I were of course in no position to estimate production loss and were not immediately concerned with dates of re-attack," even though they were the ones most proximally connected to the information necessary.⁸⁷⁵ Harlan had hired the wrong people for that job, and while they went on to exert tremendous analytical effort for bombing accuracy, Harlan never revisited the need to ensure the economic reports were completed. The AAF paid the price for affording its hired analysts too much flexibility in their duties.

In any case, Eaker did not see the problem as a lack of information or analysis in the European theater or even of insufficient reporting, but rather the absence of a coherent spokesman in Washington. He signaled back to Kuter:

*The reporting, as we have established it between the RAF and ourselves, covers the field...What is required by you and Barney [Giles] is not a new reporting agency in this theater, but a good mind, a qualified statistician to digest, compile, and brief the data which reaches Washington and may otherwise be separated and go to various staff agencies unless there is someone there to compile and make it available so that it can readily be digested by your committee.*⁸⁷⁶

Eaker spun his solution as an opportunity to build advocacy in Washington, where he knew his biggest problem was getting on the same page with Arnold—a place where they seem to have strayed since they co-wrote *This Flying Game*

⁸⁷⁵ Alderman, *Report for Colonel Leach on the History and Development of the Bombs and Fuzes Subsection of the Operational Analysis Section*, 10 April 1945, 3.

⁸⁷⁶ Maj Gen Ira C. Eaker, *Personal Letter: Eaker to Kuter*, War Department, (Maxwell AFB, AL: AFHRA, 22 July 1943), #187.1-18, IRIS 135275.

seven years earlier.⁸⁷⁷ Rather than levying yet another reporting requirement onto his staff, Eaker pinned the rose for building advocacy on Leach, who was more than happy to gain the responsibility and the excuse to remain comfortably in Washington—perhaps with the occasional visit forward to England.

That Eaker would have selected a member of a committee with whom he had significant differences of opinion over target-selection preferences was odd. Perhaps Eaker assumed Leach would simply compile and regurgitate reports he received from Eighth Air Force. Eaker hardly had rapport, much less a strong foundation of trust with either Perera or Leach. While Eaker's rationale nominating Leach is not clear, he may have underestimated the importance of the position—that of owning the responsibility for over-all assessment, because the statistics and words that described them would matter in such an opinion-charged environment. Although it is unlikely Leach played much role other than to support the COA's assessment, Eaker certainly missed the opportunity to find an advocate he could trust. What really happened here was that the generals in Washington and the generals in England were pushing the responsibility for air-campaign assessment onto each other. The result was to set the stage for a showdown of air-campaign intelligence organizations to control the CBO narrative.

⁸⁷⁷ Incidentally, the purpose of this co-authored book was openly intended as propaganda “to translate for the youth of today some of the things we have learned in order that they may avoid our errors.” The text opened with, “FLYING—What dreams it inspires! What ideas and thoughts it excites in boy and man alike!” Neither Arnold nor Eaker was unfamiliar with the idea of marketing their ideas. See: Arnold and Eaker, *This Flying Game*, xvii, 3.

The Campaign for Air Assessment

The same American air-intelligence organizations that had battled for influence in air-campaign targeting again locked horns to influence assessment as well. Their incentive was clear from the start: any thorough assessment would also imply an evaluation of planning and targeting in addition to the bomber's operational performance. Put simply, the analysts recognized the opportunity to grade not only the bombers' efforts and adherence to the plan but their own target-selection homework as well. Thus, each organization had a vested interest in controlling the assessments and the CBO narrative they portended.

The emergent "jurisdictional difficulties" to control the assessments were not missed by the Committee of Operations Analysts; they aligned with Arnold's plans division to "prepare an appreciation of the effectiveness of the CBO for use at the Quebec conference," while Arnold's A-2 (still led by General Sorensen) teamed with OSS personnel to produce an "evaluation of the results of the CBO."⁸⁷⁸ The tasks were indistinct and the result was a passive-aggressive competition to produce the dominant document. Each organization produced an assessment that reflected its own interests.

Air-campaign assessment by economists. Both the Air Staff Intelligence Division and Leach reached out to the EOU's economists at the American Embassy over the perplexing issue of CBO assessment. Never to forego an

⁸⁷⁸ Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 99.

opportunity to play intellectual one-upmanship or to exploit an AAF expertise shortcoming, the EOU (along with support from the OSS Research and Analysis Branch) proposed an initial framework for air-campaign assessment.⁸⁷⁹ Though references to the original War-Department task were scrubbed from the final draft of EOU's study on Strategic Air Bombardment Evaluation, the EOU members had included it in their drafts, which indicated their awareness of General Kuter's concerns over his staff having no formula from which to approach the problem.⁸⁸⁰

The economists understood that an analyst, no matter how well informed, cannot solve a problem without first understanding it. "There is neither precedent nor established methodology for making an evaluation of the effects of bomb damage on a complex economic structure," the economists acknowledged.⁸⁸¹ Proposing such methodologies was well within their professional wheelhouse. They had recognized the need for such work in 1942 (as previously noted), but they had preferred to stick with targeting instead. Had they delved into assessment methodology earlier, they'd have risked being consumed by even more routine work than the grind of building target folders.

The joint EOU/OSS study on bombardment evaluation showed clearly the economists' orientation in their work, which was both helpful and detrimental in its analysis. By mid-1943, the EOU economists had matured in their

⁸⁷⁹ Office of Strategic Services, *Bomb Assessment (Draft)*, War Department, (Maxwell AFB, AL: AFHRA, 22 July 1943), #187.1-19, IRIS 135277.

⁸⁸⁰ Ibid.

⁸⁸¹ Ibid.

understanding of both targeting and planning through their months spent with Hughes' team. They drew from this experience and contributed an assessment methodology as part of a comprehensive air-campaign cycle beginning with estimates of essential enemy war-making resources, noting "their relative vulnerability to air attack" and linking them via "the progress being made toward the objectives" back to changes in original estimates.⁸⁸² This was a novel concept for assessment, but it had eluded the minds of the airmen.

Interestingly, the OSS study acknowledged not only tangible effects, but also both the importance of assessing "highly imponderable" effects such as enemy morale (though they may have conflated political will of the elites with public support of the general populace). These imponderables tended to stray from concrete methodology, so interest in them trailed off as the economists recognized that "to state the problem of evaluation...is not, however, to solve it."⁸⁸³ They then offered a methodology based entirely upon tangible decreases to enemy resources available, and they tied the outcome to friendly resources required. The economists captured in their typical pedantic prose, that objective measures of assessment for an air campaign were inextricably linked to ground-force requirements:

This reduction in enemy resistance to our final occupation of his vital territory is reflected in a reduction in the resources which we must make available to our ground task forces for this victorious termination of hostilities. The amount of that reduction, properly related to the time factors involved, is the only fundamental and realistic measure of the effectiveness of the

⁸⁸² Office of Strategic Services, *Strategic Air Bombardment Evaluation (Basic Considerations)*, OSS, (Maxwell AFB, AL: AFHRA, undated ca. July 1943), #187.2-30, IRIS 135287, 1.

⁸⁸³ *Ibid.*, 4-6.

*bomber offensive.*⁸⁸⁴

Economists working for the Office of Strategic Services—not Air Corps Tactical School graduates or the AAF’s organic air intelligence officers—had devised and recommended an enduring framework for air-campaign assessment. The answer this solution provided, of course, was a measurement of German war materiel—the EOU economists’ preferred targeting scheme.

While EOU members cautioned against eliminating targets that were difficult to assess, they were nevertheless partial to targets with calculable impacts on the enemy military. As economists, they relied upon their backgrounds in maximizing quantitative factors and efficiency, while attempting to validate their preferred targeting recommendations: “That system or pattern of targets should be selected for attack in which a given expenditure of effort produces the greatest reduction in enemy military capability within desired time limits,” they argued⁸⁸⁵ The implications of this assertion, while subtle, were significant. A target’s post-attack calculability, if considered in depth during (not after) the planning process, might inform target selection—or at least identify intelligence gaps early enough to act upon them. Whether or not an attack could be assessed was not one of the EOUs original 11 criteria for target selection.⁸⁸⁶

⁸⁸⁴ Ibid., 5.

⁸⁸⁵ Ibid., 2.

⁸⁸⁶ Salant, *The Selection of Industrial Bombing Targets: Some Analytical Notes*, 17 December 1942. Cited in: Rostow, *Rostow Report*, ca. 30 April 1945, 36-37.

Assessment by a committee of lawyers and industrialists. The

Committee of Operations Analysts, however, preferred to tell Arnold what they thought he wanted to hear, as they sought to reinforce their own targeting plan. The committee's approach to assessment was threefold: To focus on the Eighth's greatest successes; to overlook the obvious struggles; and to blame the lack of progress in German industrial dislocation on the fact that Eighth Air Force had committed an alarming 55 percent of its effort on the submarine facilities, which "are not profitable bombardment targets."⁸⁸⁷ In other words, if bombing progress should be criticized, it was because the plan as executed had not reflected the COA's recommendations.

Most remarkably, the reality in theater did not support its assertions, which made the entire assessment read as embellished propaganda rather than objective evaluation. For example, COA members submitted in the leadoff section of their report: "The heavy bombardment force has indicated its ability (a) to fight its way to a target and back (b) to bomb with such precision from high altitude that industrial targets can be put out of action," which seemed a reasonable proposition, until they added, "this applies to all types of targets in all geographic areas within range against all degrees of opposition."⁸⁸⁸ Maybe the AAF's top generals accepted this. However, Staff Sergeant J.J. Dalinsky, who bailed out from the waist-gunner position of his B-17 named "Dear Mom"

⁸⁸⁷ Committee of Operations Analysts, *Past Effectiveness and Future Prospects of Eighth Air Force Effort Under Pointblank*, War Department, (Maxwell AFB, AL: AFHRA, 11 August 1943), #118.01v2, IRIS 110403, 6.

⁸⁸⁸ *Ibid.*, 2.

over Regensburg the week after the committee submitted their report, might have offered a more reasonable perspective; instead, Dalinsky simply asked to “put mike buttons on gun handles” after he’d spent the ensuing six months evading back to friendly territory.⁸⁸⁹ Perhaps the COA analysts hadn’t taken the time to get a more human and realistic sense of how the air campaign was actually fought.

A few examples from the BDA the analysts cited in their reports reflects their salesmanship. For the Vegesack mission, they plugged photo-interpretation claims that “damage to buildings was such as to ‘reduce efficiency to a minimum if not dislocate the yards entirely.’”⁸⁹⁰ As previously discussed, these findings had not happened, and the COA analysts understood this well enough to contradict their own argument later in the report. Later, they stated, “the current successes against the submarines at sea and the growing realization that bases and construction yards are unfruitful targets releases up to 55 percent of the net effort for attacks on the GAF and basic industry.”⁸⁹¹ A tendency for contradictions, seemingly offering an aisle of viewpoints from which the AAF’s commanding general might select his preferred brand, undercut their credibility.

The COA also touted the H÷ls raid, referencing both CIU interpretation and

⁸⁸⁹ One of the ORS's collateral duties was to take feedback from successful evaders. See: Eighth Air Force Operational Research Section, *ORS Interrogation of Evaders*, (Maxwell AFB, AL: AFHRA, 28 January 1944), #520.362, IRIS 224119, 1.

⁸⁹⁰ Committee of Operations Analysts, *Past Effectiveness and Future Prospects of Eighth Air Force Effort Under Pointblank*, 11 August 1943, 2.

⁸⁹¹ *Ibid.*, 10.

Joint Intelligence Sub-committee reports to make its case:

*This mission shows the Eighth Air Force fighting its way into the heart of Germany, locating an isolated industrial plant of considerable dispersion and great structural resistance, laying a bomb pattern all over it, and putting it 'out of action for several months.'*⁸⁹²

There was no doubt the raid had shown great promise, especially if they had accepted the language at face value in the bi-monthly report by Eaker's A-2, which argued that Hüls attack "looks like the most effective bombing ever done by the Eighth Air Force... bombs clearly hit many, many vital installations."⁸⁹³ But Hüls was part of the Ruhr valley, located on Germany's western fringes, and even if the COA could not yet have known that the plant was out of action for less than six weeks, damage reports were conflicting.⁸⁹⁴ The bomb plot (see Figure 4) showed significant bomb damage in the north and west of the plant, but there were hardly any bomb impacts on the south and east portion of the plant, while much of the concentration fell harmlessly in nearby fields.

Even more peculiar, the COA made no attempt to connect an estimate in projected rubber-production losses to an impact upon German forces or the Allied army necessary to overcome them, perhaps because that impact would have been minimal.⁸⁹⁵ A MEW report, which may have been available to the

⁸⁹² Ibid., 5.

⁸⁹³ A-2 Eighth Air Force, *Bi-monthly Report of Bombing Results, for the period of July 16 through July 31*, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, ca. 1 August 1943), #520.307, IRIS 219681, 1.

⁸⁹⁴ United States Strategic Bombing Survey, *Huels Synthetic Rubber Plant*, 1947, 2.

⁸⁹⁵ The extent of to which the COA offered an industrial impact statement was: "between 25% and 35% of synthetic rubber production for some months." See: Committee of Operations Analysts, *Past Effectiveness and Future Prospects of Eighth Air Force Effort Under Pointblank*, 11 August 1943, 8.

COA several weeks prior, noted that tightening of the rubber position by mid-July would have been due to “non-arrival of blockade runners during the winter,” not from immediate impacts of rubber production. Although there were some delays in Berlin, the report added, “old tyres are usually delivered.”⁸⁹⁶ Even if full results of the Hüls attack were not yet known, this was the type of information Marshall had asked of Arnold.



Figure 4. Bomb Plot of Damage at Hüls.

(Reprinted from Central Interpretation Unit, "Approximate Bomb Plot No. SA 359," in Synthetic Rubber Plant - Hüls, Medmenham RAF Station, (Maxwell AFB, AL: AFHRA, 22 June 1943), #520.365, IRIS 224125.)

COA also chest-thumped the raid on the Renault vehicle factory in Paris, claiming “Eighth Air Force produced at least as great destruction by an attack

⁸⁹⁶ Ministry of Economic Warfare, *M.E.W. Intelligence Weekly*, (London, England: AFHRA, 22 July 1943), #512.607A, IRIS 211130, 5.

from 22,000 to 26,000 feet as the RAF produced from 1,200 to 4,000 feet.”⁸⁹⁷ In spite of the impressive accuracy with which the bombs fell, and the British Ministry of Home Security’s RE8’s prediction of the loss 3,000 trucks over 3 months, the report lacked any evidence to support the AAF’s superior damage claim.⁸⁹⁸ Further, even before the committee submitted its assessment, MEW economists released one of their weekly reports recognizing “substantial progress was being made in the clearance, repair and reconstruction of the Renault Billancourt factories. More than 30 workshops were under repair, one or two were apparently completely repaired and even the most seriously damaged had been cleared of wreckage and prepared for further reconstruction,” all within six weeks of the Eighth Air Force attack.⁸⁹⁹ If COA analysts saw this report, it did not seem to deter their confidence in their claims or cause them to question other reports as to the German industrial position.⁹⁰⁰

⁸⁹⁷ Committee of Operations Analysts, *Past Effectiveness and Future Prospects of Eighth Air Force Effort Under Pointblank*, 11 August 1943, 2-3.

⁸⁹⁸ The COA's claim ultimately proved contradictory to plant records discovered by USSBS surveyors. Surveyors asserted that the RAF attack nearly doubled the amount of heavy building damage (6.73 percent versus 3.96 percent), destroyed almost three times as many machine tools (which was what really mattered to production), more than quadrupled the damage estimates to vehicles in production, and drove about 50 percent more man-hours for debris clearance; Harris' Bomber Command had dropped only 69 tons of bombs in the target area versus the Mighty Eighth's 81, but only the RAF had dropped a number of the earth-shattering 4,000-pounders, rejected by the small-bomb architects working in Eaker's bombs and fuses section. See: United States Strategic Bombing Survey, *Renault Motor Vehicles Plant, Billancourt, Paris*, ed. Munitions Division, 2nd ed., No. 80 (Washington, DC: USSBS, 1947), 4-5, 7-9, 12; *ibid.*, 4-5, 7-9.

⁸⁹⁹ Ministry of Economic Warfare, *M.E.W. Intelligence Weekly*, (London, England: AFHRA, 8 July 1943), #512.607A, IRIS 211130, 1.

⁹⁰⁰ Given the relationship between MEW's Lawrence and COA members, and even an offer from MEW to send five of its “engineers, industrialists and economists” to participate on COA's Far East study the week prior to the COAs report suggests the COA probably had regular access to

A consistent and considerable flaw in the committee's assessment was its assumption that photo-interpreters tended to underestimate rather than overestimate damage. The COA's lawyers and industrialists acknowledged that material damage within bombed buildings can be difficult to determine, especially since "precise function of those buildings is frequently inexact or outdated," but they argued, "the photographic interpreter cannot make guesses without objective evidence and hence states only that minimum which affirmatively appears."⁹⁰¹

The logic was sound, but the reality was opposite. As discussed in previous chapters, both photo-interpreters and operations researchers tended to simplify their problems by assuming that damage to structures correlated to damaged contents. From this flawed assumption, COA analysts expounded, "a virtual certainty of strikingly accelerated destruction of the industrial resources of the German war machine" in the months to come.⁹⁰² As later assessments and post-war surveys would show, most estimates incorporated into their analysis had been needlessly exaggerated.

Next, the COA boasted of the Ploesti mission's success with its special reverence to Arnold, who'd later claim, "no mission in the war was more carefully planned, with full knowledge of the odds against it, nor carried out

MEW's weekly reports, though receipt may have been delayed or relayed via Eighth Air Force. Many archival copies on file at AFHRA were Richard Hughes' personal copies. See: Kuter, *Memorandum, Kuter to Arnold*, 6 August 1943.

⁹⁰¹ Committee of Operations Analysts, *Past Effectiveness and Future Prospects of Eighth Air Force Effort Under Pointblank*, 11 August 1943, 9.

⁹⁰² *Ibid.*, 10.

despite mishaps in identifying the target, with more amazing courage.”⁹⁰³ In spite of the earlier A-2 meeting intended to cap intelligence estimates to a much lower figure, the committee pulled from a “well-authenticated” source, including the refinery’s managers, that “the damage to the production facilities of all the refineries as a whole was estimated at 70 percent subject to upward revision.”⁹⁰⁴ Plant managers themselves had incentive to exaggerate production losses in order to support arguments for increased resources for recuperation. There was an increased risk of fallacy when pulling the from the high end of intelligence sources.

COA analysts also attempted to reframe the losses taken at Ploesti to seem less distressing. Since Ploesti contained nine separate refineries, they figured “losses were 4 aircraft destroyed and 1 interned for each objective attacked,” which made the numbers seem smaller by comparison.⁹⁰⁵ Of course, the percentages were the same no matter how the statistics were carved up. “Hap” Arnold was proud of Ploesti, but for him it was about the crews’ bravery, not downplaying the losses; he still grieved when writing his memoir that 54 of 177 aircraft—over 30 percent—had failed to return from that single brutal mission.⁹⁰⁶ Ploesti hardly proved a sterling example that the bombers could fight their way to any target and back against any opposition—at least not without taking unsustainable losses.

⁹⁰³ Arnold, *Global Mission*, 494.

⁹⁰⁴ Committee of Operations Analysts, *Past Effectiveness and Future Prospects of Eighth Air Force Effort Under Pointblank*, 11 August 1943, 12.

⁹⁰⁵ *Ibid.*, 13.

⁹⁰⁶ Arnold, *Global Mission*, 494.

Finally, the analysts winced at the challenge of quantifying results of the RAF's area raids and even of differentiating which of those raids had linked directly to Pointblank industrial targets. In their view, the rare cases when the RAF had attacked "specific segments of enemy industrial capacity," results might be measured along with the AAF attacks, "but so far as the RAF strikes at industrial areas or at manpower generally or at morale its relation to the plan was indirect," Perera offered.⁹⁰⁷ Measuring indirect effects was not the analysts' bailiwick. In short, they made no effort to correlate the impacts of the two complementary air forces except to identify that assessment of the RAF attacks might be forthcoming in separate reports from the British. The problem with discounting indirect effects was that no area-bombing contributions could then be factored into the American military program.

The British responded post haste. However, the report released two days later on 22 July by their Joint Intelligence Committee (JIC) openly struggled to connect de-housing metrics to industrial production losses, so they simply accounted for direct damage. The JIC showed, for example, in the RAF's bombing of the industrial city of Essen, that "60 percent of the total loss, and almost all of the short-term loss, is attributable to direct damage to factories," which had been incidental to the area attack on the city itself.⁹⁰⁸ They determined that de-housed Germans merely lived with others until a very high

⁹⁰⁷ Perera, *Memo for Major General Eaker; Subject: General Kuter's letter of 6th July*, 20 July 1943, 2-3.

⁹⁰⁸ Joint Intelligence Sub-Committee, *Effects of Bombing Offensive on German War Effort*, in *J.I.C. (43) 294 (Final)*, War Cabinet, (Maxwell AFB, AL: AFHRA, 22 July 1943), #118.04-12, IRIS 110422, 9.

“saturation point” could be reached through bombing, and “there is no reason to believe that saturation point has been achieved in the larger cities,” with the exception of the densely populated and highly industrialized Ruhr area.⁹⁰⁹

Further, manpower for industrial repairs came from the workers themselves as soon as plants shut down, meaning there were no recognizable shortfalls in repair-crew capacity.

As for morale, intelligence showed German troops regularly received letters from home detailing “the terrors of air bombing,” but the JIC found, “there is nothing to show that their fighting spirit has yet been reduced.”⁹¹⁰ While there were notable successes, the tone of the report conveyed a sobering message that lacked confidence in the less-quantifiable area-bombing results. Among British intelligence organizations, the JIC notably operated independently of the Air Ministry and the RAF, so it lacked incentive to support Harris’ preferred strategy.

In summary, the COA likely realized, from its position in Washington, that the total size of the Army depended on the success of the CBO, so any indications of CBO shortcomings could lead to a decision to curtail the AAF in order to build up more ground strength. Its members anticipated what Arnold wanted to hear, and that is how they oriented their report. In truth, the COA’s report did little to help Arnold, Eaker, or the AAF by accentuating positive claims and downplaying loss figures. Their selection of exemplar raids (or so

⁹⁰⁹ Ibid., 8.

⁹¹⁰ Ibid., 15.

they thought) for each of the Pointblank Directive's industrial categories seemed a premature argument to redistribute, in their words, a "weight of attack sufficient to produce significant economic damage to the German war machine."⁹¹¹ They appeared to be building a case to force Eaker's hand toward attacking their preference in industrial targets before he could secure air superiority, and they gave the impression that Eaker had placed too much effort on submarine attacks, whether he'd wanted to or not. The committee had Arnold's ear, and that wasn't good for Eaker.

While his staff and the various air intelligence organizations scrambled to extinguish CBO-assessment fires, Arnold set about invigorating a public-relations campaign on the home front. If the Army would not appreciate an independent role for airpower, maybe the American public would. Maybe they would believe in his air arm is capability to win the war, not just to perform the preparatory actions for an invasion. With more time and its full share of resources, the Army's air force could do more than just negate an enemy's bid to control the air. That was the message he hoped to convey in a personal letter to Eaker:

It is important for the people to understand that our prime purpose is destruction of the enemy's ability to wage war, by our planned persistent bombing and sapping of his vital industries, his transportation, and his whole supply system...

...It is important for them to realize that this takes time, as well as money and planes and planning and work – but that it will win the war and save perhaps millions of lives which otherwise would be sacrificed in bloody ground combat...

⁹¹¹ Committee of Operations Analysts, *Past Effectiveness and Future Prospects of Eighth Air Force Effort Under Pointblank*, 11 August 1943, 7.

...In short, we want the people to understand and have faith in our way of making war. That faith can grow in strength only as we show them what we are doing, and how well we are doing it...

...We must put before the public information as to actual results of our bombing; preferably clear photographic evidence showing the before, during, and after phases of the operation. With this—in easily understandable form—should be included the vital statistics and a reasonable assessment of damage inflicted.⁹¹² [emphasis in original]

The idea buzzing around the Army's planning division that air superiority could reduce the size of the Allied invasion force had merit, but to Arnold the idea of the air campaign extended much further. He privately articulated his faith that strategic bombing *saved* lives. More Americans would return home and—better still—fewer mobilized troops meant fewer disrupted families, a stronger economy, and less disturbance to the American way of life. This was the promise of victory through airpower, and he wasn't about to give up on it as the War Department focused on invasion planning. His message was to *just keep the damage assessments reasonable and let the photos show the airpower story*. Whether intentional or not, Arnold had placed extraordinary pressure on Eaker to help him tell the story that he wanted to tell, and he was going to hold Eaker accountable if demonstrable results were not forthcoming.

Tapping Ploesti and Synthetic Oil Assessments

Adding to Eaker's predicament, earlier that month Arnold had redirected

⁹¹² H. H. Arnold, *Letter, Arnold to Eaker*, (Washington, DC: NARA, 29 June 1943), AAG 312.1-G, Operations Letters, RG 18.

the inbound 389th Bomb Group and transferred Eaker's 376th and 98th Bomb Groups to join Maj Gen Lewis Brereton's 9th Air Force on another raid against the heavily defended Ploesti oil fields; 54 of Eaker's B-24s were shot down and 532 crewmen were lost when they finally executed what turned out to be—both temporally and figuratively—an August mission to remember.⁹¹³ Most raids, if successful at all, seemed only half-steps forward, and they left Eaker's bomber force licking its wounds and short on replacements. Ploesti was no exception.

While the raid, codenamed operation Tidal Wave, was technically a Ninth Air Force mission, everyone with an interest in the European Theater had his eye on the results. The idea was to deal a crushing blow to Romanian natural petroleum refineries (as opposed to the synthetic plants in Germany), which offered the Axis ample quantities of the highest grades of fuel and lubricants—the lifeblood of the Luftwaffe.⁹¹⁴ The importance of Ploesti stemmed not just from the third of all Axis petroleum it provided, but also from the geographic location of its “panorama of high-chimneyed refineries, tanks farms, and rail network” in Eastern Europe.⁹¹⁵ Ploesti fed Hitler's Eastern Front from its advantageous proximity, so the loss of this source of refined oil would, as the Assistant Chief of Air Staff for Intelligence reported in 1944, “necessitate the transportation of crude oil hundreds of miles for refining to Italy, southern France, or southern Germany, thence to the Eastern Front, thus placing an additional burden upon the already strained transportation facilities of the

⁹¹³ Davis, *Carl A. Spaatz and the Air War in Europe*, 260.

⁹¹⁴ Assistant Chief of Air Staff (A-2), *The Ploesti Mission of 1 August 1943*, June 1944, 3-4.

⁹¹⁵ *Ibid.*, 6.

Axis.”⁹¹⁶ A weakened petroleum industry would further stress other industries.

Ploesti’s location also had a downside for the Allies. From its position 900 miles northeast of Tripoli, it was a trek for the bombers and an even greater challenge for reconnaissance flights, as the range pushed the RAF’s specially equipped Mosquitoes to their very limit.⁹¹⁷ The first of two flights intended for post-strike reconnaissance stole its glance on Ploesti while fires still filled the sky with black smoke. The reconnaissance mission failed to capture the whole target area, and it returned to base with mostly low-angle, oblique images. The second, accomplished from medium altitude two weeks later, became “the principal source of Allied intelligence on the effectiveness of the attack, despite all of the known limitations of photographic intelligence.”⁹¹⁸ In general, the oil industry was one for which photo-intelligence was well-suited, since capacity could be measured and operating status confirmed via photo-reconnaissance.⁹¹⁹

Bomb-damage assessments deemed the raid worthy of its “Ploesti Smashed” headlines, and the theater photo-interpretation chief was ecstatic.⁹²⁰ The marketing value alone of destroying Ploesti was as great as the impact on the Axis because the BDA images could be used to rally public support behind

⁹¹⁶ Ibid., 4.

⁹¹⁷ Committee of Operations Analysts, *Report of Committee of Operations Analysts with Respect to Economic Targets Within the Western Axis*, 8 March 1943, foldout 3.

⁹¹⁸ Assistant Chief of Air Staff (A-2), *The Ploesti Mission of 1 August 1943*, June 1944, 103.

⁹¹⁹ The USSBS later concluded, photo-interpretation “was performed with an accuracy that was always satisfactory and at times remarkable.” See: United States Strategic Bombing Survey, *Oil Division Final Report*, ed. Oil Division, 2nd ed., No. 124 (Washington, DC: USSBS, 1947), 134.

⁹²⁰ A Sedgwick, “Ploesti Smashed - 300 Tons Rain on Major Gasoline Source of Reich Air Force,” *The New York Times* 2 August 1943.

the Air Campaign. For this purpose, the low-angle shots were helpful, even if they hadn't captured the scope of the attack. The commander of the Middle East Interpretation Unit (MEIU) also realized from the post-strike photos that pre-raid threat information had been out-of-date. "In addition to the excellent photographs of the Ploesti raid itself, which, quite apart from their propaganda value, were most useful for assessment of damage in conjunction with later vertical photographs," wrote the Chief of Intelligence for Ninth Air Force, adding "a number of obliques were taken disclosing many points of interest which we might not otherwise have discovered."⁹²¹ Plans for pre-raid reconnaissance flights were scrapped for fear of tipping off the Germans, so planners and operations analysts in theater were left to work from dated assumptions⁹²²

Surprise was paramount, but the American bombers were surprised as well.⁹²³ It turned out the Germans had surreptitiously employed an aggressive defensive counter-measure program since the HALPRO raid a year earlier. ULTRA intercepts compensated somewhat by indicating as early as December 1942 that the Germans anticipated additional attacks, and messages the month prior to the raid, signed by a new fighter group at Ploesti, had sought "re-arrangement of the existing forces there."⁹²⁴ Though the intercepts were cryptic and tightly controlled within Allied intelligence circles, clearly the

⁹²¹ Wing Commander Commanding Middle East Interpretation Unit, *Photographs - Ninth Bomber Command*, (Maxwell AFB, AL: AFHRA, 12 August 1943), #533.923-1, IRIS 234520.

⁹²² Assistant Chief of Air Staff (A-2), *The Ploesti Mission of 1 August 1943*, June 1944, 49-52.

⁹²³ *Ibid.*, 54.

⁹²⁴ National Security Agency and Central Security Service, *ULTRA: History of U.S. Strategic Air Force Europe vs. German Air Force*, SRH-013, 39.

Germans had emphasized Ploesti's defense since the HALPRO mission had exposed Allied interest in Ploesti as a target. Other new measures, though not addressed in ULTRA, included camouflage, smoke-screen generators, barrage balloons, anti-aircraft guns, and dispersed dummy sites; intelligence and operations analysts considered all of these as possibilities but downplayed them to crews, who were told for example, "it would be advantageous for a plane encountering a balloon cable to attack it downwind and at as low an angle as possible."⁹²⁵ Intelligence analysts would later claim that the counter-measures had little impact on the crews or the mission overall.⁹²⁶ The crews of the unfortunate Liberators lost to barrage balloons probably felt otherwise.

Analysts from the British Ministry of Economic Warfare published in their *Intelligence Weekly*, which they released prior to the second post-raid reconnaissance mission, their aspirations for the raid's potential impact. Confident in the "great precision and much damage wrought" by the bombers, they felt the raid's ultimate success depended not as much upon the bombs' immediate explosions, but on the fires that burned long after the bombers departed.⁹²⁷ "The firing of oil tankage will cause a dead loss of oil which may well be on a considerable scale and is sufficiently serious in itself," argued the MEW analysts, "but fires among the operating units, if not put out very rapidly, will have caused damage that will take a considerable time to repair."⁹²⁸ From

⁹²⁵ Assistant Chief of Air Staff (A-2), *The Ploesti Mission of 1 August 1943*, June 1944, 50-51, quote on 51.

⁹²⁶ *Ibid.*, 110-112.

⁹²⁷ Ministry of Economic Warfare, *M.E.W. Intelligence Weekly*, 12 August 1943, 1.

⁹²⁸ *Ibid.*

their economic perspective, losses in existing oil supply were inconsequential compared to lost future production if the refining equipment had burnt up in the intense heat that followed the attack. For the analysts to reach their hopeful conclusions, Ploesti would require considerable additional reconnaissance or ground intelligence.

Not all of their assessments strove for concrete details, however, as the economists also delved into less tangible factors. “It is evident from reports that the accuracy of the bombing has impressed upon the Roumanians their vulnerability to further attacks,” the MEW claimed, “and there is no doubt that this event has added to the growing disillusionment that is being felt toward the Antonescu régime.”⁹²⁹ Without divulging evidence to support their claim, the economists insinuated that the daring bomber raid began to drain the loyalty of Romanian people in addition to their oil. Implications that bombing inspired uprising in the minds of an occupied populace actually allied to Germany was significant and likely to gain favor with the bomber generals. Even if unsubstantiated, that King Michael I successfully overthrew Prime Minister Ion Antonescu by coup a year later could be testament to the MEW’s claim, even if the Soviets were, by then, across the Romanian border.⁹³⁰

Finally, in order to corral the opinions of “all interested agencies” on the raid’s petroleum-production impact, the Air Staff’s target-information branch called a meeting to force a consensus that the raid destroyed “42.5 percent of

⁹²⁹ Ibid., 3.

⁹³⁰ Nick Thorpe and King of Romania Michael I, “Nobody Lifted a Finger,” *Hungarian Review*, no. 06 (2011).

total Romanian capacity.”⁹³¹ Given the political implications of such an important raid, it was best for the credibility of all intelligence organizations if their conclusions were not so widely varied. In the weeks and months following the raid, hasty repairs and idle capacity compensated for some of the deficit, so the best that could be stated of the raid’s long-term results was that it left the Axis “with no margin of spare refinery capacity which is efficiently located.”⁹³² In other words, the Germans lost their convenient cushion, but the raid was not enough to stop any engines. This allowed the intelligence organizations most interested in the Axis oil position to insist there must be more attacks on oil.

A synthetic assessment. The following week, an enthusiastic charge circulated among the 4th Bombardment Wings’ groups as they prepared for a raid against the synthetic oil plants at Wesseling, near Bonn. The message proclaimed, “the importance of the oil industry cannot be over-emphasized, and with the destruction of the Ploesti fields, the synthetic oil plants take on an added importance.”⁹³³ Now that Ploesti had received its due, other petroleum targets—especially those producing gasoline—were central to Pointblank. Eaker’s rationale for delaying attacks on them six weeks earlier had expired. New to striking oil plants, crews received excruciating detail of the target’s

⁹³¹ Office of Strategic Services, *Bomb Damage Report*, War Department, (Maxwell AFB, AL: AFHRA, 18 September 1943), #187.2-16, IRIS 135272, 9; Assistant Chief of Air Staff (A-2), *The Ploesti Mission of 1 August 1943*, June 1944, 106-107.

⁹³² Office of Strategic Services, *Bomb Damage Report*, 18 September 1943, 10-11.

⁹³³ *Form 103A Narrative*, Eighth Air Force, (Maxwell AFB, AL: AFHRA, 12 August 1943), #527.332, IRIS 230268.

likely appearance from their intelligence briefer, and they were instructed to aim their bombs for the gas plant (as opposed to high-pressure vessels), because it “is the most vital point as it is relatively easy to damage and its complete destruction would cause production to cease throughout the works.”⁹³⁴ They had focused on the target, but underestimated the threat.

What neither the crews nor the intelligence briefers had anticipated was smoke, possibly from a defensive screen, and flak that was “much more intense than briefed.”⁹³⁵ One 94th Bomb Group crew reported that the whole target area was full of smoke and three bombs hung up inside their bomb bay because the “bomb release cable was severed by flak bursts!”⁹³⁶ Their group S-2 followed up despairingly in his own report, “very few accurate observations of bombing reported, however several reports indicated [that the] primary target was covered with smoke.”⁹³⁷ As the post-mission intelligence reports moved up the chain, the Wing-level S-2 was unable to make heads or tails of any of his groups’ reports. He summarized, “making accurate survey of damage impossible. Claims of bombing of [the] primary target are not substantiated by any photos taken.”⁹³⁸ Everyone seemed to want to distance themselves from the apparent failure.

⁹³⁴ Headquarters 4th Bombardment Wing, *Briefing Notes, Primary Target*, Wesseling Mission #36, (Maxwell AFB, AL: AFHRA, 12 August 1943), #527.332, IRIS 230268.

⁹³⁵ Headquarters 4th Bombardment Wing, *Mission 36 (Wesseling)*, War Department, (Maxwell AFB, AL: AFHRA, 12 August 1943), #527.332, IRIS 230268, 103A Narrative, 194th Bomb Group.

⁹³⁶ *Ibid.*, interrogation form Crew #17.

⁹³⁷ 4th Bombardment Wing, *Form 103A Narrative*, 12 August 1943.

⁹³⁸ 4th Bombardment Wing, *Mission 36 (Wesseling)*, 12 August 1943, Intelligence Narrative, Mission of Wesseling.

The other portion of the day's raid, flown by the 1st Bombardment Wing to attack synthetic oil plants at Gelsenkirchen, fared even worse. Crews from the 1st Wing's 305th Bombardment Group were irate, and quick to pass fault through their own S-2:

The target was identified by the navigator and bombardier of our lead [aircraft] and after the bomb run was begun the lead group turned right in front and under our group indicating that the lead group was not going to bomb the primary. Rather than break away from [the] combat wing our leader followed the lead group. A similar situation occurred at the secondary target after the target had been identified. Bombing the target was sacrificed for combat wing discipline.⁹³⁹

Crews reported an ineffective smoke screen and broken cloud layers in the target area, but nothing to preclude bombing.⁹⁴⁰ The despondent assistant Wing photo officer reported, "none of our bombers were successful in their attempt to bomb" either of their assigned synthetic oil targets.⁹⁴¹ If the Ploesti oil raid had been memorable, then 12 August was a day to forget.

243 Eighth Air Force bombers dropped 560 tons of bombs with no significant damage on their primary targets that day. Another 25 bombers—just over 10 percent—were lost.⁹⁴² For reasons perhaps only General Eaker might have fully explained, the only reference to petroleum targets in a monthly operations summary stated that "attacks on two synthetic oil plants in the

⁹³⁹ S-2 305th Bombardment Group, *Teletype Report, Mission 12 August 1943*, War Department, (Maxwell AFB, AL: AFHRA, 12 August 1943), #525.332B, IRIS 228299, 2.

⁹⁴⁰ Ibid.

⁹⁴¹ Headquarters 1st Bombardment Wing, *Immediate Interpretation Report, No. 12*, 2nd Lt. George Welter, (Maxwell AFB, AL: AFHRA, 12 August 1943), #525.332, IRIS 227593.

⁹⁴² Headquarters Eighth Air Force, *Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: August, 2nd Month of Second Phase*, in *Heavy Bomber Operations*, (Maxwell AFB, AL: AFHRA, 1 October 1943), #168.61-10, IRIS 124347.

Ruhr were abortive on account of weather and smoke screens.”⁹⁴³ Further, Eaker’s monthly A-2 report to Arnold blamed the lack of bombs dropped on Gelsenkirchen on the enemy’s smoke screen and the “unlikely” chance of effectiveness at Wesseling solely on “6-8/10 cloud [cover]”, but that “flexibility of attack turned what might have been failure into major successes” since one formation managed to damage a steel mill that was assigned as a secondary target.⁹⁴⁴

The fact of the matter was that there was little impetus to press further on oil attacks. Oil targets fell lower in priority than the urgent challenges posed by the Luftwaffe, the pressure to engage in U-boat attacks, and the COA’s insistence that ball-bearings attacks would yield quick victory. Further, the COA analysts had considered from their early discussions that the Ruhr synthetic plants were of questionable vulnerability with their “small, rugged structures,” necessitating “almost direct hits.”⁹⁴⁵ Available intelligence thus implied that even if the bombers had managed effective attacks, these targets would require continuous follow up against heavy resistance. Even still, Eaker struggled to sustain his force with a reasonable rate of operations against the higher priority targets, including the ineffective U-boat attacks, and he had not

⁹⁴³ Headquarters Eighth Air Force, *Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: August, 2nd Month of Second Phase*, in *Summary by Target Categories*, (Maxwell AFB, AL: AFHRA, 1 October 1943), #168.61-10, IRIS 124347.

⁹⁴⁴ A-2 Eighth Air Force, *Semi-monthly Report of Bombing Results, 1 August through 15 August 1943*, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, 28 August 1943), #520.307, IRIS 219682, 3.

⁹⁴⁵ Committee of Operations Analysts, *Western Axis Oil Industry as Bombardment Target*, 8 March 1943, 4.

yet wagered an attack against ball-bearing factories at all. Targeting plans did not return to oil with any consistency for eight more months.

Schweinfurt-Regensburg and the Risk-Reward Calculus

The mid-August sun signaled the approaching end of summer along with waning opportunity for Eaker and his wing commanders to prove the value of their air campaign. As Colonel Richard Hughes put it from the pressure-cooker atmosphere in the Eighth Air Force planners' map room, it was time to "go for broke."⁹⁴⁶ After all, no amount of meticulous or informed bomb-damage assessment could compensate for missed opportunities, if they failed to put enough bombs on the right targets. It was time to increase their intensity on aircraft factories and to test the theory of Germany's ball-bearing bottleneck.

Advancing technology helped. The arrival of modified F-model B-17s into the European Theater, which toted an additional 800 gallons of wing-tank capacity, added more than just a few hundred miles of range per aircraft.⁹⁴⁷ They added new mission possibilities as well, although the extended range brought with it a temptation to press further beyond their escorts. The modified B-17Fs now had the range to reach North Africa by way of a deep mission into Germany.

After weeks of soupy weather frustrated the Mighty Eighth's bombing accuracy as well as its plans to synchronize an attack with the three bomb

⁹⁴⁶ Hughes, *Memoirs: Chapter VIII, 1941-1945*, 1957, 30.

⁹⁴⁷ Perret, *Winged Victory: The Army Air Forces in World War II*, 264.

groups on loan to Spaatz in Africa, the skies finally cleared.⁹⁴⁸ The plan, then in place and ready to execute, would include a shuttle mission: 147 B-17s of Curtis LeMay's Third Bomb Division, with their long-range tanks and the preponderance of escort, would wreak havoc on the ME-109 plant at Regensburg and continue on to bases in North Africa; ten minutes in trail, 230 unmodified B-17s of the First Bomb Division, led by Brigadier General Robert Williams, would deal a crushing blow to the ball-bearing factories at Schweinfurt, then reverse their routing back to England due to their lesser range.⁹⁴⁹ The brilliance of the plan, had it executed as designed, was to surprise the German fighters when LeMay's lead division turned south, leaving diminished opposition for the Schweinfurt attack as the enemy fighters refueled and rearmed.⁹⁵⁰ The grandiose mission would mark the anniversary of the first full year of American heavy bombing in Europe.⁹⁵¹

As with all great plans, reality intervened—in this case through ground fog and an overwhelming sense of urgency. Eaker's force, better trained for instrument takeoffs, launched their Fortresses close to schedule as bad weather blanketed England to ensure they could arrive in Africa before dark. Williams' larger force of twelve groups delayed another hour-and-a-half before

⁹⁴⁸ Thomas M. Coffey, *Decision over Schweinfurt: The U.S. 8th Air Force Battle for Daylight Bombing* (New York: Mckay, 1977), 257-258.

⁹⁴⁹ Headquarters VIII Bomber Command, *Tactical Mission Report*, in *Eighth Air Force Mission No. 84*, Eighth Air Force, (Maxwell AFB, AL: AFHRA, 17 August 1943), #520.331, IRIS 221631, 1. Parton, *Air Force Spoken Here*, 299.

⁹⁵⁰ Perret, *Winged Victory: The Army Air Forces in World War II*, 264. VIII Bomber Command, *Tactical Mission Report*, 17 August 1943, 1.

⁹⁵¹ Perret, *Winged Victory: The Army Air Forces in World War II*, 265.

they received the green light from General Fred Anderson.⁹⁵² The benefit of the coordinated attack had thus been negated by the delay. The result, as a dismayed Colonel Hughes later reflected, meant “Curt LeMay’s force was exposed to the full fury of all the German fighters all the way to Regensburg,” adding, “the German fighters then had ample time to fly back to their bases, refuel, and rearm, and to throw their entire strength against the delayed attack” by Williams’ lesser-escorted forces.⁹⁵³ Despite the shattered plan, the bombers fought valiantly to place their bombs on target.

Bomb-damage assessments and bomber losses were equally stunning. No sooner had the surviving crews limped in to their separate destinations, group S-2s began to tally up the numbers and review photographic evidence. To avoid any short cuts with the non-standard shuttle-mission recovery, senior intelligence officers were reminded via cable message that “a regular group interrogation will be held for the returning crews of the Regensburg missions,” and “all reports [are] expected within scheduled time.”⁹⁵⁴ This was a very high-interest mission; the recoveries at North African bases drove additional command-and-control issues, and there would be a lot of missing-crew reports.

The S-2 from the 94th Bombardment Group, one of LeMay’s units, wasted no time in transmitting his account. 20 of their 21 aircraft had managed to arrive in North Africa, though they’d ended up scattered at three different

⁹⁵² Ibid. Parton, *Air Force Spoken Here*, 299.

⁹⁵³ Hughes, *Memoirs: Chapter VIII, 1941-1945*, 1957, 35.

⁹⁵⁴ Commander 4th Bombardment Wing, *Routine Confidential Message, Attn: Senior Intelligence Officer*, Eighth Air Force, (Maxwell AFB, AL: AFHRA, 19 August 1943), #527.332, IRIS 230274.

airfields, and one aircraft had landed on a salt flat instead of an air base.⁹⁵⁵ Crews grumbled of “constant and eager” German fighter attacks from the time their escort departed (near Antwerp) until close to the target area, although the enemy pilots “seemed green in attacking a formation, riding along parallel, nosing in for a few bursts, and then pulling away.”⁹⁵⁶ The timid behavior might have indicated that attrition of experienced pilots and training for hurried replacements was taking a toll on the Luftwaffe.

With the exception of one B-17 that “blew up” before Regensburg, he reported all crews dropped their ten 500-pound bombs on target with favorable details: “Bombing appeared excellent. All bomb releases observed were immediately in the target area. Smoke and flames enveloped the M.P.I. [mean point of impact].”⁹⁵⁷ Interestingly, his interrogation notes and hand-written worksheets included data from only 14 of the 20 aircraft he incorporated into his report, so the source of the other 6 remains in question.⁹⁵⁸ What was not in question, however, was the crews’ sense of accomplishment. Following the report’s instructions for the S-2 to “use crew language if you like,” he recorded the last two crews’ bombing results were “damned good” and “target destroyed.”⁹⁵⁹ Morale was high in the 94th, and they were confident they had done well.

⁹⁵⁵ S-2 94th Bombardment Group, *Teletype Report, Form 103A Narrative*, Eighth Air Force, (Maxwell AFB, AL: AFHRA, Ca. 17 August 1943), #527.332, IRIS 230274, 1.

⁹⁵⁶ *Ibid.*

⁹⁵⁷ *Ibid.*, 2.

⁹⁵⁸ S-2 94th Bombardment Group, *Teletype Report Worksheets*, Eighth Air Force, (Maxwell AFB, AL: AFHRA, Ca. 17 August 1943), #527.332, IRIS 230274, Report Tabulation Sheet.

⁹⁵⁹ *Ibid.*, Worksheet for Teletype Report paragraph 7.

A successful raid was about more than just the bombs. A reconnaissance flight captured aerial photographs four hours after the raid, and the CIU followed with an urgent intelligence report the next day. Photo-interpreters confirmed the crews' confidence: "Damage within the target area is of a high order of concentration, nearly all the craters being within the bounds of the factory," the intelligence report boasted, adding that many of the buildings had still been ablaze when the photographs were taken.⁹⁶⁰ Unfortunately, what appeared to be outstanding damage was offset by losses. Of the 146 B-17s dispatched, 127 attacked the target and (optimistically) claimed 140 enemy fighters destroyed, but the cost was devastating; 24 aircraft were lost, including more than 200 aircrew killed or missing.⁹⁶¹ They'd lost more than 15 percent of their attacking force on just one raid on one of 22 targets that compromised key elements of industry supporting single-engine fighter production.⁹⁶²

As higher headquarters added their spin on post-raid results, the assertions grew more pronounced: "Heavy damage was inflicted on the factory and nearly all the buildings were affected in some degree," claimed the bomber

⁹⁶⁰ Central Interpretation Unit, *Immediate Interpretation Report No. K.1671*, in *Eighth Air Force Mission No. 84*, RAF Medmenham, (Maxwell AFB, AL: AFHRA, 18 August 1943), #520.331, IRIS 221631.

⁹⁶¹ Headquarters VIII Bomber Command, *Bomber Command Narrative of Operations, Mission No. 84*, (Maxwell AFB, AL: AFHRA, 17 August 1943), #519.332, IRIS 216158.

⁹⁶² The Committee of Operations Analysts argued that 93% of single engine fighters were produced in just 7 aircraft final-assembly plants, of which the Regensburg Messerschmitt plant accounted for 10%. However, the COA analysts felt that five component-erecting plants were also "deemed essential to achieve effective results," in addition to ten engine-assembly plants, which added up to 22 total. See: Committee of Operations Analysts, *Report of Committee of Operations Analysts with Respect to Economic Targets Within the Western Axis*, 8 March 1943, foldout 1.

command report, loosely referencing photo-reconnaissance intelligence.⁹⁶³

When Arnold's A-2 staff in Washington incorporated the attack into their own assessments, their language followed the trend even further:

*Our attack of 17 August 1943, made in conjunction with the attack on Schweinfurt, was probably the most successful attack ever made by aircraft on an industrial target. Nearly every building of this large plant suffered severe damage...It is estimated by competent authorities that this attack caused the loss in production of five hundred Me-109s.*⁹⁶⁴

There was no doubt that the bombers had accomplished their mission after struggling to get airborne that dreary August morning, and the words marketing their success picked up steam as the reports moved uphill. Larger questions in the path ahead were whether the cost to the Germans was worth the price paid by Eighth Air Force, and how the Germans would respond.

The OSS' Research and Analysis Branch waited only a month before delving into a tentative appreciation of the raid's near-term and long-term impacts. OSS analysts, along with their economists serving in the EOU, strongly favored continued attacks against the German fighter industry, as they had from the start. Their intelligence assessment reflected this viewpoint. They felt the raid was just a small part of an opening salvo, albeit an effective one. Probable results of the Regensburg raid, they felt, would cost the Germans at least three months of production. Along with an attack three days earlier on the Me-109

⁹⁶³ VIII Bomber Command, *Bomber Command Narrative of Operations, Mission No. 84*, 17 August 1943.

⁹⁶⁴ Assistant Chief of Air Staff (A-2), *Regensburg: ME-109 Assembly Plant*, in *Reports of Attacks on Axis Targets in Europe*, USAAF, (Maxwell AFB, AL: AFHRA, 12 September 1943), #142.035-7, IRIS 115060.

factory at Wiener-Neustadt, the raid imposed “a prompt and considerable impact on [German Air Force] front line fighter strength.”⁹⁶⁵ Near-term impacts were undoubtedly positive.

However, OSS analysts restrained their enthusiasm with regard to future plans. They argued the bombers had merely chiseled the tip of an iceberg: “While the results of the recent [Eighth Air Force] attacks on German fighter aircraft plants represent only a portion of the minimum effects required to achieve a decisive weakening of Germany’s fighter defenses, they may nevertheless be regarded as an encouraging beginning.”⁹⁶⁶ The EOU economists, operating in closer consultation with Eaker’s planners than the analysts in Washington, sought to keep Eaker focused—at least partly—on the air superiority battle. While they would let Eaker’s crews enjoy their pat on the back, it was far too soon to celebrate victory over the Luftwaffe.

The assessments and reality grew increasingly muddled as the months ticked by without the Eighth revisiting Regensburg. The CIU’s photo-interpretters expressed alarm as they noted extraordinary efforts to repair the plant by the middle of October. “Activity is seen at many points in the factory area,” they noted from follow-up reconnaissance, “though little of it is likely to be directly concerned with aircraft production.”⁹⁶⁷ Whatever was going on at the Messerschmitt plant, it involved an unusual number of workers and a

⁹⁶⁵ Office of Strategic Services, *Bomb Damage Report*, 18 September 1943, 8.

⁹⁶⁶ *Ibid.*, 24.

⁹⁶⁷ Central Interpretation Unit, *Immediate Interpretation Report No. K.S.124, Clearance and Reconstruction*, in *Eighth Air Force Mission No. 84*, RAF Medmenham, (Maxwell AFB, AL: AFHRA, 10 October 1943), #520.331, IRIS 221631, 2.

stockpile of resources—well beyond the efforts of a slapdash repair job.

The Committee of Operations Analysts, when identifying Regensburg as a target, had understood it to be vulnerable in the same way they understood “all [aircraft] plants are vulnerable to HE and incendiary attack,” provided the attack incurred sufficient damage to “component erecting shops and final assembly sheds.”⁹⁶⁸ It turned out the Regensburg plant was uniquely vulnerable due to the plant’s lack of preparedness, although such indicators had not been available to Allied air-intelligence organizations.⁹⁶⁹ Reconstruction efforts at the plant were therefore more robust than the original plant design, and this took time. Maybe the plant did not need another attack yet, after all.

The British Ministry of Home Security’s RE8 also weighed in, but with a more open-ended evaluation, including a range of possible options for the Germans. RE8 analysts concluded that the target would be optimal for re-attack after four months, whether or not the Germans chose to disperse some of the plant’s production functions.⁹⁷⁰ No re-attack occurred until further

⁹⁶⁸ Committee of Operations Analysts, *Report of Committee of Operations Analysts with Respect to Economic Targets Within the Western Axis*, 8 March 1943, foldout 1; Committee of Operations Analysts, *Summary of Position of France, Belgium, and Netherlands in Axis Aircraft Production*, War Department, (Maxwell AFB, AL: AFHRA, 2 August 1943), #118.04B-3, IRIS 110443.

⁹⁶⁹ Surveyors later determined the plant had been wholly unprepared to withstand attack from the standpoint of “a proper alarm system, air raid bunkers to safeguard personnel, or satisfactory facilities for raw materials and finished products,” so the casualty toll exceeded 1100 workers, along with unrecoverable damage to 70 percent of stored materials and 30 percent of machine tools. See: United States Strategic Bombing Survey, *Messerschmitt AG Augsburg, Germany, Part B*, ed. Aircraft Division, 2nd ed., No. 11 (Washington, DC: USSBS, 1947), 7.

⁹⁷⁰ Ministry of Home Security, *Reconstruction Report, Messerschmitt A G Regensburg - Prufening, Germany*, Research and Experiments Department, (Maxwell AFB, AL: AFHRA, 12 October 1943), #519.332, IRIS 216158, 1.

reconnaissance showed unambiguous production activity and attempts to camouflage buildings more than five-and-a-half months after the original attack.⁹⁷¹ If the Germans hadn't been serious about pre-emptively dispersing, protecting, and hiding their industries before the raid on Regensburg, they became so afterwards. As for Eaker's target planners, if they were relying exclusively on the EOU or the MEW to update their original assumptions, they were getting conflicting information—and they weren't following the recommendations anyway.

With a scathing post-mission report, Colonel Curtis LeMay single-handedly dismantled any further plans for shuttle missions to North Africa. Despite the fact that he'd conducted an advanced trip to Africa himself, he found that the bare-base facilities were underequipped and personnel there were ill-trained to service his fleet of B-17s, much less repair battle damage and prepare them for combat on the return leg.⁹⁷² The unpredictability of combat had left many aircraft too short on fuel to reach their intended destinations and the entire situation placed inordinate strain on his crews. As to preparing for combat on the return leg from an austere location, LeMay was partial to his own intelligence officers. He was grateful for the support his wing received in Africa, but he felt "our own S-2 officers, well acquainted with our crews and knowing

⁹⁷¹ Central Interpretation Unit, *Interpretation Report No. K.S. 407, Regensburg*, RAF Medmenham, (Maxwell AFB, AL: AFHRA, 3 February 1944), #519.332, IRIS 216158, 1-2.

⁹⁷² Colonel Curtis E. LeMay, *Memorandum, Subject: Difficulties encountered on Shuttle Raid, Landing at North Africa Bases*, 4th Bombardment Wing Headquarters, (Maxwell AFB, AL: AFHRA, 29 August 1943), #168.61-10, IRIS 124347, 1-3.

their background, could have given better service.”⁹⁷³ Commanders like LeMay placed a premium on trust with his crews and the fate of his nation on the line. Nearly two weeks after the raid on Regensburg, Eighth Air Force operations staff acknowledged his concerns and the fact that he still had two airplanes and crews stuck in Africa.⁹⁷⁴

Ball bearings, flyers, and advertisements. The Schweinfurt raid was a different story than Regensburg (both raids were accomplished together the same day—known historically as the Schweinfurt-Regensburg mission), though it would reveal a similar pattern of conflicting viewpoints. That ongoing debate over the target had been controversial added intrigue to its eventual prosecution and attention to expectations of its success. Air-intelligence organizations maintained varying degrees of emphasis on the ball-bearing bottleneck, but their consensus—following ACTS’ logic for industrial dislocation—consistently placed the system among top priority targets. The controversy arose with “Bomber” Harris, who shared no such common thinking.

As advocated in the Pointblank directive, Schweinfurt made an ideal venue for a combined day-night raid by the Allied air forces, and MEW had maintained its pressure on Harris since the 1942 publication of its *Bomber’s Baedeker*. As MEW saw it, Schweinfurt had been one of only two staggering anomalies in its attractiveness as an area target of economic importance. Along

⁹⁷³ Ibid., 2.

⁹⁷⁴ A-3 Assistant Chief of Staff, *Regensburg Shuttle Mission*, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, 30 August 1943), #168.61-10, IRIS 124347.

with Bitterfeld (and its chemical factory), MEW nominated Schweinfurt as the only other city of a population under 100,000 to grace its list of 33 priority-one cities.⁹⁷⁵ However, “Bomber” Harris maintained his ardent rejection of “panacea targets” in the summer of 1943, though according to the AAF’s VIII Bomber Command, the only reason the RAF did not participate in the 17 August raid was the unfortunate timing of a full moon—too risky for an RAF night attack.⁹⁷⁶ Harris later clarified his opinion in no uncertain terms, that “the target experts went completely mad” when they selected ball bearings.⁹⁷⁷ Other histories contend MEW’s Sidney Bufton had bypassed Harris and appealed directly to Hughes and Eaker.⁹⁷⁸ Eighth Air Force would go alone after this single town that allegedly produced 50 percent of Axis ball bearings despite its position as the number three target industry for the CBO.⁹⁷⁹

VIII Bomber Command compiled its narrative as soon as the interrogation reports and immediate interpretation reports came in. Opposition had been brutal. Of the dispatched force of 230 bombers, 36 went missing, and only 183 had bombed their primary targets at Schweinfurt, dropping more than 1,000 250-pound British incendiaries, 719 500-pound bombs, and another 235 1,000-pounders.⁹⁸⁰ Despite the losses, “bombing results were very good,” the

⁹⁷⁵ Ministry of Economic Warfare, *The Bomber's Baedeker*, January 1943, 8.

⁹⁷⁶ VIII Bomber Command, *Bomber Command Narrative of Operations, Mission No. 84*, 17 August 1943, 5.

⁹⁷⁷ Harris, *Bomber Offensive*, 221.

⁹⁷⁸ Coffey, *Decision over Schweinfurt: The U.S. 8th Air Force Battle for Daylight Bombing*, 237-239.

⁹⁷⁹ Hansell, *Lecture to Air War College: "The Development of the United States Concept of Bombardment Operations"*, 16 February 1951, 9. Hansell, *The Air Plan that Defeated Hitler*, 163.

⁹⁸⁰ VIII Bomber Command, *Bomber Command Narrative of Operations, Mission No. 84*, 17 August 1943, 1.

VIII Bomber Command report claimed, as a number of machine shops and other important buildings had received “direct hits.”⁹⁸¹

But the interrogation reports had indicated a subtle but important nuance. Whereas the assessments of Group S-2s tended to align with that of their crews, this raid was different. Two of the Group S-2s, as if conferring or sensing the level of scrutiny upon their results, held their crews accountable and made their contradictions evident. For example, the 306th Bombardment Group crews were adamant of their success but their S-2 was unable match their excitement: “crews think bombing better than seems to be borne out by the first photos.”⁹⁸² Another Group S-2 reflected similar skepticism: “crews report excellent bombing results on the target... Bursts were claimed on the aiming point area and on the marshalling yards to the south. However, photographs taken by our lead [aircraft] do not show hits on our target, but rather on a buildup of factory district about 3/4 mile to the north of our target. There was much smoke near the target, evidently from another formation’s bombing.”⁹⁸³ Finally it seemed that the 305th Bombardment Group had earned the credit though the S-2 still distanced himself from the crews’ elation and long-term recommendation:

Bombing of all three targets was described as very good. Huge fires were seen and dense clouds of heavy smoke covered all three targets. The actual aiming point was sighted and good results from our bombs are claimed. Crews were convinced that

⁹⁸¹ Ibid.

⁹⁸² S-2 306th Bombardment Group, *Teletype Report, Mission 17 August 1943*, War Department, (Maxwell AFB, AL: AFHRA, 17 August 1943), #525.332B, IRIS 228302, 3.

⁹⁸³ S-2 92nd Bombardment Group, *Teletype Report, Mission 17 August 1943*, War Department, (Maxwell AFB, AL: AFHRA, 18 August 1943), #525.332B, IRIS 228302, 8.

*there would be no use of returning to this particular target and they felt equally strong that no more ball bearings would be produced there for some time.*⁹⁸⁴

This was one raid where the crews would have preferred to complete the post-raid assessments themselves, including whether or not the target warranted a re-attack. Nevertheless, the tenor of the reports showed the Group-level S-2s beginning to show confidence in their responsibility for objective reporting. Nevertheless, the intelligence officers' muted reports had not dulled the optimism expressed in the VIII Bomber Command narrative.

Reconnaissance squadrons eagerly produced BDA for the high-priority mission, capturing their first overhead photography just 40 minutes after the bombers passed over the target. In an unusually expedient step, the Central Interpretation Unit released its first BDA report from post-strike reconnaissance before the CIU's interpreters had even reported on the images taken from the bombers themselves. They'd anticipated the unusually high demand for BDA. Smoke and cloud cover was too dense for a thorough assessment, but the interpreters noted of this first pass, "it appears likely that the greater part of the smoke originates from fires burning within the target area."⁹⁸⁵ This was fantastic news. Schweinfurt appeared to be engulfed in flame, just as the crews reported.

Their next report, based upon photos taken by bombers' cameras, noted

⁹⁸⁴ S-2 305th Bombardment Group, *Teletype Report, Mission 17 August 1943*, War Department, (Maxwell AFB, AL: AFHRA, 18 August 1943), #525.332B, IRIS 228302, 4.

⁹⁸⁵ Central Interpretation Unit, *Immediate Interpretation Report No. K.1672*, in *Eighth Air Force Mission No. 84*, RAF Medmenham, (Maxwell AFB, AL: AFHRA, 18 August 1943), #520.331, IRIS 221631, 1.

that “although a number of bombs are seen bursting in the target areas, the heaviest concentrations are slightly north, west, and southwest of the targets.”⁹⁸⁶ There was undoubtedly considerable damage to the target area, but the gist was that the bombs hadn’t quite centered on the optimal aiming point and it was too early to determine the exact extent of the damage. Photo-interpretation from a “good quality” reconnaissance pass two days later disseminated better news—“all three factories at Schweinfurt and together producing more than half of the roller and ball bearings of Germany have suffered damage as a result of the raid,” they wrote as they added as much detail as possible about damaged buildings and facilities.⁹⁸⁷ As the dust settled and smoke cleared, allowing for closer investigation, much of the damage appeared only incidental to the ball-bearing factories themselves.

For the many intelligence organizations that advocated attacks on ball bearings, their assessments largely reflected their proximity to the final decision to conduct the raid. The OSS Research and Analysis branch, given its self-described position as “more distinctly oriented towards the need of the Armed Services than any other research agency,” showed its stake in the results and its close partnership (via EOU) with Eighth Air Force.⁹⁸⁸ OSS economists spun a positive projection. With a cautionary caveat due to uncertainty in their “preliminary reports,” the OSS economists claimed:

⁹⁸⁶ Central Interpretation Unit, *Interpretation Report No. S.A. 466*, RAF Medmenham, (Maxwell AFB, AL: AFHRA, 17 August 1943), #519.332, IRIS 216158, 1.

⁹⁸⁷ Central Interpretation Unit, *Interpretation Report No. K.1677*, in *Eighth Air Force Mission No. 84*, RAF Medmenham, (Maxwell AFB, AL: AFHRA, 23 August 1943), #520.331, IRIS 221631, 1.

⁹⁸⁸ United States War Department, *OSS War Report*, 1, 344.

If these estimates are valid, the Schweinfurt raid will cause both a sharp curtailment of industrial uses of bearings during the next three to five months and at least a temporary and limited reduction of the supply of bearings used in finished munitions...

...Since it is estimated that the major plant hit in this raid will lose three months output, it appears production will again be close to normal in the early months of 1944...

...If the estimates of output loss presented above are approximately valid, the margin protecting military use of bearings has now been eliminated.⁹⁸⁹

What was remarkable about their assessment was not that the OSS dealt with considerable ambiguity, though it was to their credit that they recognized such ambiguity in their preliminary assessments; it was remarkable that they cast the ambiguity in such a positive light given the lack of data to support their findings. Implicit in their assessment was that any further successful attacks on ball bearings would yield a direct impact on German materiel, and that reattack would not be essential until the following year. The data behind their assessments may have been ambiguous, but their support to Eaker and his crews' morale was not.

Arnold's A-2, supporting his fascination with the ball-bearing idea, gravitated to the OSS information, arguing that "the previously tight German anti-friction bearing situation has been reduced to a serious deficit position by the USAAF attack on Schweinfurt which is believed to have eliminated one-fourth of the normal production of bearings for a three-month period," later adding, "the Schweinfurt achievement will result in the reduction of deliveries

⁹⁸⁹ Office of Strategic Services, *Bomb Damage Report*, 18 September 1943, 14-16.

to the armed forces of military equipment which would have been in use within six months.”⁹⁹⁰ These were magic words in the debate for resources with the Army. The bombing success against ball bearings could justify a smaller invasion force and more resources allocated for the AAF’s heavy-bomber program. The A-2 assessment was aimed directly at helping their boss.

Such optimism was not universal. Just two days later, with Sorensen’s signature still wet on the Air Staff A-2 report, a separate stack of raid reports circulated among the Air Staff. These reports, stunning in their sobriety, were attributed by internal correspondence to Colonel Harris B. Hull, the plank holder leading VIII Bomber Command’s intelligence division since 1942 and an Eaker confidant.⁹⁹¹ Indicating a complete reversal to A-2’s perspective, Hull maintained of the ball-bearing targets, “the machinery used is highly susceptible to damage and very difficult to replace... Unfortunately, the main concentration of bombs fell between the plants and on the railway track sidings and stations, and great damage was done to the communication and transportation system of the city.”⁹⁹² That the machinery was highly

⁹⁹⁰ Assistant Chief of Air Staff (A-2), *An Appraisal of Accomplishments and Potentialities*, 10 September 1943, iv.

⁹⁹¹ Arnold, *American Airpower Comes of Age*, vol. 2, 64 (n.136). A routing slip pushing the raid reports to Col Loutzenheiser of AC/AS plans included the hand-written text “Some of Col. Hull’s data. You read it and get depressed too!” Assistant Chief of Air Staff (A-2), *Routing Slip to Colonel Loutzenheiser*, in *Reports of Attacks on Axis Targets in Europe*, USAAF, (Maxwell AFB, AL: AFHRA, 12 September 1943), 142.035-7, IRIS 115060. Of note, the AFHRA database attributes the reports to AC/AS Intelligence, likely because the documentation arrived to the archives from that office, but the document’s internal correspondence and pronoun usage (e.g. “our raid...”) suggests the origin was VIII Bomber Command A-2 prior to Hull’s departure to MAAF, along with Eaker, two months later.

⁹⁹² Assistant Chief of Air Staff (A-2), *Schweinfurt: Ball Bearing Factories*, in *Reports of Attacks on Axis Targets in Europe*, USAAF, (Maxwell AFB, AL: AFHRA, 12 September 1943), 142.035-7, IRIS 115060.

susceptible to damage was not yet evident (and never would be), and neither was the incidental damage to the Schweinfurt transportation system. It was, however, evident that the target needed another visit if it was to receive the type of damage the intelligence reports demanded.

Economists from British RE8 continued their own trend of conservative estimates, and they pulled no punches as they countered the OSS and A-2 assessments with an even more pessimistic outlook: “The attacks on the ball-bearing plants at Schweinfurt caused relatively light damage...This amounts altogether to a loss of about 1 week’s supply of total anti-friction bearing output available to Germany...Both plants will have been ready for re-attack immediately after the raid, since the reduction in the rate of output at each was very small.”⁹⁹³ They confidently concluded from the same source material that the raid accomplished negligible results. As they saw it, the raid had not been worth the lives of the many airmen who’d perished or even the more fortunate fate of those who’d parachuted into harvest wheat fields—probably the only ones who were grateful the RAF had not followed up with a night raid.⁹⁹⁴

Hitler’s Vengeance and The Blue Hour

“Bomber” Harris hadn’t simply opted out of the AAF’s first attack on ball-bearings. In fact, his Bomber Command launched its own massive raid on the

⁹⁹³ Ministry of Home Security, *Raid Assessment Report, Ball Bearing Plants, Schweinfurt, Germany*, Research and Experiments Department, (Maxwell AFB, AL: AFHRA, undated, ca. 17 August 1943), #519.332, IRIS 216158, 1.

⁹⁹⁴ Martin Middlebrook, *The Schweinfurt-Regensburg Mission*, U.S. ed. (New York: Scribner, 1983), 294-299.

ideally moonlit night of 17/18 August 1943, and it did so *en masse*. However, Harris had received a competing priority from an unusual targeting source—Churchill himself, and the highly secretive target had nothing to do with the Pointblank Directive. It was also a difficult target, as it was too challenging to attack even with the help of radio-navigation and the bombers' onboard radar. Harris declared, "I knew that I should have to use the main force to ensure destruction of a target of such strategic importance; and that the attack would have to be made in moonlight; there could be no question in trusting only to H2S for the identification and marking of a target of this nature and Peenemünde was far beyond OBOE range."⁹⁹⁵ Reacting to unprecedented pressure to produce results, Harris even had his crews practice a "Master Bomber" tactic, whereby a specially trained crew of his elite pathfinder force would make a real-time call for trailing bombers to trust the pathfinder's target markers or to switch bomb releases to "time and distance" from Rügen Island—the initial point prior to the target.⁹⁹⁶ It was an innovative scheme, the type that arises from extraordinary circumstances—or at least from extraordinary pressure.

But the mission's true purpose, to destroy Hitler's dastardly experimental rocket facility at Peenemünde, was too secretive even for the aircrew to know. Instead, crews were fed a contrived-but-plausible cover story that they were hitting a "radio-location laboratory and aircraft testing site"—a threat against

⁹⁹⁵ Harris, *Bomber Offensive*, 182.

⁹⁹⁶ *Ibid.*

the bombers themselves.⁹⁹⁷ The crews were also told they'd better get it right on the first attempt or, as Harris put it, the raid "would have to be repeated on the next night, and on all suitable nights thereafter, regardless of casualties."⁹⁹⁸ Harris motivated his crews, dispatched his force of 597 bombers on a one-time operation (dubbed *Hydra*), and he lost 40 bombers and 215 crewmen in the effort—a toll that might have been far worse had Eighth Air Force not absorbed the best of the Luftwaffe's brutal parry earlier that day.⁹⁹⁹ This raid on Peenemünde possibly set Hitler's rocket program back by two months, but it was only the first salvo of yet another costly diversionary effort—this one more political than military—that would consume 36,795 bomber sorties and 102,491 tons of bombs, amounting to a whopping 15.5 percent of the total tonnage of bombs dropped over the subsequent year.¹⁰⁰⁰

As a target, Peenemünde had been hyped by mystique and controversy.¹⁰⁰¹ It had indeed emerged as a symbol of British fears for the worst-case scenario, that the Germans had advanced their long-range rocket program and that the skies over London might soon bellow in clouds of "powerful explosives, poison gas, or perhaps even biological or nuclear weapons," an Air Force history

⁹⁹⁷ Hastings, *Bomber Command*, 169.

⁹⁹⁸ Harris, *Bomber Offensive*, 183.

⁹⁹⁹ Williams, *Operation Crossbow*, 137; Hastings, *Bomber Command*, 169. Horst Boog, Gerhard Krebs, and Detlef Vogel, *The Strategic Air War in Europe and the War in the West and East Asia 1943-1944/5*, Germany and the Second World War (Oxford: Clarendon Press, 2006), 42.

¹⁰⁰⁰ United States Strategic Bombing Survey, *V-Weapons (Crossbow) Campaign*, ed. Military Analysis Division, 2nd ed., No. 60 (Washington, DC: USSBS, 1947), 3. Boog, Krebs, and Vogel, *Strategic Air War*, 42.

¹⁰⁰¹ Even the post-war bombing surveyors could not resist a rare editorial comment that the Crossbow Campaign, of which this raid became the ex-post-facto unofficial beginning, had been "clouded by secrecy and distorted by propaganda." See: United States Strategic Bombing Survey, *V-Weapons (Crossbow) Campaign*, 1.

captured.¹⁰⁰² Fear is a powerful human motivator and an extraordinary marketing tool.¹⁰⁰³

As touted by British intelligence, the threat aroused such alarm in Churchill that he had hired his own son-in-law, Duncan Sandys, to lead a hasty investigation into the V-weapons program.¹⁰⁰⁴ Codenamed *Bodyline*—the act of intentionally aiming at a cricket batsman—Sandys’ investigation intimated of German foul play by aiming rockets at civilians. Such play “was not only against the rules but certainly unsportsmanlike,” later highlighted a British photo-interpreter.¹⁰⁰⁵ Behind the British hysteria and Duncan Sandys’ report was a power struggle among competing factions of scientists, photo-interpreters, and other intelligence analysts to control the narrative of V-weapon discovery as well as the Allied response.¹⁰⁰⁶

The factions involved in targeting Hitler’s V-weapons, a target set that had

¹⁰⁰² Adam L. Gruen, *Preemptive Defense: Allied Air Power Versus Hitler's V-weapons, 1943-1945*, (Washington, DC: U.S. GPO, 1998), <http://purl.access.gpo.gov/GPO/LPS47668>. 1.

¹⁰⁰³ David Benady has argued, “Politicians and corporations often promise to protect us from perceived threats by playing to our fears.” Benady suggests that deliberate efforts by a handwash brand to inflate public fears of swine flu in order to sell their product serves as an example of this tendency. See: David Benady, “Marketing Fear,” *Marketing*, 2009 Aug 19 2009. Fear is a motivator for statesman and militaries alike. Posen offers that military organizations are prone to capitalizing on uncertainty to pursue their own ends--usually budget size and offensive doctrines. See: Posen, *The Sources of Military Doctrine: France, Britain, and Germany Between the World Wars*, 47-50, 75-77.

¹⁰⁰⁴ Gruen, *Preemptive Defense: Allied Air Power Versus Hitler's V-weapons, 1943-1945*. 9.

¹⁰⁰⁵ Powys-Lybbe, *Eye of Intelligence*, 192.

¹⁰⁰⁶ V-weapons or vergeltunswaffe (“get even” weapons) included several variations, although only the V-1 “flying bomb” or “buzz bomb” and the V-2 rocket saw operational use against England. Both were remarkably simple in terms of materials and suitability for mass-production, though they marked a revolutionary development in unmanned flight. According to the USSBS, both also carried a 2,200-pound warhead. For a more detailed description, see: United States Strategic Bombing Survey, *Aircraft Division Industry Report*, Second ed., No. 4 (Washington, DC: USSBS, January 1947), 112-119.

been unpredictable to operational planners, shifted influence over Allied targeting away from the generals toward a small circle of upper-level intelligence analysts, many of whom were scientists. Photo-interpreter Constance Babington-Smith later recalled of the campaign against Hitler's V-weapons, "there were the intelligence experts who weighed all the varied evidence, and upon whose judgment depended what action was likely to be taken."¹⁰⁰⁷ In other words, the analysts who controlled the intelligence about the V-weapon program also controlled the target priorities.

The resulting power struggle induced lasting enmity between three groups: British scientists (Lord Cherwell notably among them), who preferred not to admit that German rocket scientists could accomplish what the British scientists could not; photo-interpreters, one of whom would be chastised indefinitely by the other factions for allegedly refusing to label "a vertical column 40 feet high and 4 feet thick" as a rocket; and analysts who represented the emerging importance of non-photographic forms of intelligence into the realms of targeting and assessment.¹⁰⁰⁸ After Churchill held a war-cabinet meeting on 29 June 1943, during which he addressed viewpoints of the disparate factions and committed all sides to disrupting the threat, the feud became more about saving face and seeking prestige.¹⁰⁰⁹ The one argument the three British intelligence factions could agree upon was that locating and neutralizing German long-range weapons demanded maximum effort from the

¹⁰⁰⁷ Babington Smith, *Air Spy*, 204.

¹⁰⁰⁸ Williams, *Operation Crossbow*, 119. Powys-Lybbe, *Eye of Intelligence*, 191.

¹⁰⁰⁹ Williams, *Operation Crossbow*, 120-123.

Combined Bomber Offensive. Nevertheless, their differences in opinion over the origins of V-weapon targeting was illustrative of their organizational biases.

The scientists' perspective, predominated by Dr. Reginald Victor "R.V." Jones of British MI6, insisted that credit for pursuing the V-weapon threat (especially rockets), belonged to elite scientists and top-level intelligence analysts. As historian Allan Williams offered, Jones held to a small circle of trust, partly for security, but also because he felt, "a few clever people, even a single individual, can be more effective and efficient than a large organization."¹⁰¹⁰ He guarded his sources and his side of the story closely.

Jones claimed he was tipped off to German developments in 1942 by a secretive report by a Danish engineer, which purported of prototype V-2 launches from Peenemünde that October, as well as the transcript of a bugged conversation between two captive German generals.¹⁰¹¹ He even argued that high-profile fear-mongering by Sandys' report complicated rather than supported his clandestine work, because such reports "resulted in ill-considered questionnaires being sent out to all parts of our agent network."¹⁰¹² Those such as Jones, who were charged with particularly clandestine inquiry, preferred that their work remain that way, lest their sources became less reliable and their influence more diffuse.

Much to the photo-interpreters' dissatisfaction, Jones claimed to have

¹⁰¹⁰ Ibid., 107.

¹⁰¹¹ R. V. Jones, *The Wizard War: British Scientific Intelligence, 1939-1945*, 1st American ed. (New York, NY: Coward, McCann & Geoghegan, 1978), 332-333.

¹⁰¹² Ibid., 339.

personally identified the first V-2 rocket several days after the CIU's interpreters unsuccessfully reviewed the same images, which gave him "the kind of pulse of elation that you get when after hours of casting you realize that a salmon has taken your line—especially when someone else has had an exhaustive first chance at the pool."¹⁰¹³ Despite a considerable effort by a historian and former photo-interpreter to extricate the truth out of the disparate claims and probable timelines of V-weapon discovery, perhaps the most that can be said was that the relationship between the scientists and the photo-interpreters was "fraught with friction."¹⁰¹⁴ It seemed everyone with an investigative role wanted the credit for discovering and locating Hitler's V-weapons, but the only resolvable certainty was that the Germans had clearly developed long-range-weapon technology when the first pilotless V-1s soared into England on 12 June 1944.¹⁰¹⁵

Photo-interpretation advocates did not accept the scientists' argument. They held that their opinions might have cast meaningful shape to the shadows in their images had Peter Riddell's training that demanded "only reporting known facts" not prohibited opinions in photo-interpretation reports.¹⁰¹⁶ For example, Ursula Powys-Lybbe, another British photo-interpreter, later argued of the Bodyline investigation: "It must be stressed once again that interpretation officers were not permitted to make definitive statements about

¹⁰¹³ Ibid., 340.

¹⁰¹⁴ Roy M. Stanley, *V-Weapons Hunt: Defeating German Secret Weapons* (Barnsley: Pen & Sword Military, 2010), 46-70, quote on 54.

¹⁰¹⁵ United States Strategic Bombing Survey, *V-Weapons (Crossbow) Campaign*, 6.

¹⁰¹⁶ Williams, *Operation Crossbow*, 141.

any object they might have seen until it had been established by the authorities for what it was in actual terms, no matter what the [photo-interpreters] might have deduced personally.”¹⁰¹⁷ The photo-interpreters blamed their leadership for unnecessarily cuffing their creativity in solving targeting problems.

The photo-interpreters also had advocates outside of their own ranks. Notably, General Arnold had been enamored by the story behind the interpreters’ role in V-weapon and ski-site discovery, and of one photo-interpreter in particular: “Incidentally, this intelligence was not gained through the underground but from the air,” Arnold later quipped in his memoir, “it came from a detailed study of aerial photos by [photo-interpretation] experts at Medmenham, including a young WAAF officer named Flight Officer Constance Babington-Smith.”¹⁰¹⁸ Known to her friends as “Babs” and recognized for her “delicate features” and “sparkling deep intelligence,” Babington-Smith conveyed the tale with admirable humility in her own memoir.¹⁰¹⁹ However, it would seem the scent of her often-cited *L’Heure Bleue* perfume pervaded the impression others had of her more strongly than her own words.¹⁰²⁰

Babington-Smith adopted a zeal for her work reminiscent of the flamboyant

¹⁰¹⁷ Powys-Lybbe, *Eye of Intelligence*, 191.

¹⁰¹⁸ Arnold, *Global Mission*, 497.

¹⁰¹⁹ Williams, *Operation Crossbow*, 9

¹⁰²⁰ Per Flight Officer Babington-Smith herself, “...the perfume in question was Guerlain’s *L’Heure Bleue*, which I used rather a little too lavishly in those days, on the theory that the masculinity of WAAF uniform needed a little counteracting.” See: Babington Smith, *Air Spy*, 247. Williams, *Operation Crossbow*, 9; Jeremy Harwood, *World War Two From Above: An Aerial View of the Global Conflict* (Wollombi, AUS: Exisle Publishing, 2014), 71.

Sydney Cotton through her defiant bureaucratic risks. She not only bucked the establishment of her male-dominated service by outwardly maintaining her femininity, but she also applied her creative yet expertly tuned imagination as she deliberately investigated photographic images that were outside the immediate purview of her “everlasting watch for new German aircraft.”¹⁰²¹ She’d also examined wooded areas and fields that were normally privileged only to the Army interpreters, which led to her remarkable photographic discoveries in June and November of 1943.¹⁰²²

Babington-Smith was also no stranger to marketing her craft, having appeared in the Air Ministry’s 1941 propaganda film, *Target for Tonight*.¹⁰²³ Incidentally, her choice of perfume, still marketed by its manufacturer after a hundred years as “endearing, unsettling, captivating,” might better describe the *endearing* impression Babington-Smith had on those who met her, the *unsettling* effect Hitler’s “buzz bombs” had on panic-stricken Londoners, and

¹⁰²¹ Babington Smith, *Air Spy*, 226. Williams, *Operation Crossbow*, 123.

¹⁰²² Of note, Air Force Historians (referencing a New York Times Article) credited Flight Officer Constance Babington-Smith with identifying the V-1 flying bomb in May 1943. She corrected the record over a decade later when she first published her memoir. According to Babington-Smith, the object she’d originally identified turned out to be a “liquid-rocket” Me-163, not a V-1, and the date was later--23 June 1943; she identified an unknown 20-foot-wingspan aircraft along with the ski-shaped launcher in November. See: Babington Smith, *Air Spy*, 210. Craven and Cate, *Argument to V-E Day*, 84,89. Further, the source of Craven and Cate's error appears to be the New York Times, which had actually published two conflicting articles (not just the one to which the historians refer), and both were incorrect. In the first article, the Air Ministry attributes the find to her in March, 1943; the second article, published after the war, claims May. In any case both the Air Ministry and the media were eager to praise the apparent heroine and sell the story. See: "Robot Nemesis a Woman: WAAF Photo Interpreter First Spotted Bomb 18 Months Ago," *New York Times* 10 September 1944. Also: "WAAF Tells of Aid in Saving New York," *New York Times* 6 October 1945. Allan Williams also highlights the discrepancy in the Air Force history, but not the source of the error. See: Williams, *Operation Crossbow*, 87.

¹⁰²³ Williams, *Operation Crossbow*, 70-74.

the *captivating* grasp Operation Crossbow eventually maintained on Eighth Air Force Bombers as they shifted from Pointblank targets to V-weapon sites.¹⁰²⁴

A third perspective posited that credit for early intelligence regarding Hitler's V-weapons belonged not directly to photo-interpreters or scientists, but to a combination of HUMINT (human intelligence) sources: "disaffected German nationals; foreign nationals who worked with the Germans but maintained contact with [various] underground movements; and prisoners of war captured in North Africa."¹⁰²⁵ This viewpoint held that photo-interpreters only succeeded *after* they were instructed what to look for by those who were cleared for other forms of intelligence. This position rested on the idea that V-weapons had been present in reconnaissance photographs for months but had passed through the hands of photo-interpreters without remark.¹⁰²⁶

Matters of the target's origins aside, the American intelligence organizations, with their characteristic preoccupation with efficiency, perceived Crossbow as yet another distraction from their own preferences. The EOU economists eventually accepted that "some effort" may be required "of a strategically defensive character," with the following stipulation:

In view of the important alternative offensive tasks of our force, it is essential that the Crossbow bombing program as a whole be the most economical and effective, within the limits of the

¹⁰²⁴ According to the manufacturer's website, Babington-Smith's choice of fragrance has been in production since 1912, across nearly the entire history of airpower. Guerlain SA Département Internet, "L'Heure Bleue," Accessed 19 April 2017, <https://www.guerlain.com/us/en-us/fragrance/womens-fragrances/lheure-bleue>.

¹⁰²⁵ Gruen, *Preemptive Defense: Allied Air Power Versus Hitler's V-weapons, 1943-1945*. 8.

¹⁰²⁶ Williams, *Operation Crossbow*, 113. Babington Smith, *Air Spy*, 210-211.

*intelligence.*¹⁰²⁷

Of course, relationships mattered, and Babington-Smith had been assisting the EOU with its analysis of German aircraft production. She later recalled, “I had made a close study of test beds, because Walt Rostow and the American target experts had wanted to know numbers at each German factory—as evidence of potential output.”¹⁰²⁸ The EOU, aided by its position in the American embassy, surely understood it was powerless to interfere with the full weight of Churchill’s influence over the Combined Chiefs. Further, the EOU had more to lose in jeopardizing its precious connections with influential actors at the CIU than it might have gained in prestige with AAF leaders by holding strong to its previous targeting recommendations. Besides, the EOU members lived and worked within the V-weapons’ range alongside their British counterparts, so a small concession to endorse Crossbow targets might have seemed rational on their part, whether or not the actual risk of being hit was very high.

Eighth Air Force’s Operations Researchers, furthering their preference for small bombs and assessing building damage (versus contents), weighed in with their recommendations for attacking V-1 ski sites (the launch platforms for flying bombs): “If the objective were to cause maximum destruction,” they figured, “the most effective weapon was the 500 lb. GP (fuzed .025 tail).”¹⁰²⁹ As with other targets, their tendency to push for small bombs when confronted

¹⁰²⁷ Rostow, *Rostow Report*, ca. 30 April 1945, 123.

¹⁰²⁸ Babington Smith, *Air Spy*, 226.

¹⁰²⁹ Alderman, *Report for Colonel Leach on the History and Development of the Bombs and Fuzes Subsection of the Operational Analysis Section*, 10 April 1945, 21.

with ambiguity was detrimental. Experiments conducted against mock-up ski-sites at Eglin Field in February 1944 proved it was best to “hit the site with a delayed-action 1,000- or 2,000-pound bomb from a very low altitude.”¹⁰³⁰

However, that the tests at Eglin were accomplished as quickly and thoroughly as they were indicated a win for the scientists and researchers—their influence and resources were expanding.

Even with the bigger bombs, however, follow-on attacks could be required. Further, the ORS mathematicians were frustrated that photo-intelligence limitations of these camouflaged and forested ski sites had made their analytic approach to BDA nearly impossible. Their commitment to these targets thus reflected that of their leadership: “Our command was anxious to be relieved of the responsibility of attacking these targets and anxious to spend full time on our more meaty industrial targets,” they noted.¹⁰³¹ The American airmen, commanders and analysts alike, were not keen to place Londoners’ fears before their dwindling chances of proving their own designs for airpower.

Apart from the motives of the various air-intelligence factions, this emotionally charged start to the Crossbow campaign revealed an interaction of opposing air strategies with consequences for both the Allies and the Germans. Although Hitler’s V-weapon development clearly did not conform to Lord Cherwell’s claim that activity at Peenemünde was “an elaborate German hoax,” as historian Roy Stanley has described, there was evidence of a deliberate ploy

¹⁰³⁰ Gruen, *Preemptive Defense: Allied Air Power Versus Hitler's V-weapons, 1943-1945*. 22.

¹⁰³¹ Alderman, *Report for Colonel Leach on the History and Development of the Bombs and Fuzes Subsection of the Operational Analysis Section*, 10 April 1945, 20-21.

by German leadership to keep the heat off of the Luftwaffe's stumbling defenses.¹⁰³² Erhard Milch, one of Hitler's top Luftwaffe officers, saw advantage in keeping the Allied bombers focused on bombing the V-weapon sites on French coast, because "the men and machines eliminated there won't then get to Germany."¹⁰³³

Hitler's V-weapons did not require much accuracy to facilitate German strategy. The fear the V-weapons instilled in the London populace drove a massive shift in Londoners' resources, including absenteeism among workers, evacuation of women and children, and appropriation of 40,000 men as repair workers for recovery from attacks.¹⁰³⁴ In a broad sense, the eventual V-weapon attacks may have spiked the Londoners' fears and their responsive measures, but the shift of Allied air-campaign resources to disarm the threat was not without its price.¹⁰³⁵

On par with its cost to Pointblank's offensive bombing scheme, Hitler's V-weapon program commanded a shift in air-intelligence priorities as well. The V-weapon search devoured 40 percent of Allied photo-reconnaissance efforts from the British Isles after 1 May 1943.¹⁰³⁶ Further, the CIU reorganized a new subsection devoted exclusively to the V-weapon search, pulling scarce human

¹⁰³² Stanley, *V-Weapons Hunt: Defeating German Secret Weapons*, 58.

¹⁰³³ GLM meeting, 10 Sep 1943, BA-MA RL 3/38, 4523-4; cited in: Boog, Krebs, and Vogel, *Strategic Air War*, 422. Brian Mark Rigg, "Half-Jewish Field Marshal Erhard Milch," *World War II*, Jan 2004 2004, 72.

¹⁰³⁴ Boog, Krebs, and Vogel, *Strategic Air War*, 451-453.

¹⁰³⁵ USSBS surveyors later argued, "the attacks on England caused widespread damage, many casualties, and a considerable reduction of industrial efficiency...They had, however, little or no military effect." See: United States Strategic Bombing Survey, *V-Weapons (Crossbow) Campaign*, 16.

¹⁰³⁶ *Ibid.*, 29.

resources away from other interpretation duties.¹⁰³⁷ The British air-intelligence organizations had realigned their focus—and themselves—to face their immediate threat.

With a commensurate rise in air-intelligence stature, however, the imperative to solve the V-weapon mystery exemplified an increasing need for all-source analysis. A select few (such as Wing Commander Douglass Kendall) who were cleared for ULTRA, photo-interpretation, and POW interrogation sources, began to increase collaboration within the air-intelligence enterprise.¹⁰³⁸ “Our exact contribution to the delay in V-weapon attack and the reduction of their scope is not measurable,” concluded an official history of ULTRA, adding that “months later a diplomatic message of uncertain reliability says that the German necessity to re-convert secret weapons back to single-engine fighter production after the American attacks in February [of 1944] materially delayed the inauguration of the secret weapon attacks.”¹⁰³⁹ Such bits and pieces of high-level intelligence, nearly useless on their own, took useful shape when paired with other forms of information. Hitler had begun to respond to heavy attacks on his V-1 sites by re-prioritizing resources toward his defensive fighters.

With their frightful vengeance weapons and their small, distributed launch sites that were not particularly well-suited to daylight precision bombing or

¹⁰³⁷ Powys-Lybbe, *Eye of Intelligence*, 197.

¹⁰³⁸ Williams, *Operation Crossbow*, 142.

¹⁰³⁹ National Security Agency and Central Security Service, *ULTRA: History of U.S. Strategic Air Force Europe vs. German Air Force*, SRH-013, 093.

night area raids, the Germans exploited a political seam in the Allied air campaign; a fearful threat had allowed scientists to assert themselves among intelligence entities and to seize control of the Allied air campaign. The Combined Chiefs lacked the independent information to contain this influence. Reichminister Albert Speer even argued that Allied media played a role in stoking support for V-weapons on the German side. Within the Reich, “there was considerable opposition to V-1, including Göring,” Speer reflected, “but the press publicity in the United States and Great Britain encouraged the Germans and converted some skeptics.”¹⁰⁴⁰ In a sense, the Crossbow Campaign and the air resources it consumed thus darkened the American’s hopes for an independent air campaign into an early twilight or *l’heure bleue*—when “the sun has set, but...the night has not yet found its star.”¹⁰⁴¹

The photo-interpreters had, in fact, found their shining star in Flight Officer Constance Babington-Smith as they credited her with the V-weapon discovery—an act which symbolized perfection in her craft. As one Allied air-intelligence officer rose to prominence, too many Germans had already perished for Hitler’s strategy to succeed in secrecy. It was, after all, a shortage in German manpower that compelled German use of French construction companies in building the V-1 launch sites, which, as one history adds,

¹⁰⁴⁰ G-2 Division Combined Intelligence Objectives Sub-Committee, *Reich Ministry of Armaments and War Production*, (Maxwell AFB, AL: AFHRA, May-June 1945), #506.620v.102, IRIS 207643, 28.

¹⁰⁴¹ Guerlain SA Département Internet, “L’Heure Bleue,” Accessed 19 April 2017, <https://www.guerlain.com/us/en-us/fragrance/womens-fragrances/lheure-bleue>.

“positively invited the French workers to conduct espionage.”¹⁰⁴² The Crossbow campaign was thus a confluence of compelling forces: political objectives, fearful outrage, intelligence prestige, and strategic interaction, all of which served to derail the American’s quest bombing efficiency.



¹⁰⁴² Boog, Krebs, and Vogel, *Strategic Air War*, 426.

Chapter Eight: Quadrant to Sextant

*Any Air Force Commander operating against the enemy is primarily concerned with the effect his bombing has on the target he sends a force to destroy. If they destroy that target he will never willingly report the bombing as other than superior...*¹⁰⁴³

—Major General Ira C. Eaker, 15 September 1943

*The 'Party Line' was, then, both a theory of bombing policy and a related method of analysis. It insisted that targets be chosen in the light of an explicitly defined military aim, linked to the full context of war strategy, and especially to its timing... the 'Party Line' was, in short, a doctrine of warfare, not of economics or politics.*¹⁰⁴⁴

—Economist Walt Rostow, Enemy Objectives Unit, Sep 42 – Apr 45

Quadrant Shifts to the Ground

The week of 17 August 1943 brought more than the first major raid on ball-bearings; it offered the next opportunity for the Combined Chiefs to assemble along with their lead planners and senior staffers in Quebec. This time, Arnold would attend after having sat out of Trident with heart trouble, although he contributed uncharacteristically “very little” to the otherwise fiery conference.¹⁰⁴⁵ He made no recorded comments directly advocating for strategic bombing vis-à-vis a ground campaign as he had prodded Eaker. Comments he did make on the European Theater involved mostly concerns about replacement crews, loss rates (particularly for the Ploesti raid), and the value

¹⁰⁴³ Eaker, *Letter, Eaker to Giles*, 15 September 1943.

¹⁰⁴⁴ Rostow, *Rostow Report*, ca. 30 April 1945, 54-55.

¹⁰⁴⁵ Arnold noted of Quadrant, “there were some very rough, tough sessions. Angry words were sometimes thrown back and forth.” See: Arnold, *Global Mission*, 444; Parton, *Air Force Spoken Here*, 302.

additional air bases as far north as Florence Italy might provide to strikes against Germany despite a possible need for additional troops to hold a line further north than originally planned—a logic which drew a retort from his boss, General Marshall, that any additional forces in Italy should not draw away from the “overriding priority” of the cross-Channel invasion.¹⁰⁴⁶

General Marshall, by contrast to Arnold, had a very specific agenda for the meeting to gain full support for Overlord. He wanted consensus to eliminate additional operations in the Mediterranean in order to keep the focus on the building up of forces in England. He insisted on a firm decision one way or the other, so “that definite plans could be made with reasonable expectation of their being carried out.”¹⁰⁴⁷ The challenge, as Marshall saw it, was not in the plans themselves, but in the political waffling that caused unnecessary delays to military operations, led to inefficient transport between theaters, and typically led to increasing force requirements once operations began.¹⁰⁴⁸

Shipping capacity persisted as a frustrating check against the Combined Chief’s desired strategy. Just as trans-Atlantic shipping space had delayed the start of bombing in 1942, it would also pose a limiting factor for both the scope and the composition of cross-Channel invasion forces. Marshall had declared his irritation at Trident as well, noting “the only limit to Torch [the invasion of

¹⁰⁴⁶ 15th Air Force would bed down further south, in Foggia Italy in November, after Allied forces pushed the Germans north. See: Boog, Krebs, and Vogel, *Strategic Air War*, 102. 108th meeting of the CCS, 15 August 1943, document 376; 109th meeting of the CCS, 16 August 1943, document 378. Quoted in: Slany et al., “Foreign Relations of the United States, 1943.”

¹⁰⁴⁷ Minutes, 104th meeting of the JCS, 15 August 1943. Quoted in: Matloff, *Strategic Planning*, 220.

¹⁰⁴⁸ Ibid., 112, 221.

North Africa] had been the availability of shipping,” and the same problem reared up again.¹⁰⁴⁹ Troop redeployments between theaters only added to the problem by consuming shipping from the same pool of oceanic resources, so any potential troop movement from the Mediterranean to England needed to happen sooner rather than later. As an official Army history later reflected, “there was a definite trend toward increasing infantry and airborne divisions during 1943 since strategic and tactical demands as well as the need to save shipping space favored the use of forces that were not so heavily armed or so completely motorized.”¹⁰⁵⁰ This shift toward nimbler but more vulnerable ground forces, whether an intentional doctrine shift or an externally imposed limitation, would place an even greater demand on the air superiority mission.

Shortly thereafter (though still at the conference), Roosevelt released a joint statement with Churchill, based largely on British Naval Intelligence, purporting that U-boats attacks on Allied ships were in decline: “In the first six months of 1943, the number of ships sunk per U-boat operating was only half that in the last six months of 1942 and only a quarter that in the first half of 1942.”¹⁰⁵¹ Images of U-boat bases may have provided useful indicators, but no metric was more meaningful to the U-boat battle in the Atlantic than the

¹⁰⁴⁹ 83rd mtg of the CCS, 13 May 1943, document 31; quoted in: Slany et al., “Foreign Relations of the United States, 1943.”

¹⁰⁵⁰ Matloff, *The 90-Division Gamble*, 374.

¹⁰⁵¹ White House Press Release, 14 August 1943, document 370. Cited in: Slany et al., “Foreign Relations of the United States, 1943.” Although other intelligence sources may have been incorporated, the Office of the State Department Historian contends: “The text of this joint statement followed very closely a draft which Churchill had sent to Roosevelt in telegram No. 408, August 11, 1943.” This was in opposition to the perspective held by the American Navy.

numbers of Allied vessels getting through to their destinations. Nevertheless, the incorrigible CNO Admiral Ernest King was “surprised to learn that the bombing of U-boat bases in France had been stopped or slowed down,” and even if they were presently under control, he felt they were being “refitted with a view to renewing the offensive.”¹⁰⁵² King had no intention of relenting on the AAF to keep its bombsights trained against the U-boats. Pressure slackened, however, from Admiral Sir Dudley Pound on the British side, as he recognized that bombing of U-boat bases on the French coast “did not justify a great diversion from the essential bombing offensive against German fighter factories.”¹⁰⁵³ Arnold held his tongue; there was an even more important conversation looming.

Husky leaves a mark. Adding to Marshall’s concerns about the pull of further Army resources into the Mediterranean, American and British airborne troops had only just initiated their assault on Sicily (Operation Husky) five weeks earlier. With an intense combination of air-ground integration, Allied forces crumpled Axis resistance, sending Germans and Italians retreating north from the island in the days prior to the Quadrant conference.

Over the two-month stretch of Husky (bombing actually began on 15 June), the Allies shot down 533 axis aircraft and destroyed many more on the ground; from Lord Arthur Tedder’s tally (as Eisenhower’s Mediterranean Air Commander), “2,000 tons of bombs had been dropped on ports and bases,

¹⁰⁵² Combined Chiefs of Staff Minutes, 14 August 1943, document 373. Cited in: *ibid*.

¹⁰⁵³ Combined Chiefs of Staff Minutes, 14 August 1943, document 373. Cited in: *ibid*.

nearly 7,500 tons on airfields, and no less than 15,500 tons on lines of communication.”¹⁰⁵⁴ By comparison, over a similar period of July and August, Eaker’s heavy bombers had managed to drop less than 8,200 tons—or a third of the ordnance expended in Husky.¹⁰⁵⁵ For Eighth Air Force, they were the two most productive months thus far in the air campaign; July alone exceeded the total weight of bombs expended in the first eight months combined—a fact anxiously reported by the EOU in September.¹⁰⁵⁶

Spaatz’s Northwest African Air Force (a component of Tedder’s command) not only swept up air superiority, but it also demonstrated extraordinary close air support. Radio-equipped air officers embedded with ground formations coordinated bombing attacks and prevented inadvertent fratricide of Allied troops.¹⁰⁵⁷ The operation left a favorable impression of airpower in the minds of ground commanders, especially Eisenhower. He appreciated the “vast bombing operation” prior to the invasion, but it was the air interdiction that left an indelible mark, “entirely aside from its success in defeating the enemy forces, it so badly battered the enemy communications in Sicily and southern Italy that the mobility of his forces was materially lowered and the supply of his troops was a most difficult process,” he commended.¹⁰⁵⁸ If there had been a downside

¹⁰⁵⁴ Arthur William Tedder, *With Prejudice: The War Memoirs of Marshal of the Royal Air Force, Lord Tedder* (Boston, MA: Little, Brown, 1967), 422, 452-453.

¹⁰⁵⁵ Headquarters Eighth Air Force, *Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: September, 3rd Month of Second Phase*, (Maxwell AFB, AL: AFHRA, 1 October 1943), #168.61-10, IRIS 124347.

¹⁰⁵⁶ Office of Strategic Services, *Bomb Damage Report*, 18 September 1943, 1.

¹⁰⁵⁷ Mets, *Master of Airpower: General Carl A. Spaatz*, 163-164.

¹⁰⁵⁸ Eisenhower, *Crusade in Europe*, 179.

to Husky, it had been the bombers' inability (along with Allied naval forces) either to block the retreating Axis forces or to destroy them before they fled across the Straits of Messina—a failure to exploit the air-ground victory.¹⁰⁵⁹

The experience left Eisenhower with high expectations and an unflappable optimism for bombing support to the battlefield, while the bombing raid on oil fields earlier that month on Ploesti seemed to him a superfluous diversion. “Too often we had found the factories listed by our experts as destroyed were again working at full output within a matter of weeks or even days,” he later remarked.¹⁰⁶⁰ Without an assessment process credible enough to demonstrate the successes of strategic bombing, its appreciation was falling victim in the minds of senior commanders who could see the benefits of air support and interdiction with their own eyes.

Though no American, including Arnold, attempted to address the progress of the CBO in appreciable terms at Quebec, the British did. Air Chief Marshal Portal, relying solely on the assessment produced by the British Joint Intelligence Committee, advocated for additional resources by attempting to show that their efforts were working even if they were not yet conclusive. His gambit was to admit, up front, that “damage caused by the air offensive was difficult to assess in precise terms,” and that the effect of industrial attacks “on forces in the field was not immediate and results on these forces would increase as time went on”; he relied instead on emphasizing the German

¹⁰⁵⁹ Mets, *Master of Airpower: General Carl A. Spaatz*, 164.

¹⁰⁶⁰ Eisenhower, *Crusade in Europe*, 161,247.

response to Allied attacks, insisting they were on the defensive in the air battle and forced to use their night fighters to repel daylight raids.¹⁰⁶¹ He pushed the point home at another meeting, using language he knew would resonate with his Army counterparts: "There is no need for us to speculate about the effect of 'Pointblank' on Germany. The Germans themselves, when they weaken the Russian and Mediterranean fronts in the face of serious reverses there, tell us by their acts what importance to attach to it."¹⁰⁶² Portal understood the interactive nature of the air campaign and its inextricable link to enemy will, even if the JIC assessment stood feebly beneath his argument. He offered, as though speaking on behalf of the AAF (especially of Arnold's role to equip):

*German fighter strength was stretched almost to the breaking point, and in spite of their precarious situation on the Russian and Mediterranean fronts, they had found it necessary to reinforce their fighter forces on the Western Front from these sources. On the other hand, the expansion of German fighter strength was continuing and had increased 13 percent this year...The Eighth Air Force, who were achieving a great task with their existing resources, believed they could achieve even greater success if their strength was increased.*¹⁰⁶³

In the final analysis, Portal secured what he'd desired from the conference, broad acknowledgement that the CBO had been under-resourced and commitment for the planned numbers of forces in theater.

However, negotiations produced unintended consequences from the airmen's perspective, especially those whose unvoiced opinions included a

¹⁰⁶¹ 109th meeting of the CCS, 16 August 1943, document 378. Quoted in: Slany et al., "Foreign Relations of the United States, 1943."

¹⁰⁶² Enclosure to C.C.S. 309, 15 August 1943, document 449. Quoted in: *ibid.*

¹⁰⁶³ Parton, *Air Force Spoken Here*, 304.

belief that airpower could still win on its own. The Combined Chiefs again revised the Pointblank directive, subordinating the air-campaign's success to that of the ground forces. The directive now wove in the primary employment of heavy bombers for interdiction:

*The progressive destruction and dislocation of the German military, industrial and economic system, the disruption of vital elements of lines of communication, and the material reduction of German air combat strength by the successful prosecution of the Combined Bomber Offensive is a prerequisite to Overlord (barring an independent and complete Russian victory before Overlord can be mounted). This operation must therefore continue to have highest strategic priority.*¹⁰⁶⁴

Once air superiority might be assured, whether to beget further airpower or to support ground forces was an unnecessary argument. The lingering ambiguity was whether interdiction of German transportation or dislocation of economic resources would be the better use of airpower, not only in the months leading into the invasion, but all the way to victory. Eaker's air campaign had not shown appreciable success with submarine efforts, was yet to secure any degree of air superiority, had not inflicted industrial impacts beyond reducing German cushion in oil and rubber, and now Eaker bought the additional implied task of closing down ground lines of communication. In the meantime, however, Eaker had received yet another inescapable priority.

The Blind, the Weary, and the Wishful

On 27 August, Eaker sent a task force based around his 3rd Air Division

¹⁰⁶⁴ C.C.S. 303/3, 17 August 1943, document 451. Quoted in: Slany et al., "Foreign Relations of the United States, 1943."

to continue Eighth Air Force's foray into delaying Hitler's V-weapon program. This target, described unobtrusively in VIII Bomber Command files as "the Aeronautical Facilities Station at Watten," was raided for the first time by Eaker's 1st and 3rd Divisions just 11 days earlier.¹⁰⁶⁵ The concrete monstrosity located there fell under an even greater shroud of ambiguity than had Peenemünde. A CIU photo-interpreter later told of its origin: "in mid-May 1943, a large concrete structure was discovered near Watten in the Pas de Calais... It was a mystery and it could not be connected with any known military objective."¹⁰⁶⁶ Hitler had apparently not intended any sort of grand disclosure, and this made the facility even more attractive as a target to the intelligence analysts. Clarifying its purpose, though not necessarily its importance, a special inquiry chartered by the Prime Minister to Duncan Sandys' Crossbow Committee (known as "The Sanders Mission") would claim that "Watten was intended to be a chemical factory associated with Crossbow sites," adding, "there are no indications that it was to be used for projection of any type of missile."¹⁰⁶⁷ Watten was a special chemical factory indeed.

¹⁰⁶⁵ Headquarters VIII Bomber Command, *Bomber Command Narrative of Operations, 92nd Operation*, (Maxwell AFB, AL: AFHRA, 7 September 1943), #145.81-140, IRIS 118081, 1.

¹⁰⁶⁶ Powys-Lybbe, *Eye of Intelligence*, 190.

¹⁰⁶⁷ This inquiry fell under the purview of Charles D. Ellis, Chairman of Rocket Sub-Committee of the Crossbow Committee, who formed a team later known as "the Sanders Mission" under Colonel Terence Sanders of the British Armament Design Department. Their purpose was to investigate the heavily constructed Crossbow sites ("problem children") other than the obvious ski- and rocket-sites after Allied occupation. The committee comprised membership primarily from the British Ministry of Supply, Air Ministry, and War Office. See: C.D. Ellis, Chairman of the Rocket Sub-committee, *Memorandum for Colonel T.R.B. Sanders*, in *Report by the Sanders Mission the Chairman of the Crossbow Committee*, The War Office, (Maxwell AFB, AL: AFHRA, 12 October 1944), #505.58-32, IRIS 206396, Appendix F. Also, Colonel Terence R.B. Sanders, *Investigation of the 'Heavy' Crossbow Installations in Northern France*, in *Report by the Sanders Mission the Chairman of the Crossbow Committee*, (Maxwell AFB, AL: AFHRA, 21 February

As opposed to photo-interpreters, British scientists felt no compulsion to base their investigative reports on provable facts. As to Watten's purpose, they reasoned, "the aluminum tanks give some lead, in that they are of a type already associated with German technique for handling hydrogen peroxide. In addition, it can be deduced from the extensive air-conditioning system that the process involved the handling of unpleasant gasses."¹⁰⁶⁸ If the Reich planned to produce ample hydrogen peroxide, which could play a role in rockets as well as "the launching gear of the flying bomb," then Watten was a necessary target as far as British intelligence analysts were concerned.¹⁰⁶⁹ As intelligence consumers, the bomber crews needed to know only enough to help them recognize their target and to keep them motivated.¹⁰⁷⁰ The idea that was passed along during the mission brief was to take out this "special construction" while

1945), #505.58-32, IRIS 206396, 6.

¹⁰⁶⁸ Sanders, *'Heavy' Crossbow Installations*, 21 February 1945, Appendix C.

¹⁰⁶⁹ MEW analysts also noted interest by the German Navy to produce hydrogen peroxide-propelled submarines and torpedoes, though they found "no evidence this material was ever used operationally in either weapon." See: Foreign Office German Economic Department, *Economic Intelligence Weekly*, Landsdowne House, Report No. 10, (Maxwell AFB, AL: AFHRA, 1 August 1945), #512.611B, IRIS 2211817, 1-3.

¹⁰⁷⁰ On 16 December 1943, Eighth Air Force disseminated a classified summary about Crossbow down to each group headquarters, noting with a certain better-late-than-never irony, "the importance of imparting the information...to combat crews operating against the installations described therein cannot be overemphasized." Interestingly, the American summary for aircrew contended that a ski-site was "nearing completion" at Watten when it was attacked on 27 August. The Sanders Mission contended that "there are no indications that it was to be used for projection of any type of missile." Adding to the enduring mystery, the USSBS surveyors concluded that the site, "which was begun in May 1943 as a V-2 launching site was redesigned as a plant for making liquid oxygen, a rocket fuel, after being seriously damaged." Depending on the source, Watten's original purpose could have been for V-1, V-2, or chemical production all along. See: Colonel H. G. Culton, Adjutant General, *Memorandum, Subject: "CROSSBOW"*, Headquarters Eighth Air Force, Office of the Commanding General, (Maxwell AFB, AL: AHFRA, 16 December 2017), #520.431A, IRIS 224261, 1-2. Also, Sanders, *'Heavy' Crossbow Installations*, 21 February 1945, 6. United States Strategic Bombing Survey, *V-Weapons (Crossbow) Campaign*, 5.

it was still being built.¹⁰⁷¹ First time success was paramount.

This 7 September raid was the second consecutive mission to Watten where a mixture of environmental factors and human error trashed the crews' bombing performance far worse than enemy defenses. The previous effort, just two weeks prior, had been stymied by haze and an ill-conceived plan as three of the four formations attacked westbound into the setting sun. Crews of the 1st Bombardment Wing, comprising the third wave across the target, seemed to come unglued as they fought through the blinding orange glare, and their S-2s ensured the post-mission reports noted as much. For example, the 306th Bombardment Group's S-2 concluded little of his crews' bomb damage, but he noted their complaints that "you can't fly formation when you can't see."¹⁰⁷² The 305th Bombardment Group S-2 had even sharper words: "The crews as a mass were very bitter about having to bomb into the late afternoon sun," he noted, adding with heartbreaking disappointment that the Groups' lead bombardier had somehow managed to locate the target, but "the navigator accidentally touched the toggle switch with his arm about 90 seconds before the proper time."¹⁰⁷³ Many crews and their group intelligence officers were frustrated, and they called it as they saw it in their reports.

¹⁰⁷¹ Headquarters 3rd Air Division, *Mission 46: Watten (France)*, (Maxwell AFB, AL: AFHRA, 27 August 1943), #527.332, IRIS 230281, Primary Target. Also, an official Air Ministry history contends that the Chief of Staff ordered the 27 August attack because "it was likely that the building would soon be covered with a concrete roof which would make it difficult serious damage by bombing and hide from the reconnaissance camera the activity of the site." See: Air Ministry, *Photographic Reconnaissance, Vol. 2, May 1941 - August 1945*, 1948, 161.

¹⁰⁷² S-2 306th Bombardment Group, *Teletype Report, Mission 27 August 1943*, War Department, (Maxwell AFB, AL: AFHRA, 27 August 1943), #525.332B, IRIS 228299, 2.

¹⁰⁷³ S-2 305th Bombardment Group, *Teletype Report, Mission 27 August 1943*, War Department, (Maxwell AFB, AL: AFHRA, 28 August 1943), #525.332B, IRIS 228299, 2.

Of the 16 total bomb groups that dropped more than 360 tons of bombs that afternoon as the crews practically felt their way across the target, two groups combined to put 19 weapons close to the aiming point.¹⁰⁷⁴ In spite of the hundreds of stray bombs, the two fortunate clusters of bombs succeeded well enough for the CIU photo-interpreter to conclude, “while these [clusters] fell almost an hour apart, together they blanket the target.”¹⁰⁷⁵

Unfortunately, the effort was not successful enough to satisfy Duncan Sandys. The 3rd Air Division S-2 received a message from higher headquarters two weeks later, on 6 September, to brief his crews: “The target was damaged in previous attack by aircraft of this wing, and it is desired to completely destroy the installation before construction has been completed.”¹⁰⁷⁶ Perhaps with better equipment, training, and tactics for poor visibility conditions, the crews may have succeeded with the target the first time. In any case, Duncan Sandys had apparently garnered enough influence from Eaker’s intelligence and planning staffs to assess the bombing and force the re-attack.

¹⁰⁷⁴ Central Interpretation Unit, *Interpretation Report No. S.A. 493*, Medmenham RAF Station, (Maxwell AFB, AL: AFHRA, 29 August 1943), #527.332, IRIS 230280, 1.

¹⁰⁷⁵ Ibid.

¹⁰⁷⁶ Headquarters 4th Bombardment Wing, *Operations Broadcast, Teletype*, (Maxwell AFB, AL: AFHRA, 6 September 1943), #527.332, IRIS 230280, Additional Briefing Material on Z-782.

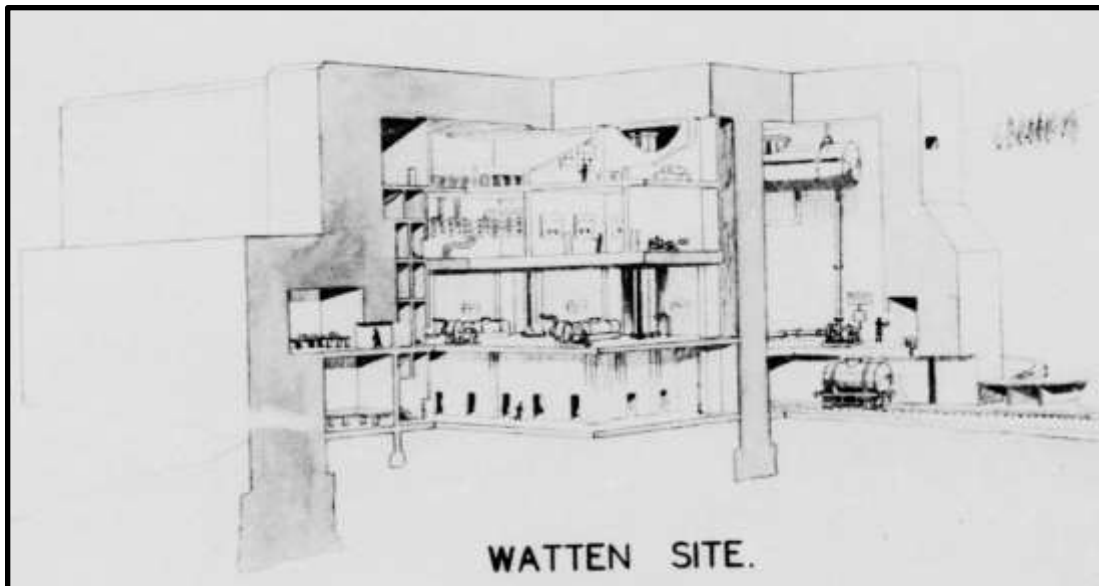


Figure 5. Perspective View Showing Size and Strength of Main Building at Watten.

(Reprinted from Air Ministry, Investigation of the 'Heavy' Crossbow Installations in Northern France, in Report by the Sanders Mission the Chairman of the Crossbow Committee, (Maxwell AFB, AL: AFHRA, 21 February 1944), #505.58-32, IRIS 206396, Volume 2, Figure. 26.)

On 7 September, Eaker launched his 3rd Air Division, still under the command of then-Colonel LeMay, on a return visit to Watten. LeMay went heavy. All 147 aircraft that he dispatched carried two 2,000-pound bombs in hopes of irreparably damaging the concrete of the main building as it was still being poured (see Figure 5).¹⁰⁷⁷ Unfortunately, only 58 bombers managed to attack the target, primarily due to weather over the French coast, so they ended up bringing home more bombs than they dropped.¹⁰⁷⁸ Weather at the target was exactly as forecast—about half of the sky was obscured by a mix of swelling cumulus and cirrus clouds—not bad for that time of year, but it was

¹⁰⁷⁷ Headquarters VIII Bomber Command, *Report of Operations*, in *Mission No. 92-93*, Eighth Air Force, (Maxwell AFB, AL: AFHRA, 7 September 1943), #520.332, IRIS 221669, Summary of Operations.

¹⁰⁷⁸ *Ibid.*; VIII Bomber Command, *Bomber Command Narrative of Operations*, 92nd Operation, 7 September 1943, 2.

too much for the bombers to sort through with their visual-bombing techniques, especially given the small target.¹⁰⁷⁹ Most of the bombers simply followed orders—and their leaders—back to England.

The bomber crews were nonplussed. No crew wanted to carry its bombs over enemy territory and back home again, especially after taking flak in the process; not only did they feel robbed of mission performance, but for practical purposes, they would not even gain the boost in aircraft performance from reducing aircraft weight.¹⁰⁸⁰ Having gained visual contact with a secondary target—in this case “any active airdrome”—and still not bombed anything was enough to inspire the crews’ to provide remarkably candid feedback up the chain of command.¹⁰⁸¹ For example, one crew from the 94th Bombardment Group fired back during interrogation that they failed to bomb due to “cloud cover. However, [we] believe we could have bombed an airdrome in France. Saw St. Omer field and St. Englebert field.”¹⁰⁸² The crews had no reservations in blaming the plan or the established procedure of silently following the lead crew. As the crews saw it, their headquarters leadership was buying into targets that the crews could not hit in bad weather with the equipment they

¹⁰⁷⁹ VIII Bomber Command, *Bomber Command Narrative of Operations, 92nd Operation*, 7 September 1943, 4.

¹⁰⁸⁰ The desire to reduce aircraft weight to gain performance would not have been unique to the Americans. For example, British Lancaster crews had been caught “dumping their 4,000-lb ‘cookies’ in the North Sea to gain height and speed.” Needless to say, bringing bombs home was not a preferred option for any bomber crew. See: Hastings, *Bomber Command*, 219.

¹⁰⁸¹ 4th Bombardment Wing, *Operations Broadcast, Teletype*, 6 September 1943, Advance Warning to 4BW Field Order No. 54.

¹⁰⁸² John B. Bayer, Jr. (S-2), *Interrogation Form*, Headquarters 4th Bombardment Wing, (Maxwell AFB, AL: AFHRA, 7 September 1943), #527.332, IRIS 230280, Group 94, Squadron 410, Crew #414.

had. As to the name of the secondary target listed on their Group's immediate telephone report up to 4th Bomb Wing Headquarters, their S-2 simply listed "none."¹⁰⁸³ Maybe the Group's lead bombardier and the Group S-2 had bought so fully into the importance of the primary target that they hadn't given much thought about listing the day's approved secondary option—one that would have helped gain air superiority for D-Day. In any case, the S-2 did not highlight the missed opportunity up the chain of command.

The best that could be said of this second mission to Watten was that no bombers were lost, despite "moderate accurate fire" from flak batteries—some of which appeared to originate from railroad guns in the target area.¹⁰⁸⁴ No enemy fighters even bothered to respond. Nevertheless, bombing performance was abysmal. Of the 57 total bomb bursts that appeared in the BDA images, only 5 could be confirmed in the target area; a few fell along a roadway and "the balance are in the woods nearby," noted a CIU photo-interpreter.¹⁰⁸⁵ Photos from a reconnaissance mission flown a couple hours after the attack showed the same. Though the images were of poor quality, as expected given the cloud cover, the pilot had maneuvered to snap the photographs at a favorable angle. A CIU interpreter could see enough to confirm the ineffectual

¹⁰⁸³ S-2 94th Bombardment Group, *Telephone Report, Form 102*, Headquarters 94th Bombardment Group, (Maxwell AFB, AL: AFHRA, 7 September 1943), #527.332, IRIS 230280, 1.

¹⁰⁸⁴ VIII Bomber Command, *Bomber Command Narrative of Operations, 92nd Operation*, 7 September 1943, 2. VIII Bomber Command, *Report of Operations*, 7 September 1943, Summary of Operations.

¹⁰⁸⁵ Central Interpretation Unit, *Interpretation Report No. S.A. 538*, (Maxwell AFB, AL: AFHRA, 8 September 1943), #520.332, IRIS 221669, 1.

attack: “No significant new damage is seen.”¹⁰⁸⁶

An Eighth Air Force monthly summary produced a few weeks later recorded the following of this raid: “The attack on the special objective in the Pas de Calais area was again successful, damage inflicted on this installation.”¹⁰⁸⁷ While it isn’t clear who produced the report, whether Eaker acknowledged it, or if Arnold read it, it is clear that the Eighth Air Force report did not include an accurate impression based on the bomb-damage assessments or the crews’ candid feedback. Eighth Air Force had taken on a character of selling its success and scrubbing negative feedback as reports proceeded up through channels.¹⁰⁸⁸ If the Watten mission should have demonstrated anything to Eighth Air Force, it was that daylight precision bombing, *weary* crews, and *blind* visibility did not mix, no matter who promoted the target or how *wishful* they were about stopping the enemy’s cheating intentions or even winning the war with airpower.¹⁰⁸⁹

Counting bombs and feigning interest. In addition to the attack on Watten, Eighth Air Force attacked another target on 7 September. After

¹⁰⁸⁶ Central Interpretation Unit, *Negative Damage Report No. S.A. 209*, (Maxwell AFB, AL: AFHRA, 8 September 1943), #520.332, IRIS 221669.

¹⁰⁸⁷ Eighth Air Force, *Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: September, 3rd Month of Second Phase*, 1 October 1943, III.

¹⁰⁸⁸ The Sanders-Mission report focused on the aftermath. It was as if the British scientists sought to validate that the bombing had done as well as it could, but the Germans persevered through sheer will and manpower: “Heavy raids in August and September, 1943, caused great damage to [concrete buildings], but by November of that year the site had been cleared up and new and stronger buildings were started...The enemy showed the great importance he attached to it by the tremendous effort he put into it.” See: Sanders, *‘Heavy’ Crossbow Installations*, 21 February 1945, Appendix C.

¹⁰⁸⁹ The bombing may have caused short-term delays at Watten and other V-weapon sites, but it was ultimately the Allied armies on the ground that stopped the missiles. See: *ibid.*

Schweinfurt's losses, Eaker spent the subsequent weeks focused on German airfields and aircraft-repair facilities in occupied territories. Although airfields were not Pointblank targets, the aircraft-repair depots such as the one at Brussels-Evere, fell broadly under the Pointblank Directive's guidelines, though neither had been endorsed by the air-intelligence organizations.¹⁰⁹⁰ As reported by VIII Bomber Command, this raid on the German-occupied facilities in Belgium featured 104 B-17s dropping more than twelve hundred 500-pound bombs; the crews achieved direct hits on hangars, factory workshops, and barracks, and strung a multitude of craters across the airfield, while taking zero losses.¹⁰⁹¹ The raid seemed an easy feather in the cap for Eaker, and certainly one that might aid the aim of achieving air superiority for the eventual cross-Channel invasion, but that still did not make the airfield itself a Pointblank target—or any of the seven airfields that Eaker attacked with his B-17s during the second half of September.¹⁰⁹²

Nevertheless, the plan for 7 September had called for “two forces of three groups each” from Brigadier General Anderson's 1st Bombardment Division; all six groups were to employ using the bomb-on-leader technique, meaning all aircraft in each group would drop simultaneously from their position in the

¹⁰⁹⁰ According to Harrison, Sir Charles Portal interpreted the Pointblank Directive even more broadly than Eighth Air Force and certainly than Arnold's A-2 staff. See: Gordon A. Harrison, *Cross-Channel Attack* (Washington, DC: Department of the Army, 1951), 209.

¹⁰⁹¹ VIII Bomber Command, *Bomber Command Narrative of Operations, 92nd Operation*, 7 September 1943.

¹⁰⁹² A-2 Eighth Air Force, *Semi-monthly Report of Bombing Results, 16 September through 30 September 1943*, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, ca 1 October 1943), #520.307, IRIS 219685, 8; Hansell, *The Air Plan that Defeated Hitler*, 201-202.

formation based upon the navigation and aiming solution of the leader.¹⁰⁹³ In a composite formation with the 92nd, the 306th Bombardment Group formed the rear group, which gave them the best view of the devastation from the preceding groups. After the exhilarated aircrews landed in England, the 306th Bombardment Group S-2 completed the post-flight interrogation and reported on his crews' apparent success, along the aggressive mindset of the Group's lead bombardier:

*Bombing excellent, as confirmed by photographs. Aiming point of this group had been hit by previous group when our A/C arrived over the target. Lead bombardier quickly changed aiming point further north and our bombs were seen to hit along northwest edge of field, amongst hangars, workshops, barracks, and administrative buildings.*¹⁰⁹⁴

Using the bomb-camera prints the next day, the Central Interpretation Unit's photo-interpreters attempted to characterize the damage. Smoke from the bomb impacts partially obscured the airfield images, but the interpreters were able to describe several concentrations of bombs in and around the target area, including direct hits on the airfield and factory area where "the concentration is so heavy that an accurate count is impossible but at least 150 distinct bursts are seen."¹⁰⁹⁵ From the appearance of it, the raid had been a dazzling success, though the Group's bomb plot showed only 33 of the 1,243

¹⁰⁹³ Brigadier General F. L. Anderson, *Report of Operations, 7 September 1943*, in *Tactical Mission Report, Brussels/Evere*, 1st Bombardment Wing Headquarters, VIII Bomber Command Headquarters, (Maxwell AFB, AL: AFHRA, 10 September 1943), #520.332, IRIS 221669, 2. Headquarters VIII Bomber Command, *Bombing Data*, in *Tactical Mission Report, Brussels/Evere*, (Maxwell AFB, AL: AFHRA, 10 September 1943), #520.332, IRIS 221669.

¹⁰⁹⁴ S-2 306th Bombardment Group, *Teletype Report, Mission 7 September 1943*, War Department, (Maxwell AFB, AL: AFHRA, 8 September 1943), #525.332B, IRIS 228309, 1.

¹⁰⁹⁵ Central Interpretation Unit, *Interpretation Report S.A. 536*, Medmenham RAF Station, (Maxwell AFB, AL: AFHRA, 9 September 1943), #520.332, IRIS 221669, 1.

bombs (2.7%) had dropped within 1,000 feet of the aiming-point, and 979 of the bombs dropped could not be located at all (see figure 6 below).¹⁰⁹⁶ Perhaps there was more to learn than could be gleaned from *counting bombs* on the strike photos or the bomb plot. None of the methods, the verbal reports, the photo-interpretation, or the bomb plotting, seemed particularly reliable, and the accuracy could not account for the fact that an entire bomb group had deliberately shifted its aim point.

A single reconnaissance pass a little more than three hours after the raid failed to capture anything of value, due partly to clouds, although much of the area of interest was not within the area covered by the photographs.¹⁰⁹⁷ The CIU released a follow-up report anyway, but any real sense of what the raid had accomplished would have to wait. Another report two weeks later finally tallied up the damage, including “210 craters on the airfield,” but offered no insight into airfield’s operational status, repair activity, or any other indicators of enemy intent.¹⁰⁹⁸ For reasons that could only be described as a lack of priority, probably due to Bodyline and Crossbow requirements, reconnaissance flights did not capture images suitable for further analysis until nearly four months after the raid. The first effort to produce a “clearance and reconstruction report” required an additional two weeks after the eventual

¹⁰⁹⁶ Headquarters 1st Bombardment Division, *Group Bombing Plot and Report*, in *Brussels/Evere Mission* (7 September 1943), #525.332, IRIS 227605.

¹⁰⁹⁷ Central Interpretation Unit, *Immediate Interpretation Report K.1710*, Medmenham RAF Station, (Maxwell AFB, AL: AFHRA, 8 September 1943), #520.332, IRIS 221669.

¹⁰⁹⁸ Central Interpretation Unit, *Immediate Interpretation Report K.1728*, Medmenham RAF Station, (Maxwell AFB, AL: AFHRA, 19 September 1943), #520.332, IRIS 221669.

reconnaissance flight.¹⁰⁹⁹

The results in the follow-up BDA report were not worth the wait. Along with a list of buildings under repair, it offered a generic summary: “reconstruction of the framework of damaged buildings and fresh roof covering is visible, but constructional work and re-equipment may continue after roofing material has been re-laid before a factory is once more in production.”¹¹⁰⁰ Flight Officer Babington-Smith’s L-section, specializing in aircraft reports, added commentary that several aircraft appeared, including “nine light-colored Me-110s.”¹¹⁰¹ Just as Squadron Leader Riddell had instructed, the analysis was scientific in its description, but safely devoid of creative insight. Was the repair facility active or not, and why had they referred to it as a factory? These sorts of questions were neither anticipated nor answered.

From the Brussels-Evere bomb-damage assessments, a number of observations began to emerge: crews did what they could to get their bombs on the target area; the images neither showed all the bombs nor told the full story of their effects; reconnaissance opportunities might be sparse amid competing priorities; and the assessments—especially if single-source—may be inconclusive, if even complete. The CIU’s interpreters were comfortable with their routine work, but reconnaissance efforts were clearly not committed to Eaker’s attacks on airfields.

¹⁰⁹⁹ Central Interpretation Unit, *Interpretation Report KS.280*, Medmenham RAF Station, (Maxwell AFB, AL: AFHRA, 14 January 1944), #520.332, IRIS 221669, 1.

¹¹⁰⁰ Ibid.

¹¹⁰¹ Ibid.

Eaker had added targets and shifted priorities partly because he wanted to show his plan was “a practical job from an active theater,” and not something they could produce in Washington, even if he had to “accentuate our increase in bombing accuracy” to justify his inclusions into his plan.¹¹⁰² That those targets came from him, not the air-intelligence organizations, did not provide the latter with much incentive to generate assessments contrary to their own targeting recommendations, in the same way they did for the ball-bearing raids. None of the repair facilities or airfields Eaker added had been in Germany, behind the Luftwaffe’s defensive curtain, where the air-intelligence-recommended targets were.

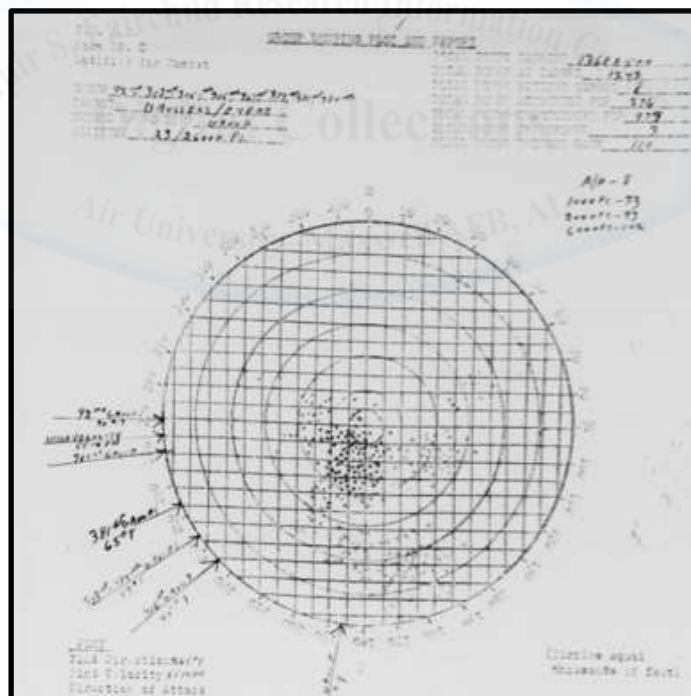


Figure 6. Group Bombing Plot - Brussels/Evere Mission.
 (Reprinted from Headquarters, 1st Bombardment Division, "Group Bombing Plot and Report," in 7 Sept. 1943, Brussels/Evere, #525.332, IRIS 227605.)

¹¹⁰² *Notes on Meeting with General Eaker*, 5 April 1943.



Figure 7. Bomb-damage photo of Brussels Airdrome.

(Headquarters, 1st Bombardment Division, "Bomb-damage photo, Brussels Airdrome," in 7 Sept. 1943, Brussels/Evere, #525.332, IRIS 227605.)

An air-intelligence bombshell. On 10 September 1943, Brigadier General Ed Sorensen finally submitted the response concocted by his A-2 division, along with a heavy dose of OSS assistance, to answer Arnold's task from the War Department of two months before. It was far too late to have helped Arnold at Quebec, but it was not too late to continue his long-standing disagreement with Eaker—especially that of injecting influence from Washington. With the Quadrant Conference, the Schweinfurt-Regensburg mission, and the blusterous COA assessment in hindsight, Arnold's most senior intelligence officer completed his sobering and focused appraisal. Sorensen stipulated up front that "much of the basic material presented was provided by the Office of Strategic Services and the Office of Economic Warfare."¹¹⁰³ His opening

¹¹⁰³ Assistant Chief of Air Staff (A-2), *An Appraisal of Accomplishments and Potentialities*, 10

remarks, while seemingly innocuous, served not only to bolster the report's credibility, but also to snub the COA, which was the theme throughout the argument that followed.

For example, Sorensen continued, "this report attempts to go beyond the mere cataloguing of physical damage," as the COA report had done, "by evaluating the significance of such damage to German war production from the point of view of military capabilities."¹¹⁰⁴ He then added, as if echoing Arnold's private words to Eaker, the report would "fairly review the accomplishments of the bomber offensive," which was what the COA report had not done.¹¹⁰⁵ Sorensen sensed he had the bureaucratic advantage, and he exploited the opportunity.

Sorensen steered his report clear of explicit references to BDA, choosing instead to project the trends suggested by the small but rapidly increasing weight of Eighth Air Force attacks.¹¹⁰⁶ Of Eaker's Eighth, Sorensen reflected that it had "passed from infancy to promising adolescence," along with the "patterns" formed by its combined raids with the RAF's indirect effects, and its ever-deeper penetrations into Germany.¹¹⁰⁷ He'd even ventured into the space left incomplete by the COA and British JIC reports by attempting to assess indirect effects such as absenteeism (due to "deaths, injuries, damage to communications and utilities, and housing damage"), the cost of repairs, and

September 1943.

¹¹⁰⁴ Ibid., i.

¹¹⁰⁵ Ibid.

¹¹⁰⁶ Ibid., ii.

¹¹⁰⁷ Ibid., 1.

even the political and social consequences of bombing.¹¹⁰⁸ Sorensen had outmaneuvered the emergent air-intelligence bureaucracy, even by delaying his report so that he could improve on the other. He assumed control of air-campaign assessment for the American side, and he owned it with a nuanced argument to win over Arnold as well as Marshall.

Two distinctions of the A-2's report exemplified its newfound power to influence the air-campaign narrative. First, Sorensen conjured an image that Eaker's Eighth had cast the German Air Force onto the horns of a dilemma—not the other way around:

The Eighth Air Force effort to date is justified even if judged solely in the light of its effect in reducing the GAF fighter strength. In this connection it has –

- 1) Cut German single-engine fighter production for 1943 by 1,200 planes, the equivalent of a complete stoppage of all German fighter aircraft plant for six weeks;*
- 2) Destroyed in combat 2,100 GAF fighters, excluding “probable claims”;*
- 3) Increased GAF combat losses to the point where Eighth Air Force claims alone amount to 75 percent of current production;*
- 4) Lowered the percentage of serviceable planes available to the GAF by damaging major repair facilities;*
- 5) Compelled the GAF to concentrate over 51 percent of all its single engine fighters (and best pilots) in the west at the expense of urgent needs of the Russian and Mediterranean fronts – itself an eloquent tribute to the threat of the bomber offensive.¹¹⁰⁹*

¹¹⁰⁸ Ibid., 39, 43, 48.

¹¹⁰⁹ Ibid., ii.

Over the coming months, the Luftwaffe's predicament could become increasingly dire as the Allied bombers amassed their strength. Sorensen projected, "bombing sorties of the Eighth Air Force may increase from 1,960 during August, to approximately 7,685 during March, 1944, a 400 percent increase," along with a commensurate "5 to 1 ratio of bomb tonnage to be dropped."¹¹¹⁰ Attacks against the German Air Force, as the top priority for the Eighth, would pitch the Luftwaffe into an even more precarious position, he argued, "suffering prohibitive single engine fighter wastage or conserving fighter strength through refusal to intercept or to close with the bombers."¹¹¹¹ The Reich could use and lose its Luftwaffe or hold it back as Allied bombers lay waste to its base of industrial support. Now was the time, Sorensen contended, to build unrelenting pressure on the Reich and prove the value of independent bombing. The report was not simply a reflective air-campaign assessment, but a complete evaluation of the present situation along with specific policy recommendations for Arnold.

Second, the A-2 finally committed to a clear argument that submarine attacks had not been worth it. Sorensen's argument was a complete reversal from the intelligence estimates from the same office after Casablanca (see chapter 5). Sorensen's report revealed its support from the EOU economists, as it reflected their position that any positive bombing results on U-boat bases were "nullified by the sharp drop in the number of U-boats at sea which

¹¹¹⁰ Ibid., 5.

¹¹¹¹ Ibid., 10.

followed increased sinkings.”¹¹¹² In short, the Navy and British Admiralty had turned the tide against the U-boats. The entire bombing effort against the submarine industry had proved only to keep a measure of balance in the German position with no reasonable potential to impact the war effort, and it was no secret that Eaker had elected to attack U-boat bases (for training and reprieve) more than his boss had preferred.

Most remarkable of A-2’s newly established dominance of CBO assessment was not its evaluation of past performance, or even its eerily accurate forecasts of potentialities—influential as they were. Through his thorough assessment, Sorensen had not just reinforced, but extended the argument made against the G-2 by Generals Arnold, McNarney, and Brett two years earlier: Airmen should own air intelligence, and that included assessing the air campaign. Sorensen, undoubtedly keen to this achievement, bothered to highlight that his report was prepared by his office, “and is concurred in by the ACoS, G-2”—a statement unconscionable during Brigadier General Miles’ earlier tenure in the G-2 seat.¹¹¹³ As A-2, Sorensen had gained an independent voice in shaping General Arnold’s perspective on future expectations for Eighth Air Force. In fact, on 30 August 1943, Sorensen also literally secured independence for his A-2 division from the Army’s G-2. Maj Gen George V. Strong, then the Assistant Chief of Staff of the Army, G-2, disseminated a memorandum officially abolishing the air unit within the Army’s Military Intelligence Division.¹¹¹⁴ From

¹¹¹² Ibid., 13.

¹¹¹³ Ibid., signature page.

¹¹¹⁴ George V. Strong, *Memorandum, Organization of Military Intelligence Division*, War

then on, the Army G-2 would depend upon the Air Force's A-2 to provide all matters of air intelligence.

Sorensen had celebrated with a word of caution to his own A-2 division, reminding them that this recognition came with new responsibility. He recognized that "the intent of the G-2 to lean more heavily" on the A-2 meant that air analysts must rise to meet increasing demand; Sorensen insisted his analysts provide the G-2 with "high priority" and "efficient service," such that the air-intelligence received by the G-2 be "as good as or better" than it had previously by its own air unit.¹¹¹⁵ Finally, he summarized where the A-2 fit in his service's broader fight for independence: "The closest liaison, cooperation, and understanding between the officers and offices of [the A-2 and the G-2] is an absolute necessity of the just value of and emphasis on the proper use of air power is to be reflected in the overall intelligence studies of the War Department."¹¹¹⁶ Sorensen intended to follow through on his victory, and he did so with his report's discussion of ball bearings.

To Sorensen, Schweinfurt symbolized the complexity of air-target selection and the depth of industrial, economic, and military intelligence uniquely necessary to the air component's mission. With Schweinfurt, he proved to the G-2 that the epitome of an air target was too different from that of traditional Army intelligence and that Air intelligence was truly a different endeavor

Department, (Maxwell AFB, AL: AFHRA, 30 August 1943), 203-6v6, IRIS 142227, 2.

¹¹¹⁵ Edgar P. Sorensen, *Memorandum, Cooperation with the Office of Assistant Chief of Staff, G-2*, War Department, (Maxwell AFB, AL: AFHRA, 6 September 1943), 203-6v6, IRIS 142227.

¹¹¹⁶ Ibid.

requiring different specialization. For example, Sorensen explained in his report that the raid on Schweinfurt, along with indirect effects of several RAF area attacks on other ball-bearing factories, had caused a loss of just 10 percent of annual ball-bearing production for Axis, but that resulting damage would account for 30 percent over the period from 17 August to 17 November. Moreover, “the impact of this loss will be aggravated by the specialization of production facilities which will make it impossible to concentrate all undamaged capacity on output of highest priority.”¹¹¹⁷ In other words, bearings were not readily substituted in manufacturing. He wanted his audience, Arnold as well as War Department staff, to recognize the industrial complexity inherent in such target analysis, and he also wanted to convey that his office had this complexity in its grasp. As to “future possibilities,” Sorensen redoubled his argument:

*It appears likely that production will again be close to normal by December 1943, unless further raids on the industry are undertaken. The tightness of the Axis bearing situation prior to aerial attack, the apparent major success of the Schweinfurt raid, and the fundamental significance of anti-friction bearings in the production of military equipment, all emphasize the conclusion that further attacks on the industry will greatly intensify a deficiency which already seriously endangers the enemy's fighting capabilities. Maximum effects of additional raids will be realized by bringing such pressure to bear during the next three critical months.*¹¹¹⁸

As Sorensen would have it, Eighth Air Force should not relent on Schweinfurt under any circumstances, and Sorensen would not relent on

¹¹¹⁷ Assistant Chief of Air Staff (A-2), *An Appraisal of Accomplishments and Potentialities*, 10 September 1943, 26.

¹¹¹⁸ *Ibid.*, 27.

controlling the narrative. In all, the A-2's 10 September report became the rubric through which Arnold might evaluate future CBO phases, including Eaker's performance over the next three months. As the various air-intelligence organizations jockeyed for influence and produced their campaign-level assessments, the one thing they had in common was that they'd all seemed to have turned the spotlight on Eaker. His bombers had not yet produced results commensurate with their targeting recommendations.

Bombing Blind and the Emden Do-over

Before the month was out, Eaker's Eighth raided Germany for the first time using onboard radar-navigation technology for bombing. Eaker had been keenly aware since the year prior that British developments in this area were ahead of the Americans', and had requested back to Washington "that we employ to the fullest extent possible all the late instrument navigational and bombing devices so that we can operate in a wider range of weather than has been possible in the past."¹¹¹⁹ That opportunity had finally arrived. The British actually had two systems that appealed to the AAF's aim to improve blind bombing, *Oboe* and *H2S*.

Oboe used ground stations to transmit a signal, which a single bomber could process and echo back to the ground; the system could achieve impressive accuracy of just a few hundred yards, but the range was limited to

¹¹¹⁹ DeWitt S. Copp, *Forged in Fire: Strategy and Decisions in the Air War over Europe, 1940-45*, 1st ed. (Garden City, NY: Doubleday, 1982), 338.

about 300 miles, which would aid the bombers only about as far as the Ruhr.¹¹²⁰ Even more problematic, the British feared that the signal frequency or even an entire avionics unit could wind up with the Germans; this kept them from offering the system for routine AAF bombing.¹¹²¹

H2S made for a better near-term option for Eighth Air Force while engineers at Massachusetts Institute of Technology's Radiation Laboratory worked on producing an improved version (later known as H2X) for American use.¹¹²² Creatively nicknamed "Home Sweet Home" by British scientists, H2S employed a "downwards-pointing, rotating antenna" that reflected its "9-cm wave pulses" off of the terrain, which then presented a rudimentary monochromatic picture in the bomber's cockpit.¹¹²³ This meant navigators and bombardiers had some ability to see terrain through the weather, although the British had used the system since 1942 to navigate their bombers to the target area, not for aiming bombs.¹¹²⁴ The system had inherent errors and limitations, many of which were electronic, but there were other sources of error as well. Operators required considerable training and interpretation proficiency with H2S to decipher the radar returns. For example, variations in terrain reflectivity could make some targets appear differently than reconnaissance

¹¹²⁰ McFarland, *America's Pursuit*, 180; Arnold, *American Airpower Comes of Age*, vol. 2, 51. Arthur Travers Harris, *Despatch on War Operations, 23rd February 1942 to 8th May 1945* (Portland, OR: F. Cass, 1995), 15.

¹¹²¹ Craven and Cate, *Argument to V-E Day*, 691.

¹¹²² McArthur, *Operations Analysis*, 108.

¹¹²³ Boog, Krebs, and Vogel, *Strategic Air War*, 18.

¹¹²⁴ Operational Analysis Section, *Report on Bombing Accuracy, Eighth Air Force, 1 September 1944 to 31 December 1944*, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, 20 April 1945), #520.310v9, IRIS 220146, 16.

photographs of the ground, and highly built-up areas, such as Berlin, could appear as “solid white returns,” as the RAF had experienced.¹¹²⁵ Because the radar signal did not reflect off of water as it did off of terrain, small coastal targets appeared distinctly on H2S. According to Eaker’s semi-monthly report, he selected Emden for this reason, along with the idea that the bombing of Hamburg had increased German reliance upon the port city, and because it was “indeed a pinpoint objective... and therefore required precision bombing of the utmost accuracy”—an add-on Arnold probably read as an excuse in the *ex post facto* report.¹¹²⁶ Two facts Eaker did not list on the report were that Emden was within escort range of P-47s then carrying 75-gallon drop tanks, which was certainly a positive, and that Emden was (as Air Force historians pointed out) “not a CBO target,” which it was not.¹¹²⁷

Lt Col Carl Norcross (the same Intelligence Officer whose formal complaint had triggered the investigation into the Harrisburg Air Intelligence School) authorized a message to motivate the bomber crews:

*This port has come into greater prominence since the bombing of Hamburg and the increasing difficulty of using Rotterdam... The exact amount of tonnage being handled at the present time is not known but with added traffic it is sure to be far in excess of 500,000 tons... The objective is to knock out the shipping traffic.*¹¹²⁸

¹¹²⁵ Wakelam, *Science of Bombing*, 141; Craven and Cate, *Argument to V-E Day*, 14.

¹¹²⁶ Eighth Air Force, *Semi-monthly Report of Bombing Results*, 16 September through 30 September 1943, ca 1 October 1943, 5.

¹¹²⁷ Craven and Cate, *Argument to V-E Day*, 692. Interestingly, an end-of-month report, likely submitted by Eaker’s A-3, included Emden as an “industrial” target. Eighth Air Force, *Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: September, 3rd Month of Second Phase*, 1 October 1943, II-Report Against Individual Targets.

¹¹²⁸ Lt Col Carl Norcross, H., *Additional Briefing Material on Target GH 5477*, 3rd Bombardment

Crews were to believe that their bombs would shut down an entire port on this first blind-bombing mission. Nothing in the message implied that the target might be easy to locate, with or without the new H2S, how difficult the task to shut it down might be, or how long the analysts expected the port to remain out of service—any of which might have added credibility to the embellished mission statement.

On 27 September, VIII Bomber Command dispatched 305 bombers from its 1st and 3rd Bombardment Divisions. They split into two formations, each led by H2S-equipped Pathfinders from the 482nd Bombardment Group, to bomb the port facilities at Emden. According to the 3rd Bombardment Division's tasking order, "if visual bombing is not possible, combat wing mass bombing procedure... will be followed."¹¹²⁹ The order specified Pathfinder pyrotechnic signals, which were large, colored parachute flares used to "skymark the target"; subsequent bombers would then aim on the flares.¹¹³⁰ The procedure was relatively straight-forward, even given VIII Bomber Command's reliance on "tentative operations instructions."¹¹³¹

As expected, weather over the target was poor. Unexpectedly (at least from Eaker's perspective), so too were the bombing results.¹¹³² VIII Bomber

Division, (Maxwell AFB, AL: AFHRA, 26 September 1943), #527.332, IRIS 230297.

¹¹²⁹ Headquarters 3rd Bombardment Division, *Field Order No. 66*, (Maxwell AFB, AL: AFHRA, 26 September 1943), #527.332, IRIS 230297, 1.

¹¹³⁰ An alternate procedure, used by the British in night visual conditions, was to illuminate the target with flares for aiming by subsequent bombers—a technique known as "groundmarking." See: Harris, *Despatch on War Operations, 23rd February 1942 to 8th May 1945*, 79-81; Hajo Herrmann, *Eagle's Wings* (Stillwater, MN: Motorbooks International, 1991), 202.

¹¹³¹ 3rd Bombardment Division, *Field Order No. 66*, 26 September 1943, 2.

¹¹³² Headquarters VIII Bomber Command, *Bomber Command Narrative of Operations, 104th*

Command's roll-up of events reported, "the pathfinder plane was to drop markers over Emden if the target was obscured by cloud. This plan was followed but the crews did not have sufficient experience in this type of operation to take full advantage of the flares."¹¹³³ As their command reported it, the crews needed more training.

Crew reports from the lead formation explained little of what had actually occurred over the target area. It was as if no one had told the crews what they were supposed to do. Many crews reported during post-flight interrogation that they had simply withheld their bombs because of the weather, while others seemed to pile up excuses as if to see if one of them would work. For example, one crew from the 410th Bomb Squadron recorded a hodgepodge of unrelated remarks, "could not see town... 8/10 undercast; not over pathfinder flares. Lead group did not drop."¹¹³⁴ Another from the same squadron did not drop on the target because "clouds covered it," so they jettisoned their bombs "near coast at mouth of river," presumably to shed weight but it was clear who'd given the order.¹¹³⁵ From the crews' perspectives of events, the failed performance sounded more like a leadership problem.

Group S-2 reports from the trailing formation, flown by 1st Bomb Division, expressed a different experience. Crews apparently understood their task, but

Operation, (Maxwell AFB, AL: AFHRA, 27 September 1943), #145.81-140, IRIS 118081, 1, 5.

¹¹³³ *Ibid.*, 2.

¹¹³⁴ 410th Bombardment Squadron, *Interrogation Form, Crew No. 427*, (Maxwell AFB, AL: AFHRA, 27 September 1943), #145.81-140, IRIS 118081.

¹¹³⁵ 410th Bombardment Squadron, *Interrogation Form, Crew No. 200*, (Maxwell AFB, AL: AFHRA, 27 September 1943), #145.81-140, IRIS 118081.

the mission still went awry. After resigning to the fact that only two aircraft in the entire group dropped bombs in the vicinity of Emden, the S-2 from the 305th related his crews' concerns that the entire mission had nearly turned to disaster: "two groups from another combat wing were crossing directly under our group over the target area and that our bombs would have fallen on these groups if released."¹¹³⁶ The 92nd Bomb Group S-2 accepted his crews' arguments that they'd dropped as directed on the pathfinder flares, though results were, understandably, "unobserved."¹¹³⁷ Finally, the 306th Bomb Group S-2 oriented his feedback toward the elite pathfinders: "crews report flares over the IP [initial point] instead of the target," so the confounded crews ended up bombing anywhere "from [the] IP to the target to [the] coast going out, making intense concentrations unlikely."¹¹³⁸ 1st Bomb Division crews reported their results with candor to their intelligence officers, who helped to articulate the mission's challenges up the chain-of-command.

Unfortunately, the plan had called for a red flare at the IP, a yellow flare for "bombs away" of the lead wing, and three more red flares for bomb release of the trailing wing.¹¹³⁹ The pathfinders may well have dropped their flares according to plan, but the glow of fire through the low-level clouds and smoke undoubtedly made for a puzzling spectacle—especially to crews performing a

¹¹³⁶ S-2 305th Bombardment Group, *Teletype Report, Mission 27 September 1943*, War Department, (Maxwell AFB, AL: AFHRA, 27 September 1943), #525.332B, IRIS 228316, 2.

¹¹³⁷ S-2 92nd Bombardment Group, *Teletype Report, Mission 27 September 1943*, War Department, (Maxwell AFB, AL: AFHRA, 27 September 1943), #525.332B, IRIS 228316, 2.

¹¹³⁸ S-2 306th Bombardment Group, *Teletype Report, Mission 27 September 1943*, War Department, (Maxwell AFB, AL: AFHRA, 27 September 1943), #525.332B, IRIS 228316, 1.

¹¹³⁹ 3rd Bombardment Division, *Field Order No. 66*, 26 September 1943, 2.

mission as they never had before. Other than what the crews had told them, the intelligence officers had little independent evidence to review, so it was difficult for them to determine what exactly had gone wrong, much less where the bombs had fallen.

Aside from the crews' verbal feedback, group- and division-level intelligence officers struggled to produce meaningful bomb-damage assessments. For example, the S-2 from the 94th Bombardment Group recorded, "resulting bombing believed poor due to target being entirely covered by clouds."¹¹⁴⁰ Of course, bombing through the clouds had been the intent of the mission in the first place—Why should the bombing be poor only because it was unobserved? The 1st Bomb Division photo-interpreter attempted his assessment, but found he had nothing to assess; he returned a memorandum to the Division's A-2 merely noting that all mission photography was "completely 10/10's cloud obscured."¹¹⁴¹

In another example, a base photographic officer did not even bother to comment on his wing's bombing performance in his photo and bomb plotting report. He simply remarked that an aerodrome and army camp appeared on a photograph of the target area.¹¹⁴² This may have been useful post-strike

¹¹⁴⁰ S-2 94th Bombardment Group, *Teletype Report, Form 103A Narrative*, 3rd Bombardment Division, (Maxwell AFB, AL: AFHRA, 27 September 1943), #527.332, IRIS 230297, 2.

¹¹⁴¹ Capt. George Welter, Div. Photo-interpreter, *Memorandum to A-2 Section*, Headquarters 1st Bombardment Division, (Maxwell AFB, AL: AFHRA, 27 September 1943), #525.332, IRIS 227611.

¹¹⁴² 1st Lt William F. Sink, Base Photographic Officer, *Photo & Bomb Plotting Report*, 3rd Bombardment Division, (Maxwell AFB, AL: AFHRA, 27 September 1943), #527.332, IRIS 230297.

intelligence, but it was not useful BDA. Unfortunately, the photographic officer installed 8 cameras onboard 94th Bomb Group aircraft, but two were lost, and only one returned with images, from which he noted: “Bomb bursts shown on the one roll obtained. Bursts not believed to be of 94th bombs.”¹¹⁴³ As with visual bombing, the CIU interpreters would attempt to pick up where the unit-level interpreters left off.

After reviewing all available images, the CIU interpreters concluded most of the bombs landed in nearby fields and villages.¹¹⁴⁴ Nearly all of the bombs dropped had been of the lighter 500-pound general-purpose and 100-pound incendiary variety, which did not help the interpreters spot craters and damage, and there was no dedicated reconnaissance sortie. The BDA from this mission was disappointing, if not from the bombers’ inaccuracies, then from the absence of usable information.

¹¹⁴³ 1st Lt William F. Sink, Base Photographic Officer, *Mission Camera Report*, 3rd Bombardment Division, (Maxwell AFB, AL: AFHRA, 27 September 1943), #527.332, IRIS 230297.

¹¹⁴⁴ Central Interpretation Unit, *Interpretation Report No. S.A. 602*, Medmenham RAF Station, (Maxwell AFB, AL: AFHRA, 29 September 1943), #525.332B, IRIS 228316.



Figure 8. BDA image from the single roll of film returned after the 94th Bomb Group's first blind-bombing raid.

(Reprinted from 94th Bombardment Group, Photograph, SAV-94-121, Emden Germany, in Bombing Annex to S-3 Narrative, Mission #64, (Maxwell AFB, AL: AFHRA, 27 September 1943), #525.332B, IRIS 228316.)

After scrubbing a repeat mission just two days later, which allowed a little more time for all involved to think through the post-mission assessments, Eaker launched another blind-bombing raid on Emden on 2 October.¹¹⁴⁵ Of 349 bombers dispatched, only 2 were lost due to “magnificent” fighter support all the way to the target.¹¹⁴⁶ S-2 reports revealed an extraordinarily different mission than the one launched not even a full week prior. Both the intelligence officers and the crews seemed to adapt to the new mission. For example, the

¹¹⁴⁵ Headquarters 3rd Bombardment Division, *Annex No. 1 to 3 B.D. Field Order No. 68*, (Maxwell AFB, AL: AFHRA, 28 September 1943), #527.332, IRIS 230299.

¹¹⁴⁶ Bomber crews were consistent in their praise for the ability of escort to persist in the target area for both Emden missions. In this case, a group S-2 recorded the word "magnificent" during crew interrogation and pushed it up in his report. See: S-2 94th Bombardment Group, *Hand-written notes for Teletype Report*, (Maxwell AFB, AL: AFHRA, 2 October 1943), #527.332, IRIS 230301; Perret, *Winged Victory: The Army Air Forces in World War II*, 273; Headquarters 3rd Bombardment Division, *Advance Warning to 3 BD Field Order No. 69*, (Maxwell AFB, AL: AFHRA, 1 October 1943), #527.332, IRIS 230301.

306th Bomb Group S-2 reported that the crew's bombs dropped into the clouds "about where the flares indicated, allowing for drift of flares," but the crew felt blind bombing would improve "as soon as there is a pathfinder with each Wing."¹¹⁴⁷ Handwritten notes from the 94th Bomb Group S-2 suggested a similar perspective. Though the S-2 noted bombing results could not be observed, he added that the bombs appeared "to be a good pattern" as they dropped into the flares. There was no telling where the bombs had landed from the on-board cameras, but at least the crews had a sense that they had done their part correctly. The S-2 also recorded constructive inputs from his crews that the pathfinder's flares should be reconfigured to smoke sooner since they had "dropped too far down almost to observe."¹¹⁴⁸ Interestingly, someone crossed the remark off of the S-2's teletype request form before the report was transmitted to the 3rd Bombardment Division on behalf of his Group Commander.¹¹⁴⁹ It would seem not all of the crews' feedback made it up the chain.

By the second mission, it seemed issues with formation-bombing deconfliction, pathfinder signals, and mission leadership had been resolved. This time, the field orders (and late corrections thereto) ensured all bomb

¹¹⁴⁷ S-2 306th Bombardment Group, *Teletype Report*, War Department, (Maxwell AFB, AL: AFHRA, 2 October 1943), #525.332B, IRIS 228317, 1.

¹¹⁴⁸ 94th Bombardment Group, *Hand-written notes for Teletype Report*, 2 October 1943.

¹¹⁴⁹ It could be that this feedback was passed directly to those responsible for the pathfinder's flare settings (rather than forwarded further up the chain) or that the remark was screened before sending the S-2 report. In either case, it is clear that the crews appreciated the listening ear of the S-2, and they took the opportunity to vent, whether or not the feedback fell under the responsibility of the S-2. See: S-2 94th Bombardment Group, *Teletype Report*, (Maxwell AFB, AL: AFHRA, 2 October 1943), #527.332, IRIS 230301, 2; S-2 94th Bombardment Group, *Form 103A Narrative*, (Maxwell AFB, AL: AFHRA, 2 October 1943), #527.332, IRIS 230301.

groups would take lateral spacing from each other well-prior to the target, even if they were not yet sure if the target would be visual; pathfinders switched their “bomb release” signal to a much clearer indicator of “three large green flares”; and the airborne air-division leader would now be empowered to make a verbal radio transmission—“king-pin” for blind bombing or “take interval” for visual bombing.¹¹⁵⁰ No plan could be perfect from the start, but at least they’d developed a crystal-clear game plan for the likely airborne contingencies.

The day after the raid, a reconnaissance sortie finally captured photographs to evaluate damage from both missions, and the CIU wasted no time disseminating its report. The CIU’s photo-interpreter noted little damage to the town of Emden, but “heavy damage” to Emden Hafen (the port area), including damage to several buildings, floating docks, quay walls, and barges.¹¹⁵¹ While it cannot be stated that blind-bombing raids shut down the port of Emden, per the original mission order for these raids, one thing can be stated for certain: both the crews and the intelligence officers seemed to convert the 1,597 tons of bombs dropped on these two missions to Emden into a crucial ton of learning.¹¹⁵² Even if some forms of feedback did not survive to final drafts, data

¹¹⁵⁰ Headquarters 3rd Bombardment Division, *Annex No. 1 to 3 B.D. Field Order No. 69*, (Maxwell AFB, AL: AFHRA, 2 October 1943), #527.332, IRIS 230301; Headquarters 4th Bombardment Wing, *Annex No. 1 of 4th Combat Wing Field Order No. 36*, (Maxwell AFB, AL: AFHRA, 2 October 1943), #527.332, IRIS 230301; Headquarters 3rd Bombardment Division, *Annex No. 2 to 3 B.D. Field Order No. 69*, (Maxwell AFB, AL: AFHRA, 1 October 1943), #527.332, IRIS 230301.

¹¹⁵¹ Central Interpretation Unit, *Supplement to Interpretation Report No. K. 1756*, RAF Medmenham, (Maxwell AFB, AL: AFHRA, 6 October 1943), #527.332, IRIS 230297. Central Interpretation Unit, *Immediate Interpretation Report No. K.1756*, RAF Medmenham, (Maxwell AFB: AFHRA, 4 October 1943), #527.332, IRIS 230297.

¹¹⁵² Headquarters VIII Bomber Command, *Flash Report - 104 Operation*, (Maxwell AFB, AL: AFHRA, 27 September 1943), #527.332, IRIS 230297; Headquarters VIII Bomber Command,

captured in post-mission intelligence reports had played an essential role in marketing good ideas up the chain of command and in highlighting what had gone wrong the first time. Although General Anderson had levied the blame for the first mission on aircrew training, everyone including his headquarters-level planners, intelligence officers, and mission leaders needed to learn as well.



Figure 9. BDA Image after 2 October Raid on Emden showing areas of damage to the port. (Reprinted from Central Interpretation Unit, *Supplement to Interpretation Report No. K. 1756*, 6 October 1943.)

Spinning Wheels Over Ball Bearings

The August Schweinfurt raid had not achieved the level of destruction either the targeting theory demanded or the intelligence organizations expected. The mediocre performance, with its inconclusive results, had failed either to validate or invalidate the ball-bearing industry as a viable target. ULTRA

Flash Report - Operation No. 106, (Maxwell AFB, AL: AFHRA, 2 October 1943), #527.332, IRIS 230301.

intercepts, while unclear in their precise intent, adding intrigue by indicating the Germans had paid very close attention to the Schweinfurt-Regensburg mission.¹¹⁵³ A follow up raid—maybe more than one—would be necessary, and the pressure was on from Washington.

Just as the intelligence organizations predicted Schweinfurt factories had recovered their production, Eaker mustered his recovering forces to attack again. September had been an intentional recovery month for Eighth Air Force, even though Eaker still closed out the month and the CBO's second phase more than 20 percent shy of the nearly 1200 bombers he'd requested.¹¹⁵⁴ Nevertheless, after regaining bombers loaned elsewhere and receiving reinforcements from stateside, Eaker had finally achieved a core strength of 20 Bomb Groups—a boost of 30 percent to his combat-ready force in just 2 months.¹¹⁵⁵ He felt the pressure to get back to Pointblank's primary target list and no target seemed more attractive than ball bearings. In fact, the COA's analysts were still so hot on the idea of ball bearings, they were busy on 30 September deciding that ball bearings should be "a primary rather than a supplementary target" in the Pacific as well, because "the basic characteristics of the industry in Japan are similar to those elsewhere."¹¹⁵⁶ Washington was

¹¹⁵³ National Security Agency and Central Security Service, *ULTRA: History of U.S. Strategic Air Force Europe vs. German Air Force*, SRH-013, 87.

¹¹⁵⁴ Office of the Combined Chiefs of Staff, *Sextant Conference, November-December 1943*, in *Papers and Minutes of Meetings, Sextant and Eureka Conferences*, (Washington, DC: Joint History Office, 1943), 2003, 129. Headquarters Eighth Air Force, *Statistical Summary of Eighth Air Force Operations, European Theater, 17 August 1942 - 8 May 1945*, (Maxwell AFB, AL: AFHRA, 10 June 1945), #520.308-1, IRIS 219694, 14.

¹¹⁵⁵ Davis, *Bombing the European Axis Powers: A Historical Digest of the Combined Bomber Offensive, 1939-1945*, 182.

¹¹⁵⁶ Committee of Operations Analysts, *Meeting Minutes*, War Department, (Maxwell AFB, AL:

abuzz with ideas of ball bearings as the shortcut to victory.

Unfortunately, the bombers still lacked escorts that could bring them all the way to Schweinfurt. When Eaker's bombers launched, their plan again deviated considerably. In addition to weather, a variety of problems, including a botched rendezvous, a slew of mechanical failures, and an ineffective diversionary raid by the 2nd Air Division, together depleted the original force of 377 airborne bombers down to a mere 291 as they pressed eastward across the channel.¹¹⁵⁷ Despite anecdotes of extraordinary heroism, including a single bomber that broke formation and placed its load of 10 bombs dead-center on the target, losses to the Luftwaffe were brutal—as historian Geoffrey Perret captured: “sixty planes shot down, another ditched in the channel, six wiped out in crash landings, and seven more written off.”¹¹⁵⁸ The day was a “Black Thursday,” indeed.¹¹⁵⁹

Deflated by a cost so horrific to his own bombers, Eaker could only hope that the cost to the German war machine had been even worse. This time, there was no doubt as to where the bombs had fallen and the group S-2s were confident. The 92nd Bombardment Group S-2, whose group ended up flying as lead for its wing, relayed through channels, “our bombs seen to hit squarely in primary target area,” noting that a single aircraft had “salvoed just before [the]

AFHRA, 30 September 1943), #118.151-8, IRIS 110554, 1.

¹¹⁵⁷ Coffey, *Decision over Schweinfurt: The U.S. 8th Air Force Battle for Daylight Bombing*, 287-290.

¹¹⁵⁸ Perret, *Winged Victory: The Army Air Forces in World War II*, 278-279.

¹¹⁵⁹ Arnold, *American Airpower Comes of Age*, vol. 2, 47.

target,” but that pictures otherwise confirmed good hits.¹¹⁶⁰ Pleasure with the apparent bombing results was offset by crews’ notice that their escort left them an hour prior to their time over target, just before the enemy aircraft showed up. The 306th Bombardment Group S-2 similarly reinforced his crew’s claims. “Bombing was good. Photographs show our bombs bursting right on aiming point, while a concentration of earlier bombs is bunched on and to the west of target ‘a’.”¹¹⁶¹ If the crews had a rough day, at least their S-2s had evidence to show for the effort.

Photo-interpreters expedited their review of the bombers’ cameras: “The brunt of the attack fell solidly on the target area with at least 100 separate distinguishable hits within the factory confines,” they concluded.¹¹⁶² It was enough for Eaker to send in an immediate message to Arnold, “unless the strike photos are very deceiving, we shall find that the three ball-bearing factories at Schweinfurt are out of business for a long, long time.”¹¹⁶³ Eaker had no reason to doubt them. Follow up from a Spitfire reconnaissance sortie flown two days after the raid, this time waiting for the smoke to clear, verified the apparently phenomenal bombing performance:

Very heavy concentrated damage is visible within the target area, and all five works of the Schweinfurt Ball-bearing Industry

¹¹⁶⁰ S-2 92nd Bombardment Group, *Teletype Report, Mission 14 October 1943*, War Department, (Maxwell AFB, AL: AFHRA, 16 October 1943), #525.332B, IRIS 228302, 7.

¹¹⁶¹ S-2 306th Bombardment Group, *Teletype Report, Mission 14 October 1943*, War Department, (Maxwell AFB, AL: AFHRA, 14 October 1943), #525.332B, IRIS 228302, 3.

¹¹⁶² Central Interpretation Unit, *Interpretation Report S.A. 628*, in *Attack on Schweinfurt Ball-Bearing Industry on 14.10.43*, Medmenham RAF Station, (Maxwell AFB, AL: AFHRA, 16 October 1943), #520.365, IRIS 224128, 1.

¹¹⁶³ Maj Gen Ira C. Eaker, *Letter, Eaker to Arnold*, Manuscript Division, AFHSO collection, Eaker Papers, Box 16, (Washington, DC: Library of Congress, 15 October 1943).

*have been affected. The damage appears as much to fire as to H.E. [high explosive], and some buildings which have been partly burnt out have received as many as 5 or 6 direct hits.*¹¹⁶⁴

From the sounds of the early photo-interpretation reports, the bombing could not possibly have been more successful. The photo-interpreters paid little mind to the machine tools they could not see. Buildings received damage, and that seemed to be enough to indicate the bombing had taken a commensurate toll.

Two days later, the *Washington Star* newspaper joined the information fray, relaying the symbolic value of Schweinfurt from a newly invigorated public-relations campaign by Arnold. The article summarized the remarks from Arnold's "unusual press conference," and he was all too pleased to accentuate the positives in preliminary intelligence reports:

Taken by itself, the loss by our air force of sixty bombers in a single raid on the German ball-bearing factories at Schweinfurt last week seems appalling. But what we must learn to remember as the aerial warfare against industrial Germany increases, is not to judge the severity of our losses on the basis of single operations and never to count them without striking some sort of balance between our losses and the damage inflicted on the enemy...

...The Schweinfurt raid accomplished its mission, which was to knock out the remaining large-scale German source of ball bearings for production of engines—not merely airplane engines, but engines for trucks, tanks, and submarines. Our losses were high; but the cost of this successful mission was relatively small.

The reason it was small is that this raid was merely another step in the execution of a pattern of destruction by air force [sic] that is the greatest single threat to Germany's ability to fight. It is not the single blow that counts, but the repetition of single blows, the effect of which accumulates as they are delivered...

¹¹⁶⁴ Central Interpretation Unit, *Immediate Interpretation Report No. K.1785*, in *Locality: Schweinfurt*, Medmenham RAF Station, (Maxwell AFB, AL: AFHRA, 17 October 1943), #520.365, IRIS 224128, 1.

*Our losses will be made up. Germany is unable to make up her own.*¹¹⁶⁵

Eaker was right about pleasing Arnold—at least with this raid. Using the hopeful results, Arnold wasted no time convincing the American public, and perhaps himself, that the effort was more than worth the cost. Airpower, as he saw it, was more capable than the other arms of Allied power, and raids such as Schweinfurt made the job easier by weakening German land and naval forces as well. Arnold needed the public to look past the frightful stories of crashing bombers and to buy into his campaign for victory through airpower over Germany. The key to Arnold's campaigns—both the one in the air over Germany and the one for public support for his air force—was to maintain two types of continuous pressure: For the first, he sought to press home the COA's target recommendations and exploit earlier gains; for the second, he repeated his message of air-campaign success to the American public, which would exploit the war as an opportunity to prove the need for independent air power.

Analysts respond as advertised. On 25 October, reacting to the Quadrant Conference and apparent success of the second raid on Schweinfurt, the COA submitted its "Suggested Bombardment Program in Preparation for Overlord." The amended plan furthered "the principles and basic data" the analysts had pushed to Arnold all year, which they noted was now "supplemented by current

¹¹⁶⁵ Author unattributed, "Schweinfurt--A Symbol," Washington Star, 19 October 1943. Cited From: Committee of Operations Analysts, *Damage Assessment, Clippings*, Headquarters Army Air Forces, (Maxwell AFB, AL: AFHRA, Ca. 1 January 1944), #118.952-1 Folder #2, IRIS 110600.

intelligence.”¹¹⁶⁶ The amended plan amounted to a ludicrous proposal and a last-ditch effort to corner Eaker. They clearly understood the imperative for strategic bombing seemed to shift to air superiority over the cross-Channel invasion, so they used that foundation to accentuate their pre-existing argument.

Atop their list, the analysts lumped together final assembly, major component manufacture, and aircraft engine plants “for those types of aircraft currently utilized for defense against bomber missions”—notably excluding airfields, Crossbow targets, and expressly arguing against Eaker’s long-held desire to hit aircraft-repair facilities, because “the requirement of reasonable permanence of damage tends to make these relatively low priority for heavy bombers.”¹¹⁶⁷

Other than aircraft-industry targets, the COA suggested committing the full weight of USAAF strategic bombardment from both Germany and Italy to just two target systems: ball bearings and precision-grinding wheels. Their list of six ball-bearing plants excluded Schweinfurt, because “the successful attack on Schweinfurt has unquestionably already caused the enemy to take measures of various types to protect the ball bearing supply... the longer additional attack is delayed, the more effective those measures can become.”¹¹⁶⁸ The analysts

¹¹⁶⁶ Col Guido R. Perera, Lt Col W. B. Leach, and Brig Gen Byron E. Gates, *Suggested Bombardment Program in Preparation for Overlord*, in *COA History (Tab 68)*, Committee of Operations Analysts, (Maxwell AFB, AL: AFHRA, 25 October 1943), #118.02v2, IRIS 110403, 1.

¹¹⁶⁷

¹¹⁶⁸ Perera, Leach, and Gates, *Suggested Bombardment Program in Preparation for Overlord*, 25 October 1943, 6.

maneuvered to protect their credibility: either the bombers hit their targets with sufficient weight and follow-up, or they could argue their plan had not been followed. However, as to how exactly such effects might be assessed, especially the impact upon the German aircraft industry, the COA had no idea:

*While attack upon ball bearings cannot be relied upon to produce any predictable degree of interruption of aircraft and engine production, it will unquestionably have some effect of that nature to a degree and of a kind not now determinable.*¹¹⁶⁹

With their renewed emphasis on precision-grinding wheels, the analysts chastised Eaker for not including them in Pointblank, and argued, “the destruction of them would have the most serious disruptive effects throughout enemy war industry within a period of weeks.”¹¹⁷⁰ They listed six targets; two of them, Alt Bendek and Dresden, were more than 580 miles from both London and the Rome-Foggia line, from which 15th Air Force would soon begin operations—these were deep penetrations with likely high casualties for the bombers.¹¹⁷¹

The COA intentionally omitted the rest of the high-priority Pointblank target systems, in particular “submarine building yards, submarine bases, petroleum, synthetic rubber and tires, military transport vehicles.”¹¹⁷² The analysts sought to consolidate all of the bombers’ efforts on only their primary recommendations. The decision to remove petroleum was interesting. COA had included petroleum in an update on Pointblank targets just two weeks earlier

¹¹⁶⁹ Ibid., 7.

¹¹⁷⁰ Ibid., 8.

¹¹⁷¹ Ibid.

¹¹⁷² Ibid., 9.

on 11 October, but among its “salient points,” it highlighted that the fact that Germany no longer needed to supply Italy with up to 1,500,000 tons annually, which would relieve some pressure on that industry. Further, even if destruction of Ploesti and Germany’s 13 Bergius hydrogenation plants were prioritized, “it is impossible to state the precise time when effects of such destruction would become apparent,” they argued.¹¹⁷³ With the invasion plan in place and the Combined Chiefs crystal clear on the need for air superiority over the cross-Channel invasion, the timing to show success was everything, so the mere suggestion that effects not be short-term was another way of condemning that industry in priority. Although they had omitted the point from the 25 October report, the COA’s 11 October report predicted that renewed attacks on the full ball-bearing industry “will have pervasive effect on the German war effort which will be felt as early as one month after their destruction.”¹¹⁷⁴ Whether or not they had evidence to defend their assertions, they knew the right words to get the commanders’ attention.

The British Ministry of Economic Warfare, in its study of the six-month period closing out 1943, walked back both Arnold’s and the COA’s assertions with respect to ball bearings. In fact, the MEW economists refuted any immediate consequence of the August attack, as they framed their raid assessment for October on the German response instead:

While there is no reason to believe that prior to the raid the

¹¹⁷³ Committee of Operations Analysts, *Brief Analysis of Target Systems for Maximum Short-Term Effect on Germany’s War Effort*, in *COA History (Tab A of Tab 68)*, (Maxwell AFB, AL: AFHRA, 11 October 1943), #118.02v2, IRIS 110403.

¹¹⁷⁴ Ibid.

*enemy was short of ball-bearings, his consistent purchases in neutral countries, reluctance to export, and the attention paid to production facilities in occupied territories, suggest that there is a somewhat precarious balance between supply and demand... There is as yet no evidence to show where the armaments industry has been affected, and Germany will doubtless attempt to mitigate the loss by seeing that it falls on the categories which are least indispensable to her.*¹¹⁷⁵

It would seem there were two distinct ways to evaluate the enemy's response to bombing such industries. Creative and aggressive measures by the enemy, on the one side, could be read as desperate indicators warranting immediate follow-up. On the other side, such actions may have indicated that the enemy mind, malleable in ways that were not easily—if ever—understood, could negate the anticipated effects of bombing, especially when the operational factors, the bombers' accuracy, survivability, or the bombs themselves, lived up to the expectations. When the result fell short, the generals and the analysts tended to point at each other.

The fallout from this chilling October performance may have influenced a friendly mind even more so than Hitler's. Eaker's response to the raid, as captured by Colonel Hughes, was as follows: "Operations beyond fighter cover were sharply curtailed, and every effort was made to have long range P-51s and P-47s sent to us as soon as possible...Almost simultaneously, the usual bad winter weather set in over Germany and, of necessity, operations were almost negligible until early 1944."¹¹⁷⁶ The Eighth Air Force Director of Intelligence

¹¹⁷⁵ Ministry of Economic Warfare, *M.E.W. Intelligence Weekly*, (London, England: AFHRA, 29 February 1944), #512.607A, IRIS 211130, 16.

¹¹⁷⁶ Hughes' use of passive voice here is curiously ambiguous. Ostensibly, he sought to avoid pinning criticism on his revered boss, but the implication was clear. See: Hughes, *Memoirs*:

later supported Eaker's deflated ambition during the period immediately after the second Schweinfurt raid with a barefaced argument that "the Eighth temporarily lost air superiority in the major target areas of Germany."¹¹⁷⁷ The problem was that Eighth Air Force's heavy bombers hadn't had it in the first place. The day after the brutal beating at Schweinfurt, Eaker finally declared to Arnold: "Nothing is more critical to our big battle here than the early arrival of P-38s and P-51s, and particularly the earliest possible delivery of three to five thousand 110 and 150 gallon auxiliary droppable tanks for fighters."¹¹⁷⁸ It had taken the Chief of Staff of the ground component to identify the weakest link in Eaker's air plan back in April, then six months of painful losses that culminated with Schweinfurt before Eaker would finally accept that his bombers could not get through without the long-range escort.

Six months earlier, in Arnold's presence, General Marshall and Admiral King had sensed the weak points in Eaker's plan, looked him in the eye, and asked him about his fighter-escort, winter-weather, and his submarine-attack assumptions (chapter 5). Still basking in the musk of his "long, delirious" days of flying and debating at Maxwell Field's Air Corps Tactical School, Eaker had confidently side-stepped all three pitches that portended of his flawed plan.¹¹⁷⁹

Chapter VIII, 1941-1945, 1957, 38.

¹¹⁷⁷ Office of the Director of Intelligence Eighth Air Force, *Target Priorities of the Eighth Air Force, A Resume of th Bombardment Directives and Concepts Underlying Them*, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, 15 May 1945), #520.323-1, IRIS 220196, 12.

¹¹⁷⁸ Eaker, *Letter, Eaker to Arnold*, 15 October 1943.

¹¹⁷⁹ The allusion here is to the single piece of prose most representative of the way pilots think. See: John Gillespie Magee, Jr., "High flight," *All Hands*, Apr 2003, 7. Of note, the publisher of this version refers to the poem as "an anthem for aviators around the world."

The problem wasn't just that Eaker's assumptions proved wrong, but that he held to his plan long after evidence indicated its flaws. The insistent target-meddling from Washington and the mix of excessively positive and contradictory feedback he received from intelligence assessments did not help him to sort out the failures earlier.

He may have seen no choice, but Eaker pulled Eighth Air Force back at precisely the moment when the intelligence assessments by Arnold's analysts and economists in England suggested the air campaign needed to thrust forward. Of course, the analysts and economists had not understood the operational limitations or the tactical considerations associated with the air campaign. From their standpoint, they'd identified a list of targets and Eaker's progress did not appear to match their recommendations. As their assessments to Arnold portrayed, fall and early winter of 1943 was the timeframe of opportunity to capitalize on the few slight but noteworthy gains and to knock Germany's strained industries further off balance. From the analysts' perspective, either the target recommendations had been ineffective, or Eaker had not followed them.

As Eaker pulled back from deep attacks for his daylight-precision bombers, the Air Ministry added pressure on Eighth Air Force to participate in area attacks, especially following Sir Arthur Harris' 3 November 1943 proclamation to Churchill, "We can wreck Berlin from end to end if the USAAF will come in on it. It will cost between 400-500 aircraft. It will cost Germany the War."¹¹⁸⁰

¹¹⁸⁰ Hastings, *Bomber Command*, 215.

The EOU economists responded by codifying their own target preferences into a “party line,” which they saw as “both a theory of bombing policy and a related method of analysis.”¹¹⁸¹ They argued against area bombing on account of its inefficiency as a form of industrial attack and the failure of the Air Ministry to prove that area bombing might otherwise lead to “anarchy or revolution.”¹¹⁸²

The EOU’s drive for efficiency resonated with its economists’ habits of mind. They’d sought to attack “the minimum number of targets whose destruction would achieve the desired goal.”¹¹⁸³ More remarkably was an admission in their history that their *party line* “opposed attacks designed simply to weaken the German economy or to cause political disruption; and emphasized the possibilities of evading the military consequences of bomb damage in a mature and resourceful economic system like that of wartime Germany.”¹¹⁸⁴ In other words, the EOU economists had implemented a bombing policy that ran counter the ACTS graduates. It is clear they were interested in proving they were right.

While the EOU engaged with the Air Ministry, a bellwether event occurred in Washington. Brigadier General Kuter, then back from England and serving as Arnold’s Chief of Plans, attempted to better prepare his boss for the upcoming Sextant Conference by requesting an update from AC/AS Intelligence of their September report (the one that was late for Quadrant). The

¹¹⁸¹ Rostow, *Rostow Report*, ca. 30 April 1945, 54-55.

¹¹⁸² Ibid.

¹¹⁸³ Ibid., 55.

¹¹⁸⁴ Ibid., 54-55.

intent of the update, according to Kuter, was “for use in strategic planning” and “for the purpose of comparison with a similar study” by the British.¹¹⁸⁵ There should have been at least something on paper to represent the American perspective of CBO progress. Three days later, Kuter cut his original three-week suspense on the requested update in half, which grated on Colonel William Bentley, a former B-17 test pilot, then serving as the acting deputy Chief of Intelligence.¹¹⁸⁶ Bentley shot back at Kuter with a “preliminary” report due to Kuter’s shortened suspense and the “sketchy basis for the specific operational plan” provided by Kuter’s office. Bentley cautioned that the updated report necessitated “many arbitrary assumptions” and that estimates of future results were “largely speculative.”¹¹⁸⁷ Bentley was forthright that his analysts had done what they could, but that the report was probably not worth much without the time and information they needed to develop it fully.

Nevertheless, Bentley’s preliminary report indicated that Eighth Air Force air-combat claims against German fighters had exceeded the production losses from bombing German aircraft factories (even when splitting the difference between the Mighty Eighth’s inflated claims and the Air Ministry’s figures of the same period, since the former nearly doubled the latter.)¹¹⁸⁸ The bombers were

¹¹⁸⁵ Laurence S. Kuter, *Memorandum, AC/AS Plans to AC/AS Intelligence; Subject: Combined Bomber Offensive*, (Maxwell AFB, AL: AFHRA, 25 October 1943), #145.81-140, IRIS 118082.

¹¹⁸⁶ Stewart W. Bentley, Jr., *The Touch of Greatness: Colonel William C. Bentley Jr., USAAC/USAF; Aviation Pioneer* (Bloomington, IN: AuthorHouse, 2010), xii.

¹¹⁸⁷ Assistant Chief of Air Staff (A-2), *The Strategic Bomber Offensive, Results of Operations to 1 November 1943*, Colonel William C. Bentley, (Maxwell AFB, AL: AFHRA, 5 November 1943), #145.81-140, IRIS 118082, 2.

¹¹⁸⁸ *Ibid.*, 2-3.

slugging out the battle for air superiority in the air through attrition rather than bombs. Further, combined results of both attacks on Schweinfurt amounted to losses of only one month's production of ball bearings, but efforts to exploit the "extremely tight" situation would require seven more attacks on the industry and another projected raid on Schweinfurt in February.¹¹⁸⁹ Apparently, according to the report, there were "no significant reduction in oil supplies" and no appreciable change in any other industry prioritized for attack under the Pointblank directive since 1 September.¹¹⁹⁰ This was bad news. While Arnold's A-2 continued work on a more complete report, Arnold flew to Cairo to meet with the Combined Chiefs with more than a little heartburn over Eaker's performance.

Sextant: A New Course and a Falling Star

The Sextant Conference, held 2-7 December 1943 in Cairo, provided the year's closing meetings for the Combined Chiefs. Among the critical decisions for the European Theater of Operations was the long-awaited announcement of the President's preference to command Overlord. After some dithering, Roosevelt selected Eisenhower, but only after realizing that he "could not sleep at night with [Marshall] out of the country."¹¹⁹¹ Eisenhower was then free to

¹¹⁸⁹ Ibid., 6, Schedule B.

¹¹⁹⁰ Ibid., 8.

¹¹⁹¹ George Catlett Marshall, *Aggressive and determined leadership*, June 1, 1943-December 31, 1944, ed. Larry I. Bland and Sharon Ritenour Stevens, vol. 4, *The Papers of George Catlett Marshall* (Baltimore, MD: Johns Hopkins University Press, 1996), 191-196. Official records do not reveal deeper insight into Spaatz's nomination to command USSTAF, except that "On his way back from Cairo, Arnold stopped in Tunis to talk with Eisenhower about air command

negotiate the rest his team, including an American airman who would lead all of his bombers. Given his previous experiences in England and in the Mediterranean, Eisenhower's decision to select Spaatz may have been an easy one.

Eisenhower wrote in his memoir, *Crusade in Europe*, that he "desired to take General Spaatz to England," adding that "by agreement made in Cairo the American strategic bombers in the Mediterranean and in England were to be combined under Spaatz's single operational command."¹¹⁹² It may well be, as other histories agree, that Eisenhower simply insisted on bringing Spaatz as "his airman," who'd demonstrated satisfactory understanding of "air support to ground troops," and that this made him the right airman to lead the preparations for Overlord.¹¹⁹³ Personal relationships, previous experience, and imperatives for military unity of command all mattered in Eisenhower's selection of Spaatz. But there were also organizational interests involved on behalf of the AAF and air intelligence worthy of examination.

Eaker's performance had been a discussion topic at Cairo. Both Eaker and Portal submitted a collaborative progress report to the Combined Chiefs, but they cited only British intelligence sources and painted as rosy a picture as they could justify from their limited palette. They conceded, "a complete and accurate picture of results achieved is not possible," but went on to argue, "the attacks on the ball-bearing industry at Schweinfurt and the synthetic rubber

reorganization," and they agreed on Spaatz. See: *ibid.*, 202-204.

¹¹⁹² Eisenhower, *Crusade in Europe*, 216.

¹¹⁹³ Mets, *Master of Airpower: General Carl A. Spaatz*, 176; Parton, *Air Force Spoken Here*, 341.

plant at Hülse have undoubtedly produced far-reaching effects throughout the range of German war industry.”¹¹⁹⁴ Further, attacks on aircraft factories at various installations were “likely to have produced effects within that industry far in excess of the sum of the visible damage.”¹¹⁹⁵ Implying that the CBO was halfway complete, the report later picked excerpts from a report by the MEW and the Air Ministry, adding that “there is very much greater decline in some individual industries (e.g. ball-bearings and rubber), which may be near the point where they could cause the collapse of the whole war machine.”¹¹⁹⁶ From the sound of it, the bombing had caused the Germans far more problems than dealing with a few squeaky wheels and worn-out tires. If the progress report and its crafty use of language from British air-intelligence sources were accepted at face value, then the CBO was proceeding quite well, even if the end of December was supposed to mark the end of the third of four phases per the original plan. Who was Arnold to believe: Eaker’s positive spin or the negative perspective of Arnold’s own intelligence staff?

Portal appeared to back Eaker with sincerity, but his statistics undermined his praise. Portal argued that Eaker had done what he could with “only some 75 percent of his full resources,” though he had accomplished “54 percent of the results expected” and was “three months behind” (an entire phase, as the plan had been designed).¹¹⁹⁷ Portal pointed out that Eaker had predicted nearly

¹¹⁹⁴ Combined Chiefs of Staff, *Sextant Conference, November-December 1943*, 1943, 120.

¹¹⁹⁵ Ibid., 121.

¹¹⁹⁶ Ibid.

¹¹⁹⁷ Ibid., 474-475.

this exact outcome in an April memorandum, but the comment served only to deflect culpability toward an already enraged Arnold.¹¹⁹⁸ Perhaps even more fitting, Portal pointed out that joint staff of both countries still had much to learn in their endeavors to employ “huge numbers of aircraft,” and that “it was not always right nor was it possible to keep rigidly to a plan laid down in advance.”¹¹⁹⁹

Portal had identified the problems of Eaker’s approach and Arnold’s impatience, as both American airmen clung to air-campaign assessments that suggested their original targeting plan in Pointblank, except for the submarine attacks, was still correct—if only it had been pursued more vigorously. Eaker blamed Arnold for his incessant diversions and the lack of resources, while Arnold blamed Eaker for failing to perform with what he had. Neither general was particularly open to bad news or the other side’s perspective, even when it had finally arrived in the form of contradictory intelligence reports or in sugar-coated language such as Portal’s.

Arnold had spent the last year preaching of airpower efficiency in Washington, and he knew his promises were backed by the COA’s credible plan for quick victory. After all, even Schweinfurt had been the COA analysts’ idea.¹²⁰⁰ However, for the second conference in a row, the lack of credibility or

¹¹⁹⁸ Maj Gen Ira C. Eaker, *Memorandum to Commanding General, ETOUSA: Plan for Build-up and Employment of the Bomber Offensive, Eighth Air Force*, in *Personal Collection of Gen Henry H. Arnold part 3 of 6*, (Maxwell AFB, AL: AFHRA, 18 April 1943), MICFILM 28253, IRIS 2053776.

¹¹⁹⁹ Combined Chiefs of Staff, *Sextant Conference, November-December 1943*, 1943, 476.

¹²⁰⁰ According to Guido Perera’s official history of the COA, the idea to attack ball bearings originated at a dinner party during which Mr. Sexton Wolmar, Vice President of an American

timeliness in the American's air-intelligence assessments left Arnold on the defensive, responding to the British assessments in general and now to Portal's argument in particular. Blame for the air campaign's lack of progress could fall in one or all of three places: (1) Eaker's lack of resources, which would reflect poorly on Arnold in his role as force provider; (2) ACTS doctrine was proving a failing experiment, which might jeopardize the need for independent airpower; or (3) Eaker had lacked creativity and flexibility as he had underutilized and underperformed the forces he commanded. Arnold chose to articulate the third.

At the opportune moment, Arnold derided Eaker's performance as he pushed his agenda to the Combined Chiefs to reorganize American strategic bomber forces in Theater. According to meeting minutes, both Arnold and Marshall had pressed their proposal to consolidate command of bombers in England and Italy for a coordinated effort against Germany. Arnold argued this new arrangement would "overcome the lack of flexibility" that led to an inadequate rate of operations out of England, where just 50 percent of Eaker's aircraft were available for combat, whereas "in other theaters 60 or 70 percent of aircraft were used."¹²⁰¹ Further, "the failure to destroy targets was due directly to the failure to employ planes in sufficient numbers," Arnold blasted.¹²⁰² The problem, as Arnold saw it, wasn't only the size of Eaker's

branch of the SKF Company (the Swedish ball-bearing manufacturer), mentioned: "Why doesn't the Air Corps knock out the ball bearing plants at Schweinfurt? Germany could not get along without them." Of course, disrupting German supply with bombers at a time when demand was already at a wartime high was not going to hurt Mr. Wolmar. See: Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 12.

¹²⁰¹ Combined Chiefs of Staff, *Sextant Conference, November-December 1943*, 1943, 475.

¹²⁰² Ibid.

formations, but bombing accuracy and day-to-day target selection as well: “A sufficient weight of bombs was not being dropped on the targets to destroy them, nor was the proper priority of targets being followed.”¹²⁰³ In short, Arnold portrayed a clear case that the plan had been sound and resources adequate, so the blame belonged on Eaker (and Harris).¹²⁰⁴

Air Force historians later concluded, “if Arnold’s dissatisfaction over the rate of Eighth Air Force operations entered into the decision [to remove Eaker], the record apparently has left no evidence of it.”¹²⁰⁵ Perhaps the Air Force historians passed too lightly over the Sextant minutes. Arnold concluded his rant with a comment that “training, technique, and operational efficiency must all be improved. Only a new commander divorced from day-to-day routine could achieve this.”¹²⁰⁶ By *new commander*, Arnold surely referred to a reorganized and consolidated command, and he clearly did not have in mind the man that he’d just disparaged to the rest of the Combined Chiefs.

Just 3 days after Sextant, Arnold’s new intelligence chief released an updated version of Sorensen’s September assessment and with it he solidified any remaining doubt in Arnold’s impressions of the second half of 1943.¹²⁰⁷

¹²⁰³ Ibid.

¹²⁰⁴ Word travelled quickly. Arnold’s chief of operational plans submitted a memorandum to Arnold’s office during the conference suggesting that his division determine if future bombing plans “are in conformity,” after noting, “it is our understanding that General Arnold and Air Chief Marshal Portal are in agreement as to the priority targets of the Combined Bomber Offensive and that General Eaker and Air Marshall Harris are not conforming...” See: Chief of Operational Plans Army Air Forces, *Memorandum to Commanding General from AC/AS Plans, Subject: Combined Bomber Offensive*, Joe L. Loutzenheiser, (Maxwell AFB, AL: AFHRA, 4 December 1943), #145.81-140, IRIS 118081.

¹²⁰⁵ Craven and Cate, *Torch to Pointblank*, 750.

¹²⁰⁶ Combined Chiefs of Staff, *Sextant Conference, November-December 1943*, 1943, 475.

¹²⁰⁷ It is notable that the September report, after specifying the OSS and Economic Warfare

Sorensen had been replaced by Major General Clayton Bissell, and Bissell's timing could not have been more perfect from the perspective of Washington air-intelligence interests. Bissell had been a law school graduate at 21 years old, a World War I ace, an ACTS graduate, and participated with Billy Mitchell in sinking the *Ostfriesland*.¹²⁰⁸ He clearly had credibility in the air service as a pilot who believed in the primacy of the strategic bomber, but he had also been a War Plans Division member who was then frozen out of General George's four-member "task force" that produced AWPD-1.¹²⁰⁹ To say the least, Bissell had no special affinity for any targeting plan other than the one currently supported by Arnold and backed by his committee of operations analysts.

Bissell's close relationship with Arnold mattered insofar as Bissell had credibility with Arnold, who trusted Bissell as a "detail man."¹²¹⁰ Even Bissell's nemesis, Claire Chennault, called him "a fanatic for meticulous staff work and detailed reports."¹²¹¹ A *detailed* air-intelligence assessment is exactly what

Division, stipulated, "neither this report nor any of its conclusions contained herein should be ascribed to either of these agencies as necessarily representing their views," but the more forceful December report stated, "the report is concurred in and adopted for separate issuance by these agencies with the approval of the AC/AS, Intelligence." It meant that Arnold, ever sensitive to the implied objectivity of outside perspectives, had the OSS backing this negative evaluation. See: Assistant Chief of Air Staff (A-2), *An Appraisal of Accomplishments and Potentialities*, 10 September 1943, signature page; Assistant Chief of Air Staff (A-2), *An Appraisal of Accomplishments and Potentialities*, in *The Strategic Aerial Bombardment of Europe*, USAAF, 1, (Maxwell AFB, AL: AFHRA, 10 December 1943), #142.042-11v3, IRIS 115257, signature page.

¹²⁰⁸ Arnold, *Global Mission*, 77, 106.

¹²⁰⁹ Hansell, *The Air Plan that Defeated Hitler*, 65-73.

¹²¹⁰ Arnold had favored Bissell in the complicated and heated battle between Bissell and Claire Chennault over operations in the China Air Task Force. See: Henry Harley Arnold, *American Airpower Comes of Age*, ed. John W. Huston, vol. 1, General Henry H. "Hap" Arnold's World War II diaries (Maxwell AFB, AL: Air University Press, 2001), 446-447, 491.

¹²¹¹ Arnold, *Global Mission*, 419-420. Arnold, *American Airpower Comes of Age*, vol. 1, 447.

Bissell wrote, and if there was going to be an airman who would expose Eaker for failing to live up to Arnold's expectations or target recommendations from Washington, he would be Bissell.

With damning clarity and a variety of carefully drawn charts and tables, Bissell's report pierced Eaker's integrity and further eroded Arnold's confidence with intimations that Eaker had, at least in some cases, *elected* to attack targets that "fail to utilize properly the principle of selectivity which is the basis and chief virtue of USAAF daylight precision bombing."¹²¹² Bissell later added in similar vein: "The USAAF, with a *very small proportion of its attack directed against relatively few important targets*, has shown that it can successfully strike at the heart of the German war effort" (emphasis added).¹²¹³ The report implied that Eaker had squandered the capable forces under his command pursuing targets other than the ones supported by Arnold's analysts.

Whereas Bissell may have agreed with Arnold on matters of air intelligence, he and Eaker did not. In fact, Bissell's relationship with Eaker deteriorated rapidly while Arnold was away at Sextant. On 3 December, Bissell inquired with Eaker for his views on installing AAF-level intelligence officers directly into the British Air Ministry. Bissell needed to work through the Theater air force component because the only other way he could install AAF officers in Britain would be as attachés, and that meant placing them under the War Department G-2—a battle he did not yet want to fight.

¹²¹² Assistant Chief of Air Staff (A-2), *An Appraisal of Accomplishments and Potentialities*, 10 December 1943, iv.

¹²¹³ *Ibid.*, ii.

Bissell's rationale was twofold: first, "so that we may adopt the good ideas therein that are applicable to our problems," and second, "to lay the groundwork for a flow of information of air intelligence direct from the Air Ministry to the AAF Intelligence."¹²¹⁴ Notably, Bissell added his broader concerns about the AAF Intelligence. He had vision for the future of his service and the time was ripe to establish a top Headquarters-level partnership with the British. "If we are ever to have a worthwhile AAF intelligence organization," Bissell opined, "we must get assigned to it a certain number of very capable young officers who will make Intelligence work their career. Their hearts must be in it and they must be good." He went on to argue that he needed more regular AAF officers to compensate for the "civilians in uniform" who had "no practical experience with the problems confronting Air Forces in combat."¹²¹⁵

Eaker blocked Bissell's request to put AAF intelligence officers in the Air Ministry unless they were to be assigned or attached to Eighth Air Force. "I wish I could agree with you about putting a group of your representatives in the Air Ministry to report directly back to you," Eaker retorted, but he'd been frustrated by "crossed wires" with other War Department agencies, he felt that he was directly responsible for all activity related to Air Force matters in the theater, and "to have another independent agency in Theater muddies the water, often makes for ill-feeling and results in definite confusion."¹²¹⁶ Eaker's

¹²¹⁴ Clayton Bissell, *Letter, Bissell to Eaker*, War Department, (Maxwell AFB, AL: AFHRA, 3 December 1943), #830.289v1, IRIS 267299.

¹²¹⁵ Ibid.

¹²¹⁶ Ira Eaker, *Letter, Eaker to Bissell*, War Department, (Maxwell AFB, AL: AFHRA, 15 December 1943), #830.289v1, IRIS 267299.

leadership style had been to control information and how it was presented, and he was not about to change. “In other words, let us make the command set-up work,” he shot back at Bissell, “instead of by-passing it.”¹²¹⁷

But Bissell had already bypassed Eaker with his report to Arnold. As to the ball-bearing attacks, Bissell’s carefully worded analysis pinned the lack of success on German response and on Eaker’s failure to follow up. Though much of the analysts’ rationale for Schweinfurt’s high priority had been the relationship between ball bearings and the aircraft industry, Bissell concluded that “this industry will probably not be affected greatly because of the possibility of rerouting the production of undamaged facilities.”¹²¹⁸ Though the August raid had little impact on ball-bearing production, the October raid drove November production down by 31 percent; without more attacks, however, full production would resume by March.¹²¹⁹ From Bissell’s perspective, ball bearings still seemed the bottleneck target of choice, if only Eaker had figured out some way to sustain the assault on Schweinfurt with lower costs to his own forces. This rationale resonated with Arnold, who’d even suggested to Eaker the day after the October raid that he consider: “possible changes in your formations; dive to minimum altitude coupled with break-up of formations to Squadrons for return home; contact Portal to see if long range fighters can be secured from him.”¹²²⁰ Arnold had little patience for a combat

¹²¹⁷ Ibid.

¹²¹⁸ Assistant Chief of Air Staff (A-2), *An Appraisal of Accomplishments and Potentialities*, 10 December 1943, 13.

¹²¹⁹ Ibid., 14.

¹²²⁰ H. H. Arnold, *Message Arnold to Eaker*, Manuscript Division, Spaatz Papers, Box 324,

commander who appeared to lack “imagination and aggressiveness,” even if that commander had been his long-time friend.¹²²¹

At a watershed moment for AAF Air Intelligence, Arnold accepted Bissell’s appraisal of Eaker’s performance. The AAF’s Commanding General sided with his top intelligence officer over the semi-monthly reports and personal pleas of a commanding general senior to Bissell. In fact, the foreword in Bissell’s report, written by Arnold himself, conveyed the latter’s sincere frustration. Arnold pointed out that only 20 percent of Eaker’s weight of effort (by bomb tonnage) during the preceding four-and-a-half-month period had fallen on industries “vital to Germany’s ability to continue the war, vulnerable to aerial bombardment, and within the capacity of our available forces.”¹²²² Arnold was “considerably dissatisfied,” noted COA’s Colonel Guido Perera in an understated tone; the A-2 report, he added, was “in some contrast to reports submitted by the Eighth Air Force to General Arnold.”¹²²³ While it is unclear which reports Arnold found to be inaccurate, it probably did not help that Eaker’s semi-monthly reports of bombing results to Arnold, as produced by the Eighth Air Force intelligence section, had taken an extraordinarily positive tone despite the struggling reality of the stalled air campaign.¹²²⁴ The October

(Washington, DC: Library of Congress, 16 October 1943).

¹²²¹ Arnold, *American Airpower Comes of Age*, vol. 2, 108.

¹²²² Assistant Chief of Air Staff (A-2), *An Appraisal of Accomplishments and Potentialities*, 10 December 1943, forward.

¹²²³ Perera, *History of the Organization and Operations of the Committee of Operations Analysts*, 1944, 99-100.

¹²²⁴ Though many reports out of Eighth Air Force did not specifically attribute the originating office, the bi-monthly reports (titled “semi-monthly” after 1 August 1943--both were produced every two weeks) did. Distribution went directly to General Arnold and General Devers, in addition to copies retained locally. For example, see: A-2 Eighth Air Force, *Semi-monthly Report*

report, for example, had claimed that “Eighth Air Force heavy bombers virtually tore the roof off of Hitler’s Fortress Europa,” before claiming that “most of the 475 tons dropped found their individual targets” during the “extremely effective attack on Germany’s ball and roller bearing industry.”¹²²⁵ The bluster didn’t match the bombing results, and Bissell—Arnold’s intelligence chief—ensured that Arnold knew it.

Eaker was, in Arnold’s words, “moved down to commanding the Mediterranean Air Force”—in position as well as geography—at least in part because Arnold needed to know that he had a general in place in England who could not only overcome operational challenges as the war intensified, but who would respond and report openly to Arnold’s concerns from Washington.¹²²⁶ To Arnold, the chance of proving the independent worth of airpower was more important than personal friendship. With Bissell at the top, Arnold’s air-intelligence gurus had convinced him that Eaker failed in England for the growth and prestige of their own enterprise. Both Arnold and Bissell placed

of Bombing Results, 16 August through 31 August 1943, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, 2 September 1943), #520.307, IRIS 219683, 17. Semi-monthly reports continued as an operational intelligence function after reorganization to USSTAF as well. See: Lewis F Powell, Jr., *Notes on Operational Intelligence Division of Directorate of Intelligence, USSTAF, A-2 United States Strategic Air Forces in Europe*, (Maxwell AFB, AL: AFHRA, ca. May 1945), #519.600, IRIS 216944, 18.

¹²²⁵ A-2 Eighth Air Force, *Semi-monthly Report of Bombing Results, 1 October through 15 October 1943*, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, 26 October 1943), #520.307, IRIS 219686, 6.

¹²²⁶ Arnold, *Global Mission*, 502. Plans to move Eaker may well have already been in place prior to Arnold internalizing the December assessment, but it is worth noting that, even in James Parton’s account, which was shamelessly in Eaker’s defense as written by one of his former staffers, the decision was still in the air until the very end of 1943. It is also likely that Arnold was familiar with the substance of the A-2 assessment well prior to placing his signature on the forward. See: Parton, *Air Force Spoken Here*, 333-345.

their respective organizational imperatives first.

If Arnold was displeased with Eighth Air Force's progress, and in its commander, he had been pleased in equal magnitude by the air-intelligence organizations, their targeting recommendations, and their air-campaign assessments. He later noted in *Global Mission*:

*The information available to us when we considered attacking any target in Germany reflected a combined knowledge about that specific place which included everything known about it at that minute...details ranged from the most abstract evaluations of civilian scientists through the best British-American photo interpretation; the latest reports of our own and the R.A.F.'s combat crews; the reports of General Donovan's OSS operatives behind the German Lines; the careful estimates of British Ministry of Economic Warfare experts, of our own Bureau of Economic Warfare, and what not.*¹²²⁷

If there was any remaining doubt as to the sources of Arnold's rationale behind his decision to replace Eaker, he summed it up on 5 January 1944 in a way that could only be fully explained by the foregoing narrative:

*A study of reports, covering the heavy bomber effort of the Eighth Air Force during the past several months, forces me to conclude that aircraft and crews available in the United Kingdom are not utilized as fully and effectively as possible toward achievement of our aims in the European theater (emphasis added).*¹²²⁸

However, to generate the most damning statistic, that only "20 percent concentration" of USAAF bombs had fallen on "vital target systems" under Eaker's watch between 1 July and 15 November 1943, Bissell had to twist the

¹²²⁷ Arnold, *Global Mission*, 333-334.

¹²²⁸ H. H. Arnold, *Letter, Arnold to Giles; Subject: Analysis of Eighth Air Force Heavy Bomber Effort*, War Department, (Maxwell AFB, AL: AFHRA, 5 January 1944), #168.491v1, IRIS 123263. See also, McFarland and Newton, *Command the Sky*, 147-151.

facts in his own way.¹²²⁹ To calculate a percentage that low, Bissell included only attacks on aircraft production (omitting Eaker's elective attacks on repair facilities and operating airdromes), ball bearings, oil, and rubber in his calculations. Per the Pointblank Directive, these categories were priorities #1, #3, #4, and #5, respectively.¹²³⁰ Bissell's statistic omitted Eaker's attacks on U-boat installations (#2—40 percent of Eaker's bombs) and vehicle factories (#6; e.g. the 15 September raid on Renault motor works in Paris), even though these targets fell as legitimate priorities on his governing directive during that period.¹²³¹ Bissell's list was an arbitrary reformulation reflecting the COA's original preferences, since neither U-boat installations nor vehicles had been in the COA's top six categories.

In truth, attacks on U-boat installations were not removed as a Pointblank objective by the Combined Chiefs until 13 January 1944, by the same document that finally added Crossbow objectives as well as "installations supporting the German Air Force" to the list.¹²³² This meant that Eaker did not receive credit for targets (including the V-weapon site at Watten) he'd attacked at the direction of Air Chief Marshal Sir Charles Portal, who technically directed the CBO "as agent of the CCS" during 1943."¹²³³ Eaker also did not

¹²²⁹ Assistant Chief of Air Staff (A-2), *An Appraisal of Accomplishments and Potentialities*, 10 December 1943, iv.

¹²³⁰ Hansell, *The Air Plan that Defeated Hitler*, 163.

¹²³¹ Assistant Chief of Air Staff (A-2), *An Appraisal of Accomplishments and Potentialities*, 10 December 1943, 2.

¹²³² Hansell, *The Air Plan that Defeated Hitler*, 177-178. The Combined Chiefs agreed that Pointblank should remain unchanged at their 133d meeting on 3 December 1943. See: Combined Chiefs of Staff, *Sextant Conference, November-December 1943*, 1943, 463.

¹²³³ Craven and Cate, *Torch to Pointblank*, 307.

receive credit for the attacks he waged on German airfields in occupied territories, even though they were added as an official Pointblank objective within 30 days of his reassignment. Through another lens—one less shaded by organizational imperatives—Eaker’s decision to attack airfields might have been considered prescient rather than deficient.

The 20-percent statistic associated with Eaker’s Eighth Air Force, however contrived by AAF intelligence, represented Arnold’s frustration with the air campaign as a whole: the tug and pull between British and joint objectives (i.e. V-weapons, U-boats, and vehicles); the operational challenges that seemed to threaten the validity of ACTS doctrine (i.e. accuracy, results, and loss rates) without adhering strictly to the doctrinal targeting principles; and most of all, the inability to achieve quick victory in 1943, despite the War Department’s plan for a ground invasion before the bombing had even started. Arnold wanted a fresh start with Spaatz in England in 1944, and the air-campaign assessments gave him the evidence he needed to justify his decision. If Arnold replaced Eaker on the dubious merits of Bissell’s report, on account of Eaker’s difficulties with weather, manpower, equipment, training, fighter escort, the Luftwaffe, and all of his other challenges taken together, or simply on Eisenhower’s preference for Spaatz, then the decision may have been unfair to Eaker. However, Eaker had proven a wartime commander who valued placing a positive spin on his own success over the imperative for organizational learning in an air campaign, and this flaw made him quicker to beg for more resources than to seek creative approaches while he stood in the

way of the AAF's development of air intelligence. For this reason, along with all of the above, it was in the best interest of the Army Air Force, its air intelligence enterprise, and the success of the ground invasion that followed, to get Eaker out of the way. All of these interests were driven by their sponsors' organizational biases, which are ever-present influences on airpower and national security.



Conclusion and Epilogue

*The kind of able military men who rose to command under the pressure of a great and initially desperate war learned that they needed intellectuals and that physical and social scientists and all manner of bright, enterprising civilians could work well in a setting where innovation in thought and hardware was essential for survival.*¹²³⁴

—Walt Rostow, former EOU Economist

*We are now suffering greatly from our shortsightedness in failing to develop capable intelligence officers over a period of years.*¹²³⁵

—Lt Gen Ira C. Eaker, 15 December 1943

*It would appear to me that new yardsticks for measuring ultimate effect of our bombing on the German military effort must be used. Certainly, we are destroying German industries and facilities from one end of the country to the other. Also, certainly this destruction is not having the effect upon the German war effort we had expected and hoped – not the effect we all assumed would result. Accordingly, it would seem to me that a re-evaluation of bombing damage to Germany might be in order – but how and by whom?*¹²³⁶

—H. H. Arnold, Commanding General, Army Air Forces, 8 January 1945

Conclusion

The Combined Bomber Offensive was a Clausewitzian air campaign, which is to say that it shared the components of an iterative, interactive clash of wills fought with airpower. Unfortunately, just as Clausewitz's writings were loaded with confounding contradictions between theory and reality, the Air Corps

¹²³⁴ Rostow, "Waging Economic Warfare from London," 78.

¹²³⁵ Ira Eaker, *Message Arnold to Eaker*, Manuscript Division, Spaatz Papers, Box 324, (Washington, DC: Library of Congress, 15 December 1943).

¹²³⁶ H. H. Arnold, *Memorandum for Maj Gen Clayton Bissell, Assistant Chief of Staff (G-2), Subject: Bombing Targets*, War Department, (Maxwell AFB, AL: AFHRA, 8 January 1945), #142.035-8, IRIS 115061.

Tactical School's expectation that waves of self-defending four-engined bombers would independently cause catastrophic economic dislocation to an industrialized nation did not appear to match experience through 1943. However, ACTS doctrine was neither fully applied, nor could it have been. Clausewitz explains: "as soon as preparations for a war begin, the world of reality takes over from the world of abstract thought; material calculations take the place of hypothetical extremes and, if for no other reason, the interaction of the two sides tends to fall short of maximum effort."¹²³⁷ Despite President Franklin D. Roosevelt's sponsorship, as Eighth Air Force built up its strength, sufficient resources were not available in 1943 to put enough weapons on target to create the effect ACTS' theory predicted. Moreover, the Army Air Force did not have the organizational or technological mechanisms in place in time to facilitate gathering the necessary intelligence, and the enemy responded in ways that left the few analysts charged with discerning such ambiguous bombing results to report information that reflected their organizational tendencies and biases.

The AAF's senior leaders across all theaters of operations, as well as in Washington, were nearly all members of an internally competitive club of Tactical School graduates. They fought their campaign for Air Force independence as they confronted Germany, and in some cases, each other. But they had pursued independence and confronted each other out of an interwar struggle with the War Department and the Navy that left the AAF's senior

¹²³⁷ Clausewitz, *On War*, 79.

leaders wanting the credibility to provide objective analysis and genuine recommendations in matters of air power in particular and of national security in general. Their circumstances were not entirely their own fault.

The War Department's airpower enthusiasts had emerged from World War I perceiving of themselves in the Army's fledgling Air Service as members of a group that had become different from its parentage—an *other*. The War Department, protective of its own resources and organizational stratum, did not support the notion of an independent Air Force. The troops who flew airplanes, in the War Department's view, were no different than those who specialized in other branches in support of ground combat. The Air Service (the Air Corps, after 1926) deserved no special freedoms from the administrative oversight and functional control of the Army, including those of planning and intelligence. All matters of air warfare remained subordinated to the ground component. In short, the War Department did not recognize the Air Service as an *other* from itself, but merely as a useful adaptation of its own kind.

With a school led through the interwar years by their own elite, then-Air Corps pilots sharpened their views and inculcated their beliefs as they fought against those who would not recognize their views of the airplane's potential. They accentuated their identity relative to the other combat arms through exaggerated views of airpower. Efforts that pushed too hard and too fast against the War-Department establishment met with resentment and generated a backlash, as evidenced by the court-martial of (demoted) Colonel William

“Billy” Mitchell.¹²³⁸ These air power enthusiasts argued that aerial bombardment was not merely a supporting element of land, naval, or even joint warfare, but a separate war-winning capability on its own.

AAF leadership strengthened its advocacy for independence from within its ranks through a symbol of its resistance and its *otherness*. Similar to the way President George W. Bush described of the Liberty Bell as the symbol that “rang to announce the first public reading of the Declaration of Independence,” the B-17 became the iconic representation of the airmen’s struggle for independence.¹²³⁹ In the case of the B-17, however, the hopes and ideals of these resolute airmen rested upon the untested performance of the symbol itself. It was in this context, that the AAF entered World War II.

However, the B-17 was missing more than a previous test of combat: it was lacking the underpinnings of a mature air-intelligence organization and a cadre of specially trained airmen who could provide critical analysis of the enemy, along with targeting and assessment of the AAF’s bombing efforts. As Tami Davis Biddle argued of the interwar Air Corps, “the fundamental and foundational data on which the theory necessarily rested remained underdeveloped.” Further, she added, “the connections between air force action and enemy responses remained vague and speculative.”¹²⁴⁰ This was true, yet the air-intelligence shortfalls existed not because ACTS instructors, such as

¹²³⁸ Arnold, *Global Mission*, 118-122.

¹²³⁹ George W. Bush, *Remarks at an Independence Day Celebration in Philadelphia, Pennsylvania*, 37: Superintendent of Documents, 2001), 05114187.

¹²⁴⁰ Biddle, *Rhetoric and Reality*, 162.

Muir Fairchild, Laurence Kuter, or Haywood Hansell, hadn't considered their requirements; the shortfalls existed because these airmen lacked the resources and approval from the War Department to obtain the information they needed.

There is another reason the AAF entered the war lacking in air intelligence. The air arm doubled in size six times, from 24,724 officers and enlisted men in July 1939 (as work on pre-war strategic bombing doctrine peaked), and increasing to a total strength of 1,696,866 by January 1943. The growth curve for officers during the same period was even more pronounced, skyrocketing from 2,636 to 139,976.¹²⁴¹ Prior to July 1939, the insurgent Air Corps possessed neither adequate bureaucratic parity to engage in the eventual A-2/G-2 debate (culminating in Arnold's declaration that only airmen could understand air intelligence and that he was willing to bypass G-2), nor sufficient manpower to have grown a faction of its own intelligence officers from within. Further, Air-Corps pilots, at that time, believed that only pilots could truly understand airpower, including the needs of air intelligence. Whether or not they were right, these were the reasons the ACTS instructors took on the intelligence burden themselves in an ad hoc process that was infused more with optimistic assumptions than facts.

By the time Eaker took command of Eighth Air Force in early 1943, there were three streams of personnel development for air intelligence: ACTS graduates such as Hansell and Cabell (eventually also Sorensen and Bissell), who were essentially pilots on temporary duty filling intelligence roles; officers

¹²⁴¹ Office of Statistical Control, *Army Air Forces Statistical Digest - World War II*, 1945, 16.

flowing out of the AAF's Air Intelligence School (AAFAIS) by the hundreds with insufficient credibility and inadequate training after Spaatz's action to budget for them in July 1941 to establish the AAF's own air-intelligence corps; and analysts both in Washington and overseas, who provided outsourced staffs to meet the AAF's immediate air-intelligence requirements. For reasons likely understood only in 1943, all three of these streams came far too late to provide a fully informed air-intelligence apparatus for the heavy bombers.

Less understandable at that time was that each of these streams would carry powerful undercurrents created by the biases of the personnel in each group. Each of these groups engaged in their own ways with the well-established British intelligence organizations, who, in-turn, saw themselves as superior benefactors. In short, the British air-intelligence organizations, while they were willing to guide the AAF's air-intelligence organization, preferred to remain the dominant source of information to both the RAF and the AAF, thus maintaining stronger control of their own bureaucratic survival. The AAF's independence, like American independence itself, may have been inevitable, but British air-intelligence organizations were understandably more oriented toward their own interests. They sought to ensure the relevance of the RAF's area-bombing doctrine, and in some cases (such as the photo-interpreters with the Bodyline investigation), they sought prestige of their craft as well as their organizational and individual survival.

While each of the AAF's factions possessed its own personality and its own proclivities, each of them followed similar patterns of establishing

organizational identities, ensuring its own survival, and seeking prestige in the broader context of the air campaign and its post-war expectations. The intelligence organizations followed this pattern, at all times guided by an instinctive rubric of efficiency. Their relationships to each other reflected cooperation (as between the OSS and A-2 on the September and December 1943 assessments) or competition (as in the Enemy Objectives Unit evaluation and rejection of many the Committee of Operations Analysts' report's recommendations) as suited their interests. Just as the AAF's top generals, notably Arnold, Eaker, and Spaatz, publically and privately marketed ideas about their organizational (and sometimes personal) goals, the air-intelligence organizations did the same throughout 1943 and the rest of the war.

Outsourced intelligence. Arnold's hurried program to assemble targeting intelligence resulted in the formation of the COA's core committee as a temporary arrangement, since the analysts had little to no understanding of bomber employment (without Ed Sorensen, who had interests of his own), they were uninhibited in taking Arnold's guidance to an extreme. Attached to the upper echelon of AAF power, their incentive, especially given Arnold's personality, was to reinforce his air-centric vision. The COA analysts' unspoken goal became to demonstrate that civilian expertise could extend ACTS doctrine beyond even the capacity of the school's graduates to identify the enemy's critical vulnerabilities. The analysts wanted to prove to the AAF's leadership, principally Arnold, that air intelligence could validate his claims about airpower and that their knowledge of industrial societies was an important contribution

to the AAF's brand of air intelligence.

The COA celebrated that its industrialists had validated a target that appeared to be a uniquely concentrated and cross-cutting phenomenon vital to war-materiel production. As a target, Schweinfurt was as meaningful to COA just for its selection as it was for the expected effects of bombing the factories themselves. In other words, just as the B-17 represented independent airpower to ACTS disciples, Schweinfurt represented the pinnacle of target selection for air intelligence. Both symbols—the B-17 and ball bearings—were tied to the same theoretical doctrine that prescribed for victory through airpower. Arnold likely saw both symbols so intertwined that they would succeed or fail together; thus, he kept the pressure on his commanders in Europe to keep their pressure on the German ball-bearing industry.

Schweinfurt was not worth the opportunity cost in striking other targets, though this was unknowable at the time. The reality was that the German anti-friction bearing industry—led after the October raid by its own General Kommisar—had been rationalized through a combination of versatile machine tools, bearing substitution, previously underestimated supply stocks, military equipment prioritization, and the heavy-machine tools' resilience against all but direct hits and intense fire damage.¹²⁴² Perhaps, as General Haywood S. "Possum" Hansell argued, as he later defended his own role in the air campaign, that "the bombing had been good but the bombs used against

¹²⁴² United States Strategic Bombing Survey, *The German Anti-Friction Bearings Industry*, ed. Equipment Division, 2nd ed., No. 53 (Washington, DC: USSBS, 1947), 1, 5, 28, 36-38.

Schweinfurt had not been heavy enough.”¹²⁴³ More reasonably, ball bearings had not proven a cost-effective target against possible alternatives (such as more and earlier attacks on oil) from a standpoint of costs incurred versus costs imposed, in terms of lives and materiel. Without the necessary all-source intelligence for the Allies to make such determinations, however, the analysts continued to assert their own agenda with the ill-chosen target.

The EOU influenced the air campaign in another way. Similar to the COA, the EOU’s lack of operational background affected the quality of its inputs, although its economists clearly gained perspective more quickly than the COA through their interactions with air leaders close to the air effort. They were unquestionably brilliant, as most (if not all) of them went on to acclaim in academia or further public service. They attempted to make up for their lack of industrial expertise with their background as economists and their brain power. To some extent, they succeeded. Unfortunately, as Robert Keohane has observed (though perhaps unfairly), there may be a “tendency of economists to disregard the opinions of experts in other fields, to be totally unaware of the political/ideological biases inherent in their own policy recommendations, and to go beyond their competence when advising governments.”¹²⁴⁴ There is some applicability to Keohane’s observation with the EOU’s development of its own *party line*, although arguably the EOU did so in a vacuum, lacking specific operational guidance or familiarity with ACTS doctrine.

¹²⁴³ Hansell, *The Strategic Air War Against Germany and Japan: A Memoir*, 86.

¹²⁴⁴ Cited in: Gilpin and Gilpin, *Global Political Economy: Understanding the International Economic Order*, 71.

To the EOU members, at least in 1943 (before their relentless push for oil in 1944), airframe assembly plants—not ball bearings—symbolized their quintessential target choice. They proved with mathematical certainty and the information they had available at the time that eliminating the final steps in the production process served as the optimal method of keeping the Luftwaffe out of the sky. The problem with their target choice lay with their assumptions, which had largely ignored or underestimated possible enemy responses. For example, the economists (with help from their associate OSS R&A branch) wrongfully assumed that the decision to repair or disperse production at Regensburg was an either-or choice for the Germans, who had, in fact, chosen both courses of action. In dissecting enemy decision-making, the economists looked for evidence of any decision until they'd found enough to tilt one direction or the other:

It might have been expected that the Germans would abandon the plant and seek security from attack for the future by dispersal. However, rebuilding is in progress, which emphasized the urgent need for planes in the near future. Reconstruction rather than dispersal will give the Germans a few hundred additional planes from an exposed plant. The larger immediate output appears at this phase of the war to be preferred by the Germans to a more assured flow of fighters coming into production at a somewhat later date.¹²⁴⁵

In fact, USSBS surveyors later determined dispersal of some factory functions was already underway before the 17 August attack, and the German factory managers accelerated their dispersal plan with the flurry of post-raid

¹²⁴⁵ Office of Strategic Services, *Bomb Damage Report*, War Department, (Maxwell AFB, AL: AFHRA, 25 October 1943), #187.2-16, IRIS 135273, 14.

activity.¹²⁴⁶ Further, woodland construction sites had eluded detection by the aerial reconnaissance. Construction that photo-interpreters did detect had been adequate to resume all functions “other than metal stamping and detail” back to “pre-raid level” by the middle of October.¹²⁴⁷ The USSBS later pointed out that the Germans maintained greater capacity in airframes than engines, though production facilities for both aspects of both were eventually located “in caves, cellars and attics throughout Germany.”¹²⁴⁸ In short, airframes also turned out to be an ineffective target, selected with an overly simplified methodology, but this ineffectiveness was unverified in time for analysts to recommend a more effective bombing effort.

If the Luftwaffe eventually bled dry after rising to defend its last sources of aviation fuel for want of trained pilots—not from a shortage of airplanes—that cannot be held against the EOU or its methodology.¹²⁴⁹ The EOU’s economists did not have the information they needed to refute their own recommendation. It is nevertheless instructive to understand the origin of their recommendations and their many assumptions. Unfortunately, the EOU’s approach, at least in 1943, had been to simplify its target-selection methodology in response to ambiguity rather than to push harder for the information or collaboration it

¹²⁴⁶ United States Strategic Bombing Survey, *Messerschmitt AG Augsburg, Germany, Part B*, 8-9.

¹²⁴⁷ Ministry of Home Security, *Reconstruction Report, Messerschmitt A G Regensburg - Prufening, Germany*, 12 October 1943, 1.

¹²⁴⁸ United States Strategic Bombing Survey, *Aircraft Division Industry Report*, 2; United States Strategic Bombing Survey, *The United States Strategic Bombing Survey: Summary Report (European War)*, 7th ed. (1987; repr., Maxwell AFB, AL: Air University Press, 2001), 16-18.

¹²⁴⁹ Mets, *Master of Airpower: General Carl A. Spaatz*, 205-207. Lewis F Powell, Jr., interview by Richard H. Kohn and Diane T. Putney, 23 January 1985.

needed. Many of its assumptions did not appear to have been tracked, much less revisited, as more information became available, especially with regard to target vulnerabilities or German responses.

Where previous experience and specialized knowledge may lead to biased solutions by any organization charged with target selection, assumptions must be consciously acknowledged and relentlessly reevaluated. One final example obtains: the COA's elimination of the electrical system, noted in Chapter 6. In all reasonable likelihood, the German electrical system had been the ideal-yet-overlooked target from an efficiency standpoint. After visiting damaged stations in Germany, USSBS analysts concluded "that 0.2 of a ton of bombs per acre of plant area in all instances disrupts operations for a period of weeks or months and that a tonnage in excess of 0.4 tons per acre made restoration of service a matter of from six months to a year or longer."¹²⁵⁰ Reichminister Albert Speer, who was Hitler's Inspector General for Water and Power (among his many other regime duties) added in a post-war interview: "according to estimates of the Reich, a loss of 60 percent of the total power production would suffice to lead to a collapse of the whole network."¹²⁵¹ Accepting Speer's comments with caution, since he was by then a man choosing his words to avoid disappointing his captors, the Allies nevertheless had made no serious attempt to target the system. The electrical system turned out to be highly susceptible to bomb damage and systemic failure, but COA analysts ruled out the system for

¹²⁵⁰ United States Strategic Bombing Survey, *German Electric Utilities Industry Report*, 1947, 3.

¹²⁵¹ *Ibid.*, 46.

deliberate large-scale attack based upon false assumptions.

That COA or EOU members occasionally erred in their recommendations should not be attributed to flawed judgment on their part, given their lack of factual information or conclusive feedback on their decisions. After all, they had to work with the information available to them and could only reasonably develop methodologies based upon their own backgrounds and understanding of the environment. It may, however, have helped them to have openly discussed their potential biases, especially toward the areas of their own expertise. Based on meeting minutes, organizational histories, and interviews, they did not appear to do this. Gareth Morgan describes this phenomenon: “If one really wants to understand one’s environment, one must begin by understanding oneself, for one’s understanding of the environment is always a projection of oneself.”¹²⁵² To the ball-bearing manufacturer, the environment is full of ball bearings.

Extending this point, EOU Economist Carl Kaysen offered a poignant post-war revelation:

Ball-bearing consumption patterns, for example, were never very accurately known, and at least part of the intelligence mistakes in the target analysis of the ball-bearing industry were attributable to lack of information of consumption patterns, especially on the point of technical suitability. Judgments on technical suitability were based almost entirely on analogy from domestic experience. This analogy is greatly limited in value by the fact that the many substitution possibilities are not discovered or known until necessity forces their discovery. Lacking this necessity, domestic engineers and technicians will not think of substitutions as possible because of the obvious

¹²⁵² Tsoukas, *New Thinking in Organizational Behaviour: From Social Engineering to Reflective Action*, 142-143.

*availability and obvious economy of existing methods.*¹²⁵³

Kaysen, while undoubtedly incentivized to divert blame toward the industrialists (versus the economists such as he was), nevertheless adds nuance to the common argument that analysts committed mirror-imaging errors. In Kaysen's argument, the industry was not only mirror-imaged from the standpoint of its design and output, but also in terms of possible responses from the enemy. Because American industries had not taken extraordinary measures, including accepting inferior designs or product, to keep the assembly lines moving, engineers did not envision the potential for such measures on the German side.

Another travesty for outsourced intelligence in air-campaign targeting was rather that the analysts were largely responsible for seeking out their own feedback or tied to snippets of information from other organizations. Examples of this included the EOU's efforts to estimate German aircraft production based upon the British Air Ministry's seemingly arbitrary serial-number reports, and even "the cleaning and recording of markings from a pile of German ball bearings" by EOU economists.¹²⁵⁴ Further, their experiences showed that intelligence organizations that invest considerable energy into targeting constructs may not be quick to abandon their preferred solutions, especially after defending them to other organizations. Even more importantly, the COA and the EOU represented another campaign, larger to them than the AAF's

¹²⁵³ Kaysen, *Notes on Strategic Air Intelligence in World War II (ETO)*, October 1949, 15.

¹²⁵⁴ *Ibid.*, 31. Rostow, *Rostow Report*, ca. 30 April 1945, 5, 66-67.

own struggle for independence: these analysts represented the burgeoning force of East Coast-based analysts who sought to prove the importance of an independent national intelligence enterprise with the same ability to provide advice to the President as the War Department. Whereas the COA accentuated Schweinfurt, the EOU economists cherished the viewpoint that they had developed their own “doctrine of warfare” as an expression of their extraordinary analytic capabilities, including their recommended attacks on German aircraft production, which they would continue to defend long after the war.¹²⁵⁵

The civilians and wartime civilians-in-uniform (as opposed to the Regular Army officers) contributed in ways the AAF could not have done itself. They offered expertise and research acumen that the AAF could not generate internally in the time available, if at all. They brought with them extensive networks of public and private colleagues along with their vast academic, business, inter- and intra-governmental resources. In some cases, especially in working with the British, the civilians who supported the AAF established new relationships where uniformed personnel could not. That they brought their biases along with them was not unique to their contributions, but endemic to all human endeavors.

Building internal intelligence capacity. Arnold’s decision to grow his internal intelligence enterprise and to use his ACTS graduates to lead it played out as related decisions. That AAF’s original air-intelligence school stumbled as

¹²⁵⁵ Rostow, “Waging Economic Warfare from London,” 75.

a stand-alone program is as much a reflection of its hasty inception and lack of institutional support as its leadership failures. The school quickly exhausted the supply of highly interested and qualified applicants, who ended up filling many of the most important wartime air-intelligence posts for junior and mid-level officers overseas. That many of its unmotivated graduates later amounted to little productive value within the air-intelligence field did not surprise senior A-2 officers. As evidenced by the consistency in the signature lines of S-2 reports within Eighth Air Force, many of the squadron-, group-, and wing-level S-2 positions held stable during 1943, once the posts had been assumed by capable officers.

At lower levels, where the S-2s were figuratively (and probably literally) closer to the flight line, their interests aligned more closely to those of their operational units than the broader battles for A-2 independence (from G-2) or AAF independence writ large. Institutionally, unit-level S-2s were caught within the conflicting interests of an air force obsessed with removing paperwork demands from its revered (though often war-weary) aircrew, aircrew who desperately needed to feel that their traumatizing missions had been worth their heart-breaking losses, and the value of their own roles in supporting the slow-but-steady development of the AAF's air-intelligence enterprise. In most cases, the S-2s appeared to side with their own units in terms of how they reported on each mission, emphasizing success whenever they could. However, in missions more likely to draw close scrutiny from above, such as the Schweinfurt raids, the first blind-bombing effort at Emden, or the first V-

weapon-site attack at Watten, they adopted a more objective approach, either holding the aircrew accountable for excess optimism, playing a critical role in capturing and translating the mission's lessons, or even reporting on mission-related errors made by higher headquarters (such as planning attacks into the sun).

These tensions felt by unit-level intelligence officers reflected the Air Force's shifting weight of effort toward airpower roles in joint warfare, their unit's role in performing its mission (as assigned by higher headquarters), and the intelligence officers' own role in supporting the air-intelligence enterprise. These tensions did not resolve in 1943, and they have not resolved in the nearly 75 years since, nor should they. These tensions reflect the complexity inherent in the roles and duties assigned to the air-intelligence officer. Only the most mature and skillful of air-intelligence professionals master the required nuance, and such mastery requires an adept proficiency of marketing one's ideas.

The tag-team of Sorensen and Bissell succeeded in establishing the unique character of air intelligence, which resulted in breaking the A-2 out from under the G-2 while the AAF still sought its own independence. Then, Bissell capitalized on Sorensen's gains by achieving control of the War Department's Military Intelligence Division. Most accounts of the Combined Bomber Offensive make no mention of this event, as it would seem an unimportant sideshow at best. However, it should be viewed among the more significant and successful bureaucratic insurgencies in the Pentagon's history, and it happened in the

year of the building's dedication (1943).

Even if the battle between the A-2 and the G-2 had been a side-show to the air-campaign over Germany, it was arguably the catalyst that kept the other battles raging. The battle for air intelligence autonomy underscored the AAF's critical information shortfall and paralleled the AAF's goals. The air-intelligence products, both the targeting recommendations and the assessments, served as media for the AAF to defend its doctrine and for the intelligence organizations to propel their preferences. As 1943—the essential learning period for the air campaign—came to a close, the A-2 came to the forefront.

Sorensen and Bissell, in sequence, had served at the locus of all three battles for independence: the AAF, national intelligence, and the A-2. They secured the later victory first and assisted in the former two. For reasons already discussed, the office of the A-2 could not compete with the unique capabilities and contributions of the COA or the EOU in terms of nominating targets with plausible supporting research and rationale. In fact, the A-2 benefitted in its fight with the G-2 from the reports submitted by the other organizations, because these reports added a stream of information still wholly overwhelming to the G-2 and further validating the *otherness* of air-intelligence from traditional military intelligence.

The A-2 could, however, dominate the battle to control air-campaign assessment. If only because Arnold had frozen the A-2 out of the targeting plans when he established the COA, the A-2 was the office most clearly in position to objectively assess the air campaign from an internal perspective for

the AAF. Sorensen and Bissell maneuvered into position to collect information from Europe as well as Washington, package it in a manner that would best represent their position in all three fights, and sell the assessments to Arnold and the War Department. This was how Schweinfurt, as a symbol for air intelligence, aided the A-2's fight for recognition even before its value as a target could fizzle out in post-war assessments (see Epilogue).

Whether they consciously recognized it at the time or not, Sorensen and Bissell, serving sequentially as the AAF's top intelligence officer, had been in position to sell Schweinfurt in order to grow the size and influence of the air-intelligence enterprise upon which they sat. Schweinfurt worked as a symbol of ideal target selection for the following reasons: it served Arnold's interests for quick victory; the COA's (and to a lesser extent, EOU's) interests proving their organizational expertise; the A-2 division's interest in forming an air-intelligence enterprise down to the unit-level; and Schweinfurt appeared to be linked to the overall political objective of the war—unconditional surrender. The problem with Schweinfurt, like the B-17, was that the symbol itself needed to prove worthy of its marketing value. In other words, the COA and A-2 needed to show Schweinfurt was actually an efficient and effective target. As a result, Schweinfurt could not be abandoned as a target by the AAF's leadership, its outsourced-intelligence analysts, or its internal air-intelligence organization without abandoning the ambitions of all three of these organizations' battles—none of which actually had anything directly to do with German capitulation. As long as Schweinfurt maintained its plausible linkage

to victory, whenever such victory actually occurred, then all three battles might be won.

Finally, in *Ten Propositions Regarding Air Power*, Phillip Meilinger argued: “In essence, Air Power is targeting, targeting is intelligence, and intelligence is analyzing the effects of air operations.”¹²⁵⁶ Meilinger’s insightful syllogism rings true through this study and echoes with airpower application and air intelligence in every high-explosive bomb dropped by modern air forces. Meilinger adds, “not only have most air theorists had a single, key target theory, but they have also been surprisingly prescriptive: their target is the key in all types of wars, in all types of situations and against all types of opponents.”¹²⁵⁷ Refining Meilinger’s observation, this study shows that the air-intelligence analysts, not just the theorists, had their own targeting prescriptions as well. Because airpower and air intelligence are “integrally intertwined” in ways that were not demanded of land (or naval) warfare, as Meilinger suggested, the battle for AAF independence was necessarily coincident with the growth and recognition of an independent air-intelligence enterprise.¹²⁵⁸ As such, the growth of airpower cannot be thoroughly comprehended without an understanding of the maturation of its air-intelligence component.

What are the implications for military strategy if organizational interests matter? The first question asked in this monograph was: *How do we*

¹²⁵⁶ Meilinger, *Ten Propositions Regarding Air Power*, 1995, 20, 78.

¹²⁵⁷ Ibid.

¹²⁵⁸ Ibid., 23.

fight and win efficiently? In a traditional sense, this is the wrong question for national security, and it greases a slippery slope for military strategy. Efficiency imperatives can lead to misguided military objectives or goals that do not fix their ultimate aim upon the political goals established by a national government that is in tune to the will of its people. In a Clausewitzian sense, the goals of the government, the people, and the military align in harmony.¹²⁵⁹ But militaries are organizations, and organizations follow inclinations to pursue efficiency, so they will tend to develop solutions that reflect the question above whether or not that question is asked of them.

Historian Richard Davis wrote that in of World War II, “the American military’s conduct of the war [was to] place military objectives before political goals.”¹²⁶⁰ Davis was not wrong, but his observation might be restated as: *The American military’s conduct of the war was to define its military objectives in view of organizational preferences rather than political goals.* This was especially apparent as related to the conduct of the air campaign. The AAF’s struggle for independence played out as a competition over finite national resources with the Army and the Navy. Prevailing arguments in this competition rested on comparisons of efficiency, which was defined in terms of quicker and cheaper victory rather than, perhaps, as better alignments toward desired political goals. In other words, military organizations, including those performing air intelligence, pursued efficiency over effectiveness.

¹²⁵⁹ Clausewitz, *On War*, 89.

¹²⁶⁰ Davis, *Bombing the European Axis Powers: A Historical Digest of the Combined Bomber Offensive, 1939-1945*, 143.

Although organizational struggles for independence formed the context for this monograph, organizational preferences for efficiency are not unique to this context. Are military organizations wrong for pursuing efficiency? No more so than a parasite can be faulted for killing its host while instinctively pursuing its own survival. Does this mean that traditional conceptions of military strategy, from Clausewitz's view that "effectiveness relates not to the means but to the end" to Yarger's similar contemporary view that "strategy must reflect a preference for effectiveness" are wrong?¹²⁶¹ Not necessarily; however, political goals must be considered from a standpoint that also considers the implications for military organizations. Political goals that force a military organization to perform roles or missions for which that organization is not designed incur risk. As a possible upside, the military organization may innovate by acquiring and incorporating outside expertise or by internally reorganizing, retraining, and re-equipping, as the AAF did (both) with its air-intelligence enterprise.

Alternatively, a military organization may smash itself with the rising tide of political will against the rocks of poorly or ill-defined political objectives in an effort to pursue a poor objective efficiently. Stephen Rosen's view toward long-term competitive strategies suggests an "approach that understands that organizations may be locked into routines that lead to error because they led to success in the past."¹²⁶² Such routines may be the ones for which a military is

¹²⁶¹ Yarger, *Strategy and the National Security Professional: Strategic Thinking and Strategy Formulation in the 21st Century*, 137; Clausewitz, *On War*, 97.

¹²⁶² Rosen, "Competitive Strategies: Theoretical Foundations, Limits, and Extensions," 15. Also,

best designed. An important aspect of a war-winning strategy may be to ensure that military organizations achieve victory in circumstances that consider their readiness for the next war as well.

When might a political objective yield to a military organizational preference? There can be no definitive answer to this question, except to say that the answer probably isn't never. For example, a political goal that destroys a military organization in order to pursue a short-term aim may increase risk to long-term strategic advantage. A modern Air Force, for example, that has grossly re-aligned internally in order to perform permissive Close Air Support (CAS) and Intelligence, Surveillance, and Reconnaissance (ISR) roles in counter-insurgency might do so at the peril of future military readiness by pursuing organizational efficiency at these missions at the expense of readiness for future high-end fights.

The question at the core of this thesis that begins by asking whether air intelligence is organizationally or technologically driven proves to be an interaction between both mechanisms. The air campaign unfolds through targeting decisions and assessments that are shaped by organizational preferences. Technology, primarily in (early) forms of imagery and signals intelligence, provides tools and data to analysts that are too ambiguous, too

Stephen Chiabotti argues that military organizations struggle to innovate because they are "comfortable with routine," and their "doctrine, standard operating procedures, as well as tactics, techniques, and procedures for fighting, all present impediments to innovation." Military organizations are more likely to improve upon existing practices than to seek entirely different approaches. See: Stephen D. Chiabotti, "Pensive Sword: Educating Officers in Austere Times," *Strategic Studies Quarterly* 8, no. 3 (Fall 2014): 30-31.

unreliable, too incomplete, or too controlled to synthesize into objective assessments by organizations bent on their own perspectives. In this case, Ira Eaker's Eighth Air Force's targeting practices reflected the pressures placed upon him by the AAF's symbolic grip on the B-17 and the air-intelligence organizations' fixation with idealized targets such as Schweinfurt. Targets driven by political goals (such as V-weapon sites or U-boat pens), inconsistent with the AAF's organizational aims, were shirked, ineffective, or attacked only as they appealed to other Eighth Air Force purposes (such as training and respite).

The AAF through 1943 pursued a *theoretical* Clausewitzian air campaign. In other words, it sought to bomb its own way to victory through its own organizational interests. When Marshall asked Arnold to assess the air campaign in July of 1943, Arnold permitted (if not guided) the AAF to evaluate itself through its own concept of victory. That Arnold's A-2 sought to control the assessments in a confluence of organizational biases should hardly have been surprising—there were no sources available for truly objective comparison. In reality, air campaigns are joint endeavors and political goals are messy. Air campaigns are often fought with imperfect information, conflicting guidance, muddled lines of authority, complicated alliances, short-sighted commanders, unpredictable opponents, harsh environmental conditions, and inevitable friction that “makes the apparently easy so difficult.”¹²⁶³ In short, an air campaign fought for purely organizational goals (airpower for airpower's

¹²⁶³ Clausewitz, *On War*, 121.

sake) is flawed from the start. However, a wise strategist might consider how such goals would influence the true political aims since organizational goals will inevitably creep into the targeting plans and assessments.

When unchecked, organizations (such as the AAF in this narrative) may adopt symbols and exaggerate claims to justify their own preferences. Organizations use such symbols to market their ideas in ways that mask their optimistic assumptions as their symbols serve as idealized examples of their organizational interests. In the case of the air campaign against Germany, both the B-17 and Schweinfurt served as powerful marketing tools for the AAF and air intelligence, but both organizations clung to their respective symbols in ways that stifled their objectivity and creativity.

Further, mission- and campaign-level assessments are important human aspects of an air campaign, even though there is bias inherent in their production (by analysts and crews) and in their use (by commanders). These assessments feed targeting decisions that are also riddled with organizational biases. We cannot remove the biases from the organizations or the humans who comprise them any more than we can remove the interaction from strategy. These are parts of the whole. We can, however, be conscious that bias is part of organizational behavior and of human judgment, and we can be prepared to guard against it. As long as wars are fought by militaries and militaries are organizations, then organizational behavior matters to endeavors of military strategy.

Finally, there are many ways to analyze and assess air campaigns. In *Fast*

Tanks and Heavy Bombers, David Johnson concludes:

*The combination of fighter escorts and an almost endless supply of bombers and crews allowed the Army Air Forces to continue what had become a bloody battle of attrition for command of the air war over Europe. Because of this overwhelming quantitative superiority, losses returned to an acceptable range. As Eaker had predicted, the side that could make good its losses won.*¹²⁶⁴

David Johnson isn't wrong. In some cases, however, air campaigns might be understood and prosecuted better as trials of organizational learning rather than as competitions between military-industrial complexes. Organizational learning may help reduce the costs of war, especially campaigns of attrition.

War is expensive.



¹²⁶⁴ David E. Johnson, *Fast Tanks and Heavy Bombers: Innovation in the U.S. Army, 1917-1945* (Ithaca, N.Y.: Cornell University Press, 1998), 211.

Epilogue

From Big Week to the ball-bearing wind-down. By the German surrender on V-E Day, 8 May 1945, Allied air forces dropped a combined total of almost 2.7 million tons of bombs on Germany, of which 83 percent fell after 1 January 1944.¹²⁶⁵ Along with Eisenhower's return to Europe as Supreme Commander of Allied Forces and the re-alignment of strategic bombers under his command, the focus of the air campaign shifted—at least in its stated purpose—to support his invasion forces for Overlord.¹²⁶⁶ The battle for air superiority turned decisively after Jimmy Doolittle famously turned William Kepner's VIII Fighter command loose, following Arnold's order to "...Destroy the Enemy Air Force wherever you find them, in the air, on the ground, and in the factories."¹²⁶⁷ The weather finally cleared for Big Week between 20-26 February 1944, and Eighth Air Force culminated Operation Argument, nearly exhausting its planned targets of German aircraft production.¹²⁶⁸

Spaatz inherited Arnold's criticisms of Eighth Air Force. He felt the need to show he was adhering to Arnold's target preferences as best he could, in addition to improving both the tempo and the results of the air campaign. Nevertheless, he was still vexed by factors beyond his control—namely, weather

¹²⁶⁵ United States Strategic Bombing Survey, *Over-all Report (European War)*, vol. 2 (Washington: US GPO, 30 September 1945), 1-10.

¹²⁶⁶ At least until control of USSTAF reverted from Eisenhower's SHAEF to the Combined Chiefs of Staff on 14 September 1944. See: Craven and Cate, *Argument to V-E Day*, 321.

¹²⁶⁷ Letter, Arnold to Eaker and Twining; Cited in: *ibid.*, 8.

¹²⁶⁸ A-2 United States Air Forces in Europe, *History of Directorate of Intelligence USSTAF, January 1944 - May 1945*, (Maxwell AFB, AL: AFHRA, 8 September 1945), #519.600, IRIS 216944, 14; Yenne, *Big Week: Six Days that Changed the Course of World War II*, 136-146.

and targeting diversions.¹²⁶⁹ For example, he reported back to Arnold on 5 February 1944 that in January, “only 51 percent of the efforts of Eighth Air Force, 4 percent of the efforts of the Fifteenth Air Force, and 91 percent of the efforts of the RAF Bomber Command were directed against Pointblank targets.”¹²⁷⁰ Spaatz knew this was a problem because Pointblank was still synonymous with independent strategic bombing, and almost all of the diverted American bomb-tonnage in January had gone to Crossbow.¹²⁷¹ As Spaatz saw it, keeping Londoners safe and protecting the build-up of land forces in England were noble purposes, but Crossbow targets would not force Germany to capitulate.

Exactly as Arnold’s Intelligence staff had recommended the previous November, Spaatz returned to Schweinfurt in February. The first effort against Schweinfurt by Doolittle’s Eighth Air Force boasted great promise. Enjoying “unlimited visibility,” a massive force of 13 combat wings launched on 24 February, from which 235 bombers aimed for the “undamaged and repaired buildings” among the ball-bearing factories; 20 fighter groups escorted the operation, including two groups of P-51s and two more of P-38s that stayed with the bombers all the way through the target area.¹²⁷² The crews’ target folders may have been stale, however, because British photoreconnaissance

¹²⁶⁹ Arnold, *American Airpower Comes of Age*, vol. 2, 132-140.

¹²⁷⁰ Carl A. Spaatz, *Letter, Spaatz to Arnold*, (Maxwell AFB, AL: AFHRA, 5 February 1944), #145.81-140, IRIS 118084.

¹²⁷¹ Ibid., enclosure: Summary of Eighth Air Force Heavy Bomber Operations, 1 January 1944 to 1931 January 1944.

¹²⁷² Brigadier General F. L. Anderson, *Report of Operations, 24 February 1944*, Headquarters Eighth Air Force, (Maxwell AFB, AL: AFHRA, 5 March 1944), #520.332, IRIS 222161, 1-2.

and interpretation units had been so consumed with Crossbow that the CIU had not issued any updates on Schweinfurt since October—not even a typical repair and reconstruction report.¹²⁷³ Eighth Air Force, then comprised of the former VIII Bomber Command staff, initially emphasized the positive: “it is believed that all formations bombed near the assigned M.P.I. [mean point of impact].”¹²⁷⁴

This claim did not match the full story even before the interpreters reviewed the post-strike images. The 351st Group, for example, fessed up via their S-2 that they’d shifted their aiming point to the Deutsche Star factory, located on the far southwest corner of the target area, because smoke from previous groups blocked their assigned target; their S-2 backed them up, however, arguing that a preliminary review showed “generally good” results including “hits on the Deutsche Star buildings.”¹²⁷⁵ The 379th Group S-2 had nothing but positive remarks in his narrative, as he claimed “both the lead and low group dropped their bombs directly on the briefed target. The strike photos show the result to be very good.”¹²⁷⁶ Lead bombardiers from two other groups reported favorable results as well, including “good bomb strikes at the aiming point.”¹²⁷⁷ One might have expected the follow-up BDA to have shown

¹²⁷³ Central Interpretation Unit, *Immediate Interpretation Report No. K.1894*, in *Eighth Air Force Mission No. 232*, RAF Medmenham, (Maxwell AFB, AL: AFHRA, 25 February 1944), #520.332, IRIS 222161. Williams, *Operation Crossbow*, 183-190.

¹²⁷⁴ Headquarters Eighth Air Force, *Eighth Air Force Narrative of Operations, 233rd Operation*, (Maxwell AFB, AL: AFHRA, 24 February 1944), #520.332, IRIS 222161, 2.

¹²⁷⁵ A-2 1st Bombardment Division and A-2 94th Combat Wing, *Teletype Report*, (Maxwell AFB, AL: AFHRA, 24 February 1944), #520.332, IRIS 227683.

¹²⁷⁶ S-2 379th Bombardment Group, *S-2 Mission Narrative Report, Target - Schweinfurt*, N. H. Norgren, (Maxwell AFB, AL: AFHRA, 24 February 1944), #520.332, IRIS 227683.

¹²⁷⁷ Group Bombardier 92nd Bombardment Group, *Bombing Analysis and Results*, (Maxwell

considerable damage from the 4,850 bombs aimed on Schweinfurt. It didn't.

Reviewing the strike photographs, the CIU concluded that "three of the four main factories of the Schweinfurt ball-bearing industry were hit," but all the photos showed was that two factories had received a little more than a dozen impacts, the Deutsche Star showed a single hit, and the fourth factory went unscathed.¹²⁷⁸ The CIU interpreters also noted from the strike photographs that "external repairs to the more important buildings damaged previously were virtually complete."¹²⁷⁹ This raid had found the ball-bearing industry recharged. This time, however, Harris' Bomber Command followed up with a night attack on the same location. The CIU reviewed another reconnaissance pass and the damage looked good. It turned out there were actually five plants, and four of them "had been affected... all fairly severely."¹²⁸⁰

If the BDA seemed contradictory at first, it only became more so as time went on. Six weeks later, the Air Staff intelligence chief, then Brigadier General Thomas White, produced Arnold's mandated semiannual report. The report noted that new raids over the first quarter had left the Axis with just 65 percent of its ball-bearing output based upon pre-August 1943 numbers, but the report struggled to reconcile the apparent bombing success with an

AFB, AL: AFHRA, 24 February 1944), #520.332, IRIS 227683; Group Bombardier 305th Bombardment Group, *Bombing approach and dropping procedure for the mission of 24 February 1944*, J.A. Mikkelsen, (Maxwell AFB, AL: AFHRA, 24 February 1944), #520.332, IRIS 227683.

¹²⁷⁸ Central Interpretation Unit, *Interpretation Report No. SA. 1047*, in *Eighth Air Force Mission No. 232*, RAF Medmenham, (Maxwell AFB, AL: AFHRA, 25 February 1944), #520.332, IRIS 222161, 1.

¹²⁷⁹ Ibid., 3.

¹²⁸⁰ Central Interpretation Unit, *Immediate Interpretation Report No. K.1904*, in *Eighth Air Force Mission No. 232*, RAF Medmenham, (Maxwell AFB, AL: AFHRA, 6 March 1944), #520.332, IRIS 222161.

observation that the 17 total USAAF attacks (along with incidental RAF damage) on ball-bearing factories had not yet resulted in any actual reduction in German materiel “as a direct result of bearing shortages.”¹²⁸¹ As an accompanying rationale, the report could only offer that there seemed to be a commensurate “reduction in requirements resulting from bomb damage to aircraft and other industries.”¹²⁸² Rather than concede that the selection of the bottleneck-target had probably not turned out as insightful as the COA had asserted, the intelligence report insisted “continuation of attacks will seriously reduce German war production in 1944.”¹²⁸³ 17 attacks had not yet made a difference, but there was no discussion on any steps the Germans may have taken to mitigate the impact of bombing, or even if such information had been available.

Meanwhile, Spaatz did his best to navigate the space between Eisenhower’s demands and pressure from Arnold to stay the course on COA’s recommended targets, which still promised value for strategic bombing beyond immediate support to the invasion. In March, the Air Staff caught wind that Spaatz (along with the EOU and MEW economists) sensed ball-bearing attacks had become purposeless if Sweden had surreptitiously increased shipments to Germany.¹²⁸⁴

¹²⁸¹ Assistant Chief of Air Staff (A-2), *An Appraisal of Accomplishments and Potentialities*, in *The Strategic Aerial Bombardment of Europe*, USAAF, 1, (Maxwell AFB, AL: AFHRA, 20 April 1944), #142.042-11v5, IRIS 115259.

¹²⁸² Ibid.

¹²⁸³ Ibid.

¹²⁸⁴ Joe L. Loutzenheiser, *Memorandum, AC/AS Plans to AC/AS Intelligence*, (Maxwell AFB, AL: AFHRA, 4 March 1944), #145.81-144v2, IRIS 118088; John G. Winant, *Telegram: American Embassy, London to Secretary of State, Washington*, (Maxwell AFB, AL: AFHRA, 26 February 1944), #145.81-144v2, IRIS 118088.

Arnold would not relent. He even sent COA's Guido Perera and Elihu Root Jr. to England to meet with Spaatz "about a matter of target selection," with a heavy-handed order for Spaatz to give both of them access to "all data and personnel involved in the selection of Combined Bomber Objectives."¹²⁸⁵ Arnold had been convinced by the COA that victory still had a shortcut, and he had no intention of letting Spaatz off the hook.

Two more reports by Arnold's intelligence chief over the next six months revealed statistics of an entirely different bombing effort. So much had the focused shifted, in fact, that by 15 September 1944 the preponderance of all bombs dropped since July of 1943 "were primarily in support of ground operations."¹²⁸⁶ According to a September update, the German Air Force could "no longer offer effective resistance," oil output had declined "more than 60 percent," which was "well below the enemy's minimum requirements for mobile warfare," and "lines of interdiction"—especially bridge attacks—seemed to punctuate the transportation campaign by closing off resupply from the East.¹²⁸⁷ If the purpose of strategic bombing was to aid the ground invasion, then the bombing seemed to be going well.

In fact, the assessment captured results of oil and transportation bombing in terms of tactical impact on the battlefield, without any regard to the German

¹²⁸⁵ H. H. Arnold, *Letter, Arnold to Spaatz*, War Department, Tab 81, (Maxwell AFB, AL: AFHRA, 14 July 1944), #118.01v2, IRIS 110403.

¹²⁸⁶ Assistant Chief of Air Staff (A-2), *Results of Combined Bomber Offensive from 1 July 1943 to September 1944*, (Maxwell AFB, AL: AFHRA, 19 September 1944), #145.81-140, IRIS 118084, 1.

¹²⁸⁷ *Ibid.*, 2-3.

industry. As to COA's favorite, the ball-bearings, intelligence sources still did not indicate any conclusive effects on the German industry despite the continued high priority. Spaatz's bombers had apparently done their part by reducing ball-bearing production by 50 percent between February and September, but it seemed the Germans had re-prioritized "civil-industrial requirements" to mitigate the impact. Nevertheless, the report insisted that the "qualitative effect" on military equipment had been "greater than the figures... would indicate."¹²⁸⁸ The report stopped short of any clear recommendations on the way forward, but it made no mention of a change in course.

In late July 1944, EOU also committed its targeting recommendations to paper in a scheme it intended to persist throughout the remainder of the war. Ball bearings still topped the list, second only to oil production. Oil continued to be, as the economists saw it, "the most economical and effective contribution the Air Force could make to ending the war."¹²⁸⁹ Ball bearings, on the other hand, remained "difficult to trace in the intelligence," but "in view of the limited number of targets which remain, and the vulnerability of the present German position, this attack shoul[d] be pressed hom[e]."¹²⁹⁰ The message was apparently that they were already running out of unstruck ball-bearing targets by June of 1944. Despite the lack of provable results, they figured that they might as well keep at it anyway.

The final iteration of air-campaign assessment by Arnold's A-2, dated 1

¹²⁸⁸ Ibid.

¹²⁸⁹ Rostow, *Rostow Report*, ca. 30 April 1945, 122.

¹²⁹⁰ Ibid., 123.

December 1944, attempted to wrestle with the emerging reality that the war was almost over, and it did so with a notably defensive posture. For most of Pointblank's original primary target systems, the report suggested that German ingenuity was as much to blame as diversions in the bombing effort by the responsible Allied authorities.¹²⁹¹ Despite heavy bombing efforts, German aircraft production had actually *increased* in the latter half of 1944, but this was due to dispersion and an "expansion" program that German Reich Minister Albert Speer had pulled successfully from other resources.¹²⁹² Astonishingly, combat losses of German aircraft were double the losses from bombing production factories. The battle for air superiority, it seemed, had been won in the air with the Luftwaffe defending its gasoline supplies, not as much through the direct results of the bombing effort. Added to this, oil targeting had stalled out just about everything that relied upon petroleum, but the report stopped short of calling the oil attacks decisive as the Germans had yet to quit.¹²⁹³

The 26 Allied attacks on ball-bearing factories by this point had not turned out as expected.¹²⁹⁴ The report strained to find even more reasons why expected results hadn't panned out, including that the Germans had managed to mitigate bombing through "reduction in requirements," "redesign of equipment," "intensified salvage," "dispersal of plants," and "strenuous efforts

¹²⁹¹ Assistant Chief of Air Staff (A-2), *Strategic Bombing of Axis Europe, January 1943 - September 1944; Bomb Damage to Axis Target Systems*, Major General James P. Hodges, (Maxwell AFB, AL: AFHRA, 1 December 1944), #142.042-8, IRIS 115252, 1.

¹²⁹² *Ibid.*, 15.

¹²⁹³ *Ibid.*, 2-3, 16-17.

¹²⁹⁴ *Ibid.*, 19.

to restore output.”¹²⁹⁵ It was as if the COA failed to understand that the air campaign was supposed to be an interaction, and their inputs remained static while the enemy had continuously responded.

The report went on to justify ball bearings as a target choice as if a long-since stale rationale should have been sufficient: the characteristic of “cutting across German industry”; that “production was concentrated in a relatively small number of plants”; and the industry’s “highly specialized machinery” that was vulnerable and difficult to replace.¹²⁹⁶ In the end, Arnold’s Intelligence chief hoped that any reader, not only from the air service, but also “other interested agencies,” would accept his argument that ball bearings had made for an ideal target, and that bombing caused shortages “*believed* to have resulted in reduced assemblies of tanks, trucks, and other equipment,” and “undoubtedly contributed *somewhat* to the decline of German industrial output”(emphasis added), despite the fact that the industry received only 1.2 percent of the total bombing effort by weight.¹²⁹⁷

After reading this report, Arnold grew increasingly suspicious that bomb-damage assessments—perhaps the whole system in place for assessing the air campaign—had been flawed (see this chapter’s epigraph). The air campaign had not met his expectations, but he was not ready to accept that the assumptions behind his bombing doctrine or the concepts behind the targeting plans had been the bigger problems. In January 1945, Arnold wrote a letter to

¹²⁹⁵ Ibid., 2, 21.

¹²⁹⁶ Ibid., 20.

¹²⁹⁷ Ibid., 19, 21.

Major General Clayton Bissell (then the War Department G-2) complaining that the bombers had exacted “great damage” as planned, “nevertheless, the German Army and the German Air Force continue under these circumstances to fight with an effectiveness that would have been considered impossible a few years ago.”¹²⁹⁸ The enemy seemed to find ways to negate the effects of bombing, and his analysts didn’t seem to know it.

The Oil- versus Transportation-Plan Debate. The final year and a half of the war also brought new target-selection controversies. Among the more famous conflicts within the Combined Bomber Offensive, Spaatz and the “oily boys” fought against Air Chief Marshal Arthur Tedder (as Eisenhower’s Deputy) along with those who favored attacks against the German transportation system.¹²⁹⁹ As Tedder saw it:

Our forces and all their stores and equipment had to come by sea and be landed across beaches, whereas the enemy had one of the best rail and road systems in Europe at his disposal. It was considered that, since the enemy would almost certainly be holding ample stocks of oil in France to meet the immediate emergency, attack on the oil industry was not likely to give the immediate assistance which the assault required. It was therefore decided [by Eisenhower] that the primary target system for the Allied strategic bomber forces should be the transportation system upon which the movements of the enemy reinforcements

¹²⁹⁸ The same air service officer who’d drafted the report condemning Eaker had moved up to become the War Department G-2. An airman conquered the Army’s intelligence bureaucracy. See: Herman S. Wolk, *The Struggle for Air Force Independence, 1943-1947* (Bolling AFB, DC: Air Force History Support Office, 1997), 323. Arnold, *Memorandum for Maj Gen Clayton Bissell, Assistant Chief of Staff (G-2), Subject: Bombing Targets*, 8 January 1945.

¹²⁹⁹ Of note, Harris ridiculed those who sought to bomb ball-bearings as “Schweinfurt fans.” See: Biddle, *Rhetoric and Reality*, 199, 365 n. This narrative, especially leadership and EOU perspective, is exhausted in other works. For example, see: Eduard Maximilian Mark, *Aerial Interdiction: Air Power and the Land Battle in Three American Wars* (Washington, DC: Center for Air Force History, 1994), 221-236.

would depend.¹³⁰⁰

Both the man who made the decision and the interests behind the argument were a bit more complicated than they appear in Tedder's version. Eisenhower's extensive experience with air-ground cooperation, his trust in air interdiction as fundamental to maneuver warfare, and his absolute insistence that he command all of it throughout the preparation phase for D-Day reflected his formative experiences. Notable among these experiences were: writing a text in 1927 for General Pershing about tank and aircraft integration in the last year of WWI; leading a maneuver wargame in 1941 "with fully 60 percent of the air-to-ground sorties devoted to interdiction, 22 percent to strikes on armor, and 18 percent given over to close air support"; and witnessing a flurry of heavy bombers chew up the panzer assault at Salerno in order to bail out the Army's battered 36th Division.¹³⁰¹ An after-action report of the Italy campaign, released under Eisenhower's authority as Supreme Allied Commander in Chief of the Mediterranean theater, recorded that "the main function of all classes of bomber aircraft in a land campaign is to interfere with the movement of enemy forces and their supplies."¹³⁰² If the *oily boys* were going to convince Eisenhower to let the bomber commanders pursue their own targets, then target analysts were going to have to arm Spaatz with a watertight argument.

¹³⁰⁰ Arthur William Tedder, *Air Power in War* (Tuscaloosa, AL: University of Alabama Press, 2010), 108.

¹³⁰¹ Rebecca Grant, "Eisenhower, Master of Airpower," *Air Force Magazine* 83, no. 1 (2000): 64-65.

¹³⁰² Allied Force Headquarters, *The Employment of Bombers and Fighter-Bombers in Co-operation with the Army*, in *Operational Memorandum Number 54*, , S.A.C. in C. Med., (Maxwell AFB, AL: AFHRA, April 1944), #168.7026-9, IRIS 126467, 1.

The Transportation Plan, promoted chiefly along British lines with backing from MEW's Oliver Lawrence, benefitted from its optimistic assumptions. Tedder argued that attacks on the rail system, including the marshalling yards, could choke down the rail lines available for moving the Wehrmacht, disrupt their repair capacity, streamline targeting after D-day, and force them onto slower roadways.¹³⁰³ Since Tedder relied on Eisenhower's predisposition instead of actually presenting any cold facts or analytical rigor, his plan proved difficult for the oil supporters to refute.

The Oil Plan did not benefit from such an argument. While the air-intelligence organizations undoubtedly "gave first loyalty to their political and operational masters," as Robert Ehlers has argued, there is also considerable evidence that they continued to push toward their pre-existing preferences.¹³⁰⁴ For example, the COA never deviated from the position it had established by January of 1943. COA's industrialists argued "that transport as a primary objective of air attack does not offer promise," which was especially pertinent to marshalling yards, although they felt attacks on waterways and locomotive engines could offer "major possibilities... immediately preceding and concurrent with invasion."¹³⁰⁵ The industrialists did not see the expansive German transportation system as a bottleneck.

¹³⁰³ W. W. Rostow, *Pre-Invasion Bombing Strategy: General Eisenhower's Decision of March 25, 1944*, 1st ed., Ideas and action series (Austin, TX: University of Texas Press, 1981), 89-90.

¹³⁰⁴ Ehlers, "BDA: Anglo-American Air Intelligence, Bomb Damage Assessment, and the Bombing Campaigns Against Germany, 1914-1945," 340.

¹³⁰⁵ Watkins, *Feasibility of Air Attack on European Axis Transport*, 21 January 1943, summary page.

Similarly, the EOU economists never backed from their insistence after the Ploesti raid that continued emphasis on oil targets would “pay higher dividends.”¹³⁰⁶ The EOU’s official history includes an unabashed comment that the “EOU was forced to fight a political as well as an intellectual battle” in order to assert their target preferences.¹³⁰⁷ EOU’s Walt Rostow added, “it was the EOU view that no key existed; that, since heavy bombers could not be used, with existing techniques, in close army support, they should continue to do thoroughly the oil and military supply targets capable of affecting the battle over short periods,” and that even using heavy bombers as transport aircraft would be better than using heavy bombers to bomb transportation targets.¹³⁰⁸ The economists had done the math. As they saw it, transportation targets were not an efficient key to victory.

EOU Economist Carl Kaysen clarified his organizations’ position in a post-war interview. “What we said was that this marshalling yard business was crap. In the first place, marshaling yards were easy to repair, and, in the second place, 70 or 80 percent... of railroad capacity was used to supply the civilian economy, and only 20 percent or so was used directly for troop movements and supplying the battle front.”¹³⁰⁹ In other words, most of the effect on the rail system wasn’t going to impact the German Army. The EOU’s

¹³⁰⁶ Office of Strategic Services, *Bomb Damage Report*, War Department, (Maxwell AFB, AL: AFHRA, 19 August 1943), #187.2-16, IRIS 135271, 12.

¹³⁰⁷ Rostow, *Rostow Report*, ca. 30 April 1945, 97.

¹³⁰⁸ W. W. Rostow, *The Beginnings of Air Targeting*, Central Intelligence Agency, (College Park, MD: National Archives, 1963), NAI 7282754, 24.

¹³⁰⁹ Trachtenberg, Rosenberg, and Van Evera, "An Interview with Carl Kaysen". 4.

party line had already abandoned economic attacks *qua* economic attacks.

However, the EOU had support from General Charles P. Cabell, then-chief planner for Spaatz, to support an alternate bridge-attack plan to appease the transportation hounds, but in Kaysen's words, "we were trying to get Spaatz himself to sponsor it."¹³¹⁰

If the transportation system had a bottleneck analogy at all, it was bridges not marshalling yards, and bridges were better attacked by low altitude runs by medium bombers.¹³¹¹ The argument turned out to be largely academic for the target-planning organizations because bomber capacity had more than doubled to 4,000 between November 1943 and D-day. There were plenty of bombers and bombs to attack both systems.¹³¹² By V-E day, aviation gasoline had been "virtually eliminated" and disruptions to rail traffic "completely disorganized" German war production along with "serious delays" for Army traffic.¹³¹³ In the final analysis, the USSTAF accomplished these with 13.1 percent and 26.7 percent, respectively, of its more than million tons of bombs dropped.¹³¹⁴ However, Tedder's version of the Transportation plan, which had focused primarily on marshalling yards, turned out equivocal. A report produced by SHAEF G-2 two weeks prior to D-Day concluded "that rail center attacks have failed to so reduce the railway operating facilities as to impair the enemy's ability to move up reinforcements and maintain his forces in the

¹³¹⁰ Ibid., 5.

¹³¹¹ Hansell, *The Strategic Air War Against Germany and Japan: A Memoir*, 107.

¹³¹² Hansell, *The Air Plan that Defeated Hitler*, 240.

¹³¹³ Ibid., 228, 245.

¹³¹⁴ Ibid., 280.

West.”¹³¹⁵ If the ground commander’s intent is the sole evaluation of air support to a ground campaign, then Tedder’s plan failed.

Blind bombing. Despite continuous efforts by unit-level intelligence officers and bomber crews to improve their effectiveness as the war progressed, the question of whether blind bombing was effective at all became increasingly controversial to other organizations. The EOU economists, for example, saw greater value in keeping the bombers engaged on visual targets in the months preceding D-day, even if that meant attacking tactical targets with heavy bombers. There would be a higher chance of hitting something of direct military value.¹³¹⁶ Blind bombing, which was less likely to result in economic impact, was best used a last resort and only against large industrial areas: “When precision bombing is impossible in either Germany or in the tactical area, the blind bombing of large cities containing important military targets is the best use of the bomber force.”¹³¹⁷ The EOU economists did not like area bombing or the prospects of attacking German morale, but they agreed that it was better to accept the consequence of feeding “German propaganda” (with civilian casualties) than not to bomb German industry at all.¹³¹⁸

Operations researchers later reviewed American blind-bombing performance only to discover horrifying results which led to even more extreme

¹³¹⁵ G-2 (Intelligence) Division Supreme Headquarters Allied Expeditionary Force, *Evaluation of Rail Centre Attacks*, Charles P. Cabell, Personal Papers, Tab 30, (Maxwell AFB, AL: AFHRA, 20 May 1944), #168.7026-6, IRIS 126464, 1.

¹³¹⁶ To the EOU economists, who preferred attacks on oil rather than transportation, “large oil storage depots” were a valid tactical target. See: Rostow, *Rostow Report*, ca. 30 April 1945, 124.

¹³¹⁷ Ibid.

¹³¹⁸ Ibid.

conclusions. Even after the Americans had fielded their more advanced H2X system in February of 1944, the researchers found that the average circular error was more than a mile from the aiming point, and 42 percent of bombing-pattern centers were more than five miles from the target when the bombers dropped through a complete undercast.¹³¹⁹ The ORS mathematicians concluded that weather and enemy smoke screens might necessitate shifting target priorities altogether and “increasing our total effort under partial cloud and visual conditions at the expense of our 10/10 [total undercast] effort.”¹³²⁰ In other words, a low-priority target bombed visually was better than a bombing a high-priority target blind.

Blind bombing was not precision bombing and it wasn't worth the effort. This was a problem to those who clung to the AAF's daylight-precision doctrine as well to those who developed the blind-bombing system. An ORS mathematician argued that blind-bombing assessments were blocked by the operational chain of command: “it seemed that they were afraid to have the facts published, although every commander in the Air Force knew what was happening on blind missions.”¹³²¹ The truth about blind bombing was a liability to the AAF interests—there was no such thing as a fair-weather war. General Arnold, ever in tune with external perceptions, expressed concern

¹³¹⁹ Operational Analysis Section, *Report on Bombing Accuracy, Eighth Air Force, 1 September 1944 to 31 December 1944*, 20 April 1945, 21.

¹³²⁰ *Ibid.*, 4.

¹³²¹ G. Bailey Price, “Gremlin Hunting in Eighth Air Force,” in *Operations Analysis in the Eighth Air Force, 1942-1945: Four Contemporary Accounts*, ed. Hugh J. Miser (Linthicum, MD: INFORMS, 1997), 252.

about even using the *term* “blind bombing,” which he felt “appears to give both the military and the public an erroneous impression.”¹³²² Neither the term nor the performance of blind bombing could help the AAF, even if the term was proving true.¹³²³

In fact, the American operations researchers were not alone in their assessments. Their British counterparts published a study revealing similarly atrocious conclusions, noting that “in H2S raids the average density [within] half-a-mile of the aiming point is 0.0008 percent per acre of bombs dropped and within 1½ miles 0.0006 percent.”¹³²⁴ Regardless of who measured it, what was measured, or how it was reported, blind bombing never achieved a degree of accuracy even close to that of visual bombing.¹³²⁵ However, if the strategic intent was merely to justify a continued effort to launch bombers and to drop bombs through poor weather, then blind bombing worked superbly.

¹³²² H. H. Arnold, *Letter, Arnold to Spaatz*, Manuscript Division, Spaatz Papers, Box 324, (Washington, DC: Library of Congress, 5 January 1944).

¹³²³ One ORS mathematician captured a dynamic of all-around blame for blind bombing in a post-war account: “The technical people were disappointed, discouraged, and not a little defiant. Some denied that the results were as bad as the report indicated; and others insisted that the Radiation Laboratory had built good equipment, but that the Air Force was making a hopeless mess of using it. The Bombing-accuracy subsection itself was fearful that the Air Force was embarking on a program of inaccurate bombing that otherwise would have gone to visual bombing. Such doubts and criticism were suppressed for fear that we might hinder the development of instruments and techniques that eventually would be of the highest importance.” See: Price, “Gremlin Hunting,” 205.

¹³²⁴ PRO AIR 14/734, Appendix C to Memorandum by AOCinC Bomber Command, 14 February 1944; cited in: Wakelam, *Science of Bombing*, 187.

¹³²⁵ Using a snapshot from the following year, 1 September to 31 December 1944, Eighth Bomber Command reportedly dropped 81,654 tons of bombs using H2X, of which only 674 (0.82%) fell inside of 1,000 feet of the target; of 33,821 bombs dropped visually, 7,544 (>22%) fell inside of 1,000 feet of the target. Bombers dropped more than twice as many bombs by H2X than visually, not counting another 25,332 dropped by other unreliable blind-bombing techniques (Gee-H and Micro-H). See: Statistical Control Division, *AAF Bombing Accuracy*, 31 March 1945, 14.

Unfortunately, the AAF had defined the value of strategic bombing in terms of its efficiency in securing victory, and the data proved that blind bombing was disappointingly inefficient.

Survey teams. By the Spring of 1944, both Arnold and Spaatz recognized that any window of opportunity to control the post-war narrative may be exceptionally narrow, and they needed to get ahead of other organizations and interests—especially those of the British.¹³²⁶ In a series of letters written in April 1944, Spaatz suggested to Arnold that they should send a committee on the ground as soon as hostilities end “to survey and report on the results,” but that it would be important for their committee to “be the first, and if possible, the only one in the field.”¹³²⁷ Ostensibly, the survey would “furnish valuable data for application in the war against Japan,” but both generals knew this survey was about selling their success; the whole project should be endorsed by the president, Spaatz argued, and whomever they tapped to lead it should be “a man with a reputation for unquestioned impartiality.”¹³²⁸

¹³²⁶ By Charles Cabell’s account, the USSBS owes its inception to Muir Fairchild, who anticipated potential for post-war criticism and wanted a survey team “ready to move in as soon as any significant areas were liberated so that on-the-spot damage studies might be made while the ashes were still warm.” See: Cabell and Cabell Jr, *Memoirs of War, Peace, and the CIA*, 80.

¹³²⁷ Carl A. Spaatz, *Letter, Spaatz to Arnold*, (Maxwell AFB, AL: AFHRA, 20 April 1944), #145.81-140, IRIS 118084.

¹³²⁸ The story behind the formation and purpose of the USSBS is well recounted with emphasis on national, inter-service, and internal air-staff rivalry. For example, see: David MacIsaac, *Strategic Bombing in World War Two: The Story of the United States Strategic Bombing Survey* (New York: Garland Pub. Co., 1976), 1-100. Also: Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force*, 142-145; Arnold, *American Airpower Comes of Age*, vol. 2, 141-144; Craven and Cate, *Argument to V-E Day*, 789-792; Meilinger, *Bomber: The Formation and Early Years of Strategic Air Command*, 51-58; Carl A. Spaatz, *Letter, Spaatz to Arnold*, (Maxwell AFB, AL: AFHRA, 5 April 1944), #145.81-140, IRIS 118084. Spaatz, *Letter, Spaatz to Arnold*, 20 April 1944.

Spaatz seemed open-minded, not only to civilian leadership for the survey, but also to significant participation by outside consultants, including “civilian experts in the various fields of German military, economic, and political life.”¹³²⁹ His perspective opened the door for battles by intelligence organizations to expand the survey’s scope and their own involvement. For example, Arnold’s intelligence chief conceded that officers from the Air Staff, USSTAF, and both the Eighth and Fifteenth Air Forces should participate directly on the survey team, in addition to representatives from other organizations: the EOU members “who have been analyzing the economy of Axis Europe, selecting targets for strategic bombardment, and appraising results of serial attacks”; “civilian economic analysts who have been engaged in similar work”; “Officers who have been working in the Technical and Tactical, photographic and historical branches of Air Intelligence”; and “military and civilian personnel now working in the field of bomb damage analysis with the Princes Risborough Group in the U.K. [RE-8].”¹³³⁰ Put otherwise, just about every office that had played any role in targeting or bomb-damage assessment would play a role in evaluating its own performance.

The problem with mass participation was that air intelligence had not developed sufficiently to include internal quality-assurance functions. In some cases, experts supporting the United States Strategic Bombing Survey (notably COA’s Guido Perera, who’d played a central role in the selection of ball

¹³²⁹ Spaatz, *Letter, Spaatz to Arnold*, 5 April 1944.

¹³³⁰ Thomas D. White, *Memorandum, AC/AS Intelligence to AC/AS Plans*, (Maxwell AFB, AL: AFHRA, 7 May 1944), #145.81-140, IRIS 118084.

bearings), would be the same experts who had performed the original targeting work.¹³³¹ Perhaps Brigadier General Charles Cabell, then Spaatz's own Director of Plans (later Eaker's Director of Intelligence at MAAF), said it best in a letter to Laurence Kuter:

The maneuvering going on with respect to our Bombing Survey prompts me to generalize a bit on civilian or scientific assistance...

In the first place, I firmly believe in utilizing all ideas, advice, etc. but when such advisors reach a position where they can force their advice on us, then we are in trouble. We, the professional responsible officers of the Army Air Forces, must retain our independence of decision...

The 'Operations Analysts' or 'operational research sections' likewise can and do perform a valuable service to their respective commanders. Any attempt to organize them though, on and Air Force-wide scale, should be resisted (emphasis in original).¹³³²

Incidentally, Franklin D'Olier, the Prudential Insurance President eventually appointed as Chairman, had selected Charles Cabell to participate on the USSBS. Without a doubt, Cabell could have provided unique and detailed insights from his early experiences observing British photo-intelligence and interpretation through his role as Director of Intelligence for a numbered air force, but he recused himself, because "my presence would tend to negate one of the fundamental reasons for the creation of the survey: objectivity."¹³³³

Based upon the circumstances of its membership, the survey was no less likely to be biased or inconsistent than the assessments throughout the war.

¹³³¹ Perera, *Memoirs: Washington and War Years*, 1973, 158.

¹³³² Charles P. Cabell, *Letter, Cabell to Kuter*, (Maxwell AFB, AL: AFHRA, 16 June 1944), #145.81-140, IRIS 118084.

¹³³³ Cabell and Cabell Jr, *Memoirs of War, Peace, and the CIA*, 81.

The comments on ball bearings are illustrative. The condensed summary provides an assessment that suggests ball-bearing attacks were not worthwhile: “From examination of the records and personalities and the testimony of war production officials, there is no evidence that the attacks on the ball-bearing industry had any measurable effect on essential war production.”¹³³⁴ The condensed version of the summary report, published separately, indicates a different message, in fact implying that heavier attack may have been warranted: the ball-bearing industry “...lost that continuity of attack which is necessary to destroy—and keep destroyed—any industry.”¹³³⁵ It seemed the survey included language that could justify opposing conclusions. Franklin D’Olier’s character may have been immune from attack, but the words in his reports were not. D’Olier would find himself defending his survey to the Secretary of Defense long after the war and clarifying “distortions of the Survey’s findings—whether innocently or willfully made,” because they “will have an influence detrimental to national security.”¹³³⁶ No organization could be above reproach or its analysis without bias no matter how strong its leader. Because organizations matter to military strategy and national security, strong leaders must be on guard for bias.

AAFAIS—an end and a beginning. In fall of 1943, after Brigadier General Clayton Bissell took over as the air staff A-2, he paid a visit to the unsettling

¹³³⁴ United States Strategic Bombing Survey, *Summary Report (European War)*, 15.

¹³³⁵ United States Strategic Bombing Survey, *Over-all Report (European War)*, 2, 26.

¹³³⁶ Franklin D’Olier, *Letter, D’Olier to Honorable Louis Johnson*, War Department, (Maxwell AFB, AL: AFHRA, 23 August 1949), #168.7024-18, IRIS 126457.

Harrisburg School.¹³³⁷ According to the optimistic viewpoint evident in the school's internally produced history, Bissell expressed pleasure to the faculty in what he'd observed there, before he "personally interviewed every member of the academic and administrative staffs."¹³³⁸ In reality, Bissell was not there for a glad-handing walkabout as a General Officer, but he understood that the school's problems were much larger than its faculty. Enough was enough. Despite its productivity in graduating more than 6,000 students, the school ingrained cynicism and reluctance in its students rather than professionalism and confidence for their tasks ahead.

In toto, the Harrisburg school had done more to stunt, rather than stimulate, the development of air intelligence. One of the war's most professional and prolific RAF photo-interpreters captured Harrisburg's plight best: "A concept of mass production was imposed from on high, and classes of literally hundreds of men, many of them not the least interested in interpretation, or suitable for the work, had to be herded through the school."¹³³⁹ On 31 March 1944, the Harrisburg campus shut down; the school was reincarnated as the Intelligence Division of the School of Applied Tactics (AAFSAT) and relocated to Orlando, Florida. There it amalgamated into the AAF's broader tactical-education enterprise and shared practices and resources with other schools, including all that became of the Air Corps Tactical

¹³³⁷ Finney, *History of the Air Corps Tactical School, 1920-1940*, 60.

¹³³⁸ *History of AAFAIS*, ca. 1 January 1945, 16:14.

¹³³⁹ Babington Smith, *Air Spy*, 152-153.

School.¹³⁴⁰ Only through this new training partnership could the air force's best pilots and intelligence officers grow professionally together.

As the war progressed, training texts from the school's Orlando location matured as they reflected input from those who rotated back from combat theaters, and increasing confidence by those in the career field. They concluded that aptitude for "logic, memory, a flair for detail, and mental endurance," mattered for photo-interpreters, as well as their civil experiences, and that which could only be acquired in the field.¹³⁴¹ Those who couldn't cut it were shuffled into other duties, and those who had what it took stayed with it. As professionals, intelligence officers were becoming more selective of their own. "Interpreters should be weeded out until only the most superior remain and are doing the actual interpretation," offered a June 1945 edit to the course material.¹³⁴²

The portrayal of photo-interpretation in Battle Damage Assessment contained in the texts took on a tone of over-confidence: "This comparative photography provides each bomber crew with conclusive evidence as to its effectiveness or ineffectiveness," the 1945 text claimed. "From such photos we can learn just how seriously the enemy has been hit, whether the target was completely knocked out of the war, or whether it will be necessary for us to go in and deliver another blow in a month or two."¹³⁴³ As discussed later, this was

¹³⁴⁰ Cohen, *Air Intelligence*, ca. 1 January 1954, 9:39.

¹³⁴¹ Green, *Photo Interpretation*, June 1945, 2.

¹³⁴² *Ibid.*, 4.

¹³⁴³ *Ibid.*, 3.

more than a little stretch, even if it did remain the aim of this form of intelligence.

By war's end, however, the place of photo-interpretation among other forms of intelligence was becoming apparent, along with the criticality of confirming multiple sources against each other. "Photo-interpretation is only one source of intelligence information and is not to be considered, in most instances, as being pure intelligence until it has been properly collected, collated, evaluated and disseminated as is all other intelligence information before it becomes intelligence."¹³⁴⁴ Unfortunately, this viewpoint was not present early enough with enough impetus to improve the quality of assessment.

All-source intelligence and USSTAF. While targeting plans diverged through the views of their sponsors, USSTAF's Intelligence Directorate marked an extraordinary maturation for air intelligence. Spaatz saw to fruition the enterprise he'd envisioned in Washington in 1941 from, in his own words, its "weak" start including "all sorts of vague guesses as to how strong the GAF was," into a coordinated and command-oriented staff capable of analyzing and disseminating "all sources."¹³⁴⁵ With vision extending well beyond hostilities in Europe, Spaatz pressed for "self-contained" intelligence aligned underneath the headquarters command structure, including at each numbered air force.¹³⁴⁶ This growth period was driven partly by an imperative to move American

¹³⁴⁴ Ibid., 4.

¹³⁴⁵ Office of the Director of Intelligence, *Minutes, Meeting of A-2s of American Air Forces in Europe*, Headquarters United States Strategic Air Forces in Europe, (Maxwell AFB, AL: AFHRA, 23 January 1945), #519.6041-1, IRIS 217207.

¹³⁴⁶ United States Air Forces in Europe, *History of USSTAF Intelligence*, 8 September 1945, 8-9.

headquarters forward from London to the continent in support of advancing ground forces, but also to the exigencies of shaping post-war opportunities.¹³⁴⁷ The American airmen finally sought to free themselves from relying on the British.

However, the timing for a split from the British could be critical. Fred Anderson, USSTAF's deputy commanding General of Operations noted, if his headquarters had to "break off from British sources at short notice we [USSTAF] would be lost."¹³⁴⁸ This rationale was partly because they also needed to reduce their reliance on the OSS in order to achieve Spaatz's vision for independent analysis. Spaatz undoubtedly boosted the demand for organic and high-level intelligence in USSTAF, and he made clear to Eisenhower that he did not want sole authority to exploit German intelligence sources pulled above him to SHAEF [Eisenhower's] headquarters. He argued, "as the senior US Air Forces representative in this theater, I am particularly cognizant of the air intelligence objectives of Army Air Forces."¹³⁴⁹ Spaatz understood his air-intelligence requirements, and he was not afraid to fight for them.

Spaatz placed his intelligence directorate under the able guidance and advocacy of Brigadier General George McDonald, yet another ACTS graduate who had formerly served as an attaché in London and as Spaatz's Director of

¹³⁴⁷ Ibid., 26-30.

¹³⁴⁸ Minutes, Conference held in the Office of DCC/Ops, USSTAF, 9 October 1944; Cited in: *ibid.*, 28-29.

¹³⁴⁹ Carl A. Spaatz, *Letter, Spaatz to Eisenhower*, Headquarters United States Strategic Air Forces in Europe, (Maxwell AFB, AL: AFHRA, ca. 23 January 1945), #519.6041-1, IRIS 217207, 1.

Intelligence in North Africa.¹³⁵⁰ Air intelligence in the European theater thrived over the remaining 17 months of the war with new energy and purpose, as McDonald left enduring influence through several key improvements. For example, he refashioned daily intelligence briefings from their former purpose in Eaker's headquarters as open and low-level briefings for mass consumption into closed meetings intended only for Spaatz and his senior staff based on the best high-level intelligence possible.¹³⁵¹ The result was not only to sharpen the focus of USSTAF senior leadership, but also to drive quality improvements in multi-source analysis by McDonald's subordinate intelligence officers.

The new arrangement did not neglect the intelligence needs of the lower-echelon staffs. McDonald's analysts also disseminated weekly air-intelligence summaries, which were stripped of unnecessary rhetoric, such as "general information and current events," and readership boomed to an eager audience of 1800 recipients.¹³⁵² In January 1945, McDonald marked a crucial milestone for air intelligence when he chaired an event he that described as "the first meeting embracing all American Air Force A-2s in the Western European Area

¹³⁵⁰ George C. McDonald, who retired as a Major General in 1950 after serving as the first USAF Director of Intelligence, had an ideal career to bridge operational experience with air intelligence. He was accomplished as a pilot, dating back to serving with Spaatz in WWI before rising to prominence as a military and air-intelligence officer. See: Powell, *Interview with Justice Lewis F. Powell, Jr.*, 23 January 1985, 20. Diane T. Putney, ed. *USAF War Studies, ULTRA and the Army Air Forces in World War II: An Interview with Associate Justice of the U.S. Supreme Court Lewis F. Powell, Jr* (Office of Air Force History: Washington, DC, 1987), 8n. Also, according to an Air Force history, McDonald had begun the practice of "incorporating combat intelligence, target intelligence, POW interrogations, counterintelligence, Y-service, and ULTRA" at North Africa Air Forces (NAAF) Headquarters. See: Kreis, *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II*, 161.

¹³⁵¹ Powell, *Notes on USSTAF Operational Intelligence*, ca. May 1945, 4-5.

¹³⁵² *Ibid.*, 5-6.

held during this war,” adding that “it augers well for better accomplishment of the broad responsibility of Intelligence.”¹³⁵³ McDonald had become more intelligence officer than he was pilot, and he deliberately developed and mentored his adolescent enterprise.

McDonald wasn’t alone with his ambition to improve theater-level intelligence. He consolidated various operational-intelligence responsibilities under a single USSTAF section led by Lieutenant Colonel Lewis F. Powell Jr.¹³⁵⁴ Powell, a former lawyer of extraordinary talent and USSTAF’s ULTRA representative, maintained the War Room for Spaatz’s “high level” briefings, ensured continual awareness of the enemy order of battle and airfield activity for those who needed it, produced reports and publications, and fused a variety of sources: “photographic reconnaissance; PW [prisoner of war] interrogation; captured documents and captured equipment; “Y” intercept [enemy radio communications]; ground reports from agents, collaborators, expatriates and friendly neutrals; and visual reports and observations of crew members and tactical reconnaissance pilots.”¹³⁵⁵ Operational Intelligence under Lewis Powell blossomed into a command-level nerve center feeding analysis in all directions, especially to Spaatz—a commander who hadn’t only proven open to learning

¹³⁵³ Director of Intelligence, *Minutes, Meeting of A-2s of American Air Forces in Europe*, 23 January 1945, section IV:1.

¹³⁵⁴ Lewis Powell later served as Justice of the United States Supreme Court for 15 years beginning in 1972. A biographer captured Lewis as “a person of that generation who believed that the practice of law required a commitment to the public interest and that describes his life from the time he first a law degree until his retirement from the Supreme Court.” See: *Lewis Powell Dies*, in *All Things Considered*, (Washington, DC: NPR, 25 August 1998).

¹³⁵⁵ Powell, *Notes on USSTAF Operational Intelligence*, ca. May 1945, 2-3, 13.

from his intelligence officers—he demanded it. Air intelligence in the European theater advanced a long way in a short time under new leadership.

The air campaign over Germany followed the blows and parries of the three fights within it, which included organizational struggles for Air Force independence, a standing national-intelligence community, and an air-intelligence enterprise within the air service. Arnold and his ACTS-graduate generals eventually secured an independent air service, partially through their championship of strategic bombing. The spoils fell to Generals Spaatz and McDonald. On 18 September 1947, Spaatz became the first Chief of Staff of the United States Air Force (USAF) and McDonald the USAF's first Director of Intelligence.¹³⁵⁶ They were the right leaders at the right time to set air intelligence on its permanent path in a new, independent service.

Donovan's OSS, with its army of researchers, analysts, and clandestine agents, was carved up in the thrash of post-war demobilization, but won its own war for peacetime-intelligence funding two years later.¹³⁵⁷ The OSS official history laments that its "long-range plans," including building a "widespread network" in China, could not be "implemented and expanded [before] President Truman issued the Executive Order which terminated the OSS as of 1 October 1945."¹³⁵⁸ Both the USAF and the Central Intelligence Agency earned their

¹³⁵⁶ Wolk, *The Struggle for Air Force Independence, 1943-1947*, 321, 323.

¹³⁵⁷ Goodman, "The Foundations of Anglo-American Intelligence Sharing," 5. Dana D'Aniello, "Old Spies Tell Some Tales: Office of Strategic Services Predated CIA, Special Forces," *Washington Post* 31 May 2004.

¹³⁵⁸ United States War Department, *Operations in the Field*, ed. Strategic Services Unit History Project, vol. 2, War Report, Office of Strategic Services (Washington, DC: US Government Printing Office, 1949), 460.

permanence on not only the same day, but the same document—the National Security Act of 1947.¹³⁵⁹ However, only the Army Air Force's A-2, fighting for ACTS doctrine, its own organizational identity, and control over air-campaign targeting and assessment, had won its status decisively in 1943... selling Schweinfurt.



¹³⁵⁹ Wolk, *The Struggle for Air Force Independence, 1943-1947*, 301-312.

Bibliography

- 1st Bombardment Division, A-2, and A-2 94th Combat Wing. Teletype Report. #520.332. Maxwell AFB, AL: AFHRA, 24 February 1944.
- 1st Bombardment Division, Headquarters. Group Bombing Plot and Report. In *Brussels/Evere Mission*. #525.332, 7 September 1943.
- . Bomb-Damage Photo, Brussels Airdrome. In *Brussels/Evere Mission*. #525.332, 7 September 1943.
- 1st Bombardment Wing, Headquarters. Immediate Interpretation Report, No. 9a. In *26 July 1943, Hannover - Hamburg*, 2nd Lt. George Welter. #525.332. Maxwell AFB, AL: AFHRA, 27 July 1943.
- . Immediate Interpretation Report, No. 12. 2nd Lt. George Welter. #525.332. Maxwell AFB, AL: AFHRA, 12 August 1943.
- 1st Bombardment Wing, S-2. Teletype Report, Mission 22 June 1943. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 22 June 1943.
- 3rd Air Division, Headquarters. Mission 46: Watten (France). #527.332. Maxwell AFB, AL: AFHRA, 27 August 1943.
- 3rd Bombardment Division, Headquarters. Annex No. 1 to 3 B.D. Field Order No. 68. #527.332. Maxwell AFB, AL: AFHRA, 28 September 1943.
- . Field Order No. 66. #527.332. Maxwell AFB, AL: AFHRA, 26 September 1943.
- . Annex No. 2 to 3 B.D. Field Order No. 69. #527.332. Maxwell AFB, AL: AFHRA, 1 October 1943.
- . Advance Warning to 3 BD Field Order No. 69. #527.332. Maxwell AFB, AL: AFHRA, 1 October 1943.
- . Annex No. 1 to 3 B.D. Field Order No. 69. #527.332. Maxwell AFB, AL: AFHRA, 2 October 1943.
- 4th Bombardment Wing, Commander. Routine Confidential Message, Attn: Senior Intelligence Officer. Eighth Air Force. #527.332. Maxwell AFB, AL: AFHRA, 19 August 1943.
- 4th Bombardment Wing, Headquarters. Operations Broadcast, Teletype. #527.332. Maxwell AFB, AL: AFHRA, 6 September 1943.
- . Annex No. 1 of 4th Combat Wing Field Order No. 36. #527.332. Maxwell AFB, AL: AFHRA, 2 October 1943.
- . Mission 36 (Wesseling). War Department. #527.332. Maxwell AFB, AL: AFHRA, 12 August 1943.
- . Briefing Notes, Primary Target. Wesseling Mission #36. #527.332. Maxwell AFB, AL: AFHRA, 12 August 1943.
- 4th Bombardment Wing, S-2. Form 103A Narrative. Eighth Air Force. #527.332. Maxwell AFB, AL: AFHRA, 12 August 1943.
- 50th Anniversary of World War II Commemoration Committee. World War II Informational Fact Sheets. United States Army, 93p. Washington, D.C: HQ Department of the Army, 1995.
- 92nd Bombardment Group, Group Bombardier. Bombing Analysis and Results. #520.332. Maxwell AFB, AL: AFHRA, 24 February 1944.
- 92nd Bombardment Group, S-2. Teletype Report, Mission 27 September 1943.

- War Department. #525.332B. Maxwell AFB, AL: AFHRA, 27 September 1943.
- . Teletype Report, Mission 14 October 1943. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 16 October 1943.
- . Teletype Report, Mission 17 August 1943. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 18 August 1943.
- 94th Bombardment Group, Headquarters. Mission briefing notes. In *Bombing Annex, Mission #10, Hüls*. #527.332. Maxwell AFB, AL: AFHRA, 22 June 1943.
- 94th Bombardment Group, S-2. Teletype Report, Mission 22 June 1943. #527.332. Maxwell AFB, AL: AFHRA, 22 June 1943.
- . Teletype Report, Form 103A Narrative. Eighth Air Force. #527.332. Maxwell AFB, AL: AFHRA, Ca. 17 August 1943.
- . Form 103A Narrative. #527.332. Maxwell AFB, AL: AFHRA, 2 October 1943.
- . Telephone Report, Form 102. Headquarters 94th Bombardment Group. #527.332. Maxwell AFB, AL: AFHRA, 7 September 1943.
- . Teletype Report, Mission 13 June 1943. 3rd Air Division. #527.332. Maxwell AFB, AL: AFHRA, 14 June 1943.
- . Teletype Report. #527.332. Maxwell AFB, AL: AFHRA, 2 October 1943.
- . Hand-written notes for Teletype Report. #527.332. Maxwell AFB, AL: AFHRA, 2 October 1943.
- . Teletype Report Worksheets. Eighth Air Force. #527.332. Maxwell AFB, AL: AFHRA, Ca. 17 August 1943.
- . Teletype Report, Form 103A Narrative. 3rd Bombardment Division. #527.332. Maxwell AFB, AL: AFHRA, 27 September 1943.
- 305th Bombardment Group, Group Bombardier. Bombing approach and dropping procedure for the mission of 24 February 1944. J.A. Mikkelsen. #520.332. Maxwell AFB, AL: AFHRA, 24 February 1944.
- 305th Bombardment Group, Headquarters. Description of Bombing Approach and Dropping Procedure, Mission of 22 June 1943. Capt Bruce A. Gardner. #520.332. Maxwell AFB, AL: AFHRA, 22 June 1943.
- . Inclosure "J", Group Bombing Plot and Report. In *Narrative Report of Operations, Field Order No. 153-A*. #520.332. Maxwell AFB, AL: AFHRA, 22 June 1943.
- 305th Bombardment Group, S-2. Photo & Bomb Plotting Report. 1st Lt Franklin E. Smith. #520.332. Maxwell AFB, AL: AFHRA, 22 June 1943.
- . Teletype Report, Mission 22 June 1943. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 22 June 1943.
- . Teletype Report, Mission 27 August 1943. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 28 August 1943.
- . Teletype Report, Mission 17 August 1943. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 18 August 1943.
- . Teletype Report, Mission 27 September 1943. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 27 September 1943.
- . Teletype Report, Section 'A' to Commanding General 1st Bomb Wing.

- War Department. #525.332B. Maxwell AFB, AL: AFHRA, 30 July 1943.
- . Teletype Report, Mission 12 August 1943. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 12 August 1943.
- 306th Bombardment Group, S-2. Teletype Report, Mission 22 June 1943. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 22 June 1943.
- . Teletype Report, Mission 27 August 1943. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 27 August 1943.
- . Teletype Report, Mission 27 September 1943. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 27 September 1943.
- . Teletype Report, Mission 14 October 1943. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 14 October 1943.
- . Teletype Report. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 2 October 1943.
- . Teletype Report, Mission 7 September 1943. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 8 September 1943.
- . Teletype Report, Mission 17 August 1943. War Department. #525.332B. Maxwell AFB, AL: AFHRA, 17 August 1943.
- 379th Bombardment Group, S-2. S-2 Mission Narrative Report, Target - Schweinfurt. N. H. Norgren. #520.332. Maxwell AFB, AL: AFHRA, 24 February 1944.
- 410th Bombardment Squadron. Interrogation Form, Crew No. 427. #145.81-140. Maxwell AFB, AL: AFHRA, 27 September 1943.
- . Interrogation Form, Crew No. 200. #145.81-140. Maxwell AFB, AL: AFHRA, 27 September 1943.
- AAF Intelligence School. Information Bulletin. #266.1. Maxwell AFB, AL: AFHRA, 10 April 1942.
- AC/AS Intelligence. Attacks of U-Boat Bases in Northern France by the USAAF. In *An Evaluation of the Air Effort Against Submarines (To January 1, 1943)*, USAAF. #142.042-6. Maxwell AFB, AL: AFHRA, 8 March 1943.
- . The Strategic Aerial Bombardment of Germany - Submarines. USAAF. #142.042-11. Maxwell AFB, AL: AFHRA, 15 September 1943.
- Adams, Gordon. *Buying National Security: How America Plans and Pays for Its Global Role and Safety at Home*. Edited by Cindy Williams. New York, NY: Routledge, 2010.
- Advisory Committee on Bombardment. Meeting Minutes. In *Oil and Chemicals*, War Department. #118.151-1. Maxwell AFB, AL: AFHRA, 23 December 1942.
- . Meeting Minutes War Department. #118.151-1. Maxwell AFB, AL: AFHRA, 21 December 1942.
- . Meeting Minutes. War Department. #118.151-1. Maxwell AFB, AL: AFHRA, 18 December 1942.
- . Meeting Minutes. War Department. #118.151-1. Maxwell AFB, AL: AFHRA, 15 December 1942.
- Ahlstrom, David, and Roger L. M. Dunbar. "Seeking the Institutional Balance of Power: Avoiding the Power of a Balanced View." *The Academy of*

- Management Review* 20, no. 1 (1995): 171-192.
- Air Corps Tactical School. Rules for Umpires. War Department. #248.101-17. Maxwell Field, AL: AFHRA, May 1936.
- . Maps and Photographs Course. #248.101-17A. Maxwell Field, AL: AFHRA, 1935-1936.
- . Course: Maps and Photographs, Tactical Employment of Aerial Photography. #248.101-17A. Maxwell Field, AL: AFHRA, 10 January 1937.
- Air Intelligence Section. Analysis of Results of USAAF Bombing Attacks on Submarine Bases in France, during November, 1942. In *An Evaluation of the Air Effort Against Submarines (To January 1, 1943)*, Air Ministry. #142.042-6. Maxwell AFB, AL: AFHRA, 7 January 1943.
- Air Ministry. The RAF in the Bombing Offensive Against Germany. Air Historical Branch. #512.041-26. Maxwell AFB, AL: AFHRA, undated draft; declassified 11 July 1984.
- . "Royal Air Force." *London Gazette*, 4 September 1934, 5607.
- . Photographic Reconnaissance, Vol. 2, May 1941 - August 1945. Air Historical Branch. AIR 41/7. Kew, London: UK National Archives, 1948.
- . Photographic Reconnaissance, Vol. 1, to April 1941. Air Historical Branch. AIR 41/6. Kew, London: UK National Archives, 1945.
- Alderman, Bissell. Report for Colonel Leach on the History and Development of the Bombs and Fuzes Subsection of the Operational Analysis Section. Headquarters Eighth Air Force. #520.3033. Maxwell AFB, AL: AFHRA, 10 April 1945.
- Allied Force Headquarters. The Employment of Bombers and Fighter-Bombers in Co-operation with the Army. In *Operational Memorandum Number 54*, , S.A.C. in C. Med. #168.7026-9. Maxwell AFB, AL: AFHRA, April 1944.
- Anderson, Brigadier General F. L. Report of Operations, 24 February 1944. Headquarters Eighth Air Force. #520.332. Maxwell AFB, AL: AFHRA, 5 March 1944.
- . Tactical Report of Mission, Kiel, 13 June 1943. 4th Bombardment Wing Headquarters. #520.332. Maxwell AFB, AL: AFHRA, 19 June 1943.
- . Report of Operations, 7 September 1943. In *Tactical Mission Report, Brussels/Evere*, 1st Bombardment Wing Headquarters. #520.332. Maxwell AFB, AL: AFHRA, 10 September 1943.
- Antisubmarine Command. Monthly Summary. USAAF. #142.042-6. Maxwell AFB, AL: AFHRA, January 1943.
- Armstrong, Brig Gen Frank A. Report of Operations, Hls, 22 June 1943 to Commanding General, VIII Bomber Command. 1st Bombardment Wing Headquarters. #520.332. Maxwell AFB, AL: AFHRA, 28 June 1943.
- . "Air Discipline." *Air Force: Official Service Journal of the U.S. Army Air Forces*. 28, no. 11 (1943).
- Army Air Forces Air Intelligence School. History of AAFAIS. USAF. #266.1. Maxwell Field, AL: AFHRA, ca. 1 January 1945.
- . *Group and Squadron S-2*. Edited by United States Army Air Forces.

- Revised ed., Washington, DC: U.S. GPO, 1943.
- . *The Briefing and Interrogation of Bomber Crews*. Harrisburg, PA: United States Army Air Forces, 1942.
- Army Air Forces, Chief of Operational Plans. Memorandum to Commanding General from AC/AS Plans, Subject: Combined Bomber Offensive. Joe L. Loutzenheiser. #145.81-140. Maxwell AFB, AL: AFHRA, 4 December 1943.
- Army Air Forces, Commanding General. Plan for Combined Bomber Offensive From the United Kingdom. In *Personal Collection of Gen Henry H. Arnold part 3 of 6*, Joint Chiefs of Staff (277). MICFILM 28253. Maxwell AFB, AL: AFHRA, 29 April 1943.
- Army Air Forces, First Motion Picture Unit. *Photographic Intelligence in Damage Assessment*. War Department, 1943; I-3340. *Training Film*.
<https://www.awm.gov.au/collection/F02322/>
- Arnold, H. H. Memorandum from Military Intelligence Division, G-2 to the Chief of Staff, War Department: "Responsibility of the Military Intelligence Division for Air Intelligence". War Department. #203-6. Maxwell AFB, AL: AFHRA, 18 April 1941.
- . Letter, Arnold to Andrews. #168.61-10. Maxwell AFB, AL: AFHRA, 24 March 1943.
- . Memorandum, Research and Analysis to Fix Earliest Practicable Date for Invasion of Western Europe. HQ USAAF. #118.161. Maxwell AFB, AL: AFHRA, 22 Dec 1942.
- . Letter, Arnold to Spaatz. War Department. #118.01v2. Maxwell AFB, AL: AFHRA, 14 July 1944.
- . Memorandum to Assistant Chief of Staff, Management Control, Subject: Analysis of Strategic Targets in Italy. War Department. #118.02v2. Maxwell AFB, AL: AFHRA, 23 March 1943.
- . Memorandum for Maj Gen Clayton Bissell, Assistant Chief of Staff (G-2), Subject: Bombing Targets. War Department. #142.035-8. Maxwell AFB, AL: AFHRA, 8 January 1945.
- . Letter, Arnold to Giles; Subject: Analysis of Eighth Air Force Heavy Bomber Effort. War Department. #168.491v1. Maxwell AFB, AL: AFHRA, 5 January 1944.
- . Personal letter, Lt Gen H.H. Arnold to Maj Gen I.C. Eaker. Headquarters Allied Air Force. #168.61-10. Maxwell AFB, AL: AFHRA, 24 January 1943.
- . Memorandum for General Eaker: Supplementary Data on Abrasives Industry in Axis Europe. Manuscript Division. Washington, DC: Library of Congress, 1 July 1943.
- . Letter, Arnold to Eaker. Manuscript Division. Washington, DC: Library of Congress, 15 June 1943.
- . Message Arnold to Eaker. Manuscript Division. Washington, DC: Library of Congress, 16 October 1943.
- . Letter, Arnold to Spaatz. Manuscript Division. Washington, DC: Library

- of Congress, 5 January 1944.
- . Letter, Arnold to Eaker. War Department. AAG 312.1-E, Operations Letters, RG 18. Held by AFHSO: NA, 10 April 1943.
- . Letter, Arnold to Eaker. War Department. AAG 312.1-F, Operations Letters, RG 18. Held by AFHSO: NA, 19 April 1943.
- . Letter, Arnold to Eaker. AAG 312.1-G, Operations Letters, RG 18. Washington, DC: NARA, 29 June 1943.
- Arnold, Henry Harley. *American Airpower Comes of Age*. General Henry H. "Hap" Arnold's World War II diaries. Edited by John W. Huston. Vol. vol. 1, Maxwell AFB, AL: Air University Press, 2001.
- . *American Airpower Comes of Age*. General Henry H. "Hap" Arnold's World War II diaries. Edited by John W. Huston. Vol. vol. 2, Maxwell AFB, AL: Air University Press, 2001.
- . *Global Mission*. Military Classics Series. Blue Ridge Summit, PA: Tab Books, 1989.
- Arnold, Henry Harley, and Ira Eaker. *This Flying Game*. Reprinted, January 1940 ed., New York and London: Funk & Wagnalls, 1936.
- Arps, Leslie H. Report: Operational Analysis Section. Headquarters Eighth Air Force. #520.303-3. Maxwell AFB, AL: AFHRA, 1 June 1945.
- Arps, Leslie H., Hugh J. Miser, Bissell Alderman, Edwin Hewitt, and G. Bailey Price. *Operations Analysis in the Eighth Air Force, 1942-1945: Four Contemporary Accounts*. Linthicum, MD: INFORMS, 1997.
- Assistant Chief of Air Service (AC/AS). Organizational Chart: Standing Committees in which AC/AS Intelligence Participates. War Department. Maxwell AFB, AL: AFHRA, ca. 15 November 1943.
- Assistant Chief of Air Staff (A-2). Results of Combined Bomber Offensive from 1 July 1943 to September 1944. #145.81-140. Maxwell AFB, AL: AFHRA, 19 September 1944.
- . Schweinfurt: Ball Bearing Factories. In *Reports of Attacks on Axis Targets in Europe*, USAAF. 142.035-7. Maxwell AFB, AL: AFHRA, 12 September 1943.
- . An Appraisal of Accomplishments and Potentialities. In *The Strategic Aerial Bombardment of Europe*, USAAF. #142.042-11v5. Maxwell AFB, AL: AFHRA, 20 April 1944.
- . Bremen (Neuenland): Focke Wulf Plant. In *Reports of Attacks on Axis Targets in Europe*, USAAF. 142.035-7. Maxwell AFB, AL: AFHRA, 12 September 1943.
- . Hamburg: Blohm and Voss and Howaldts - U-Boat Yards. In *Reports of Attacks on Axis Targets in Europe*, USAAF. 142.035-7. Maxwell AFB, AL: AFHRA, 12 September 1943.
- . Regensburg: ME-109 Assembly Plant. In *Reports of Attacks on Axis Targets in Europe*, USAAF. #142.035-7. Maxwell AFB, AL: AFHRA, 12 September 1943.
- . Routing Slip to Colonel Loutzenheiser. In *Reports of Attacks on Axis Targets in Europe*, USAAF. 142.035-7. Maxwell AFB, AL: AFHRA, 12

- September 1943.
- . The Ploesti Mission of 1 August 1943. In *USAF Historical Study No. 103*, Historical Division. #101-103. Maxwell AFB, AL: AFHRA, June 1944.
- . Strategic Bombing of Axis Europe, January 1943 - September 1944; Bomb Damage to Axis Target Systems. Major General James P. Hodges. #142.042-8. Maxwell AFB, AL: AFHRA, 1 December 1944.
- . An Appraisal of Accomplishments and Potentialities. In *The Strategic Aerial Bombardment of Europe*, USAAF. #142.042-11v3. Maxwell AFB, AL: AFHRA, 10 December 1943.
- . The Strategic Bomber Offensive, Results of Operations to 1 November 1943. Colonel William C. Bentley. #145.81-140. Maxwell AFB, AL: AFHRA, 5 November 1943.
- . An Appraisal of Accomplishments and Potentialities. In *The Strategic Aerial Bombardment of Europe*, USAAF. #142.042-11v1. Maxwell AFB, AL: AFHRA, 10 September 1943.
- . Air Estimate, The Submarine Situation in Europe, Part I. USAAF. #142.042-5. Maxwell AFB, AL: AFHRA, 12 February 1943.
- Assistant Chief of Staff, A-3. Bombing Accuracy. In *Notebooks for Gen Devers and Gen Eaker*. #168.61-2. Maxwell AFB, AL: AFHRA, 30 August 1943.
- . Regensburg Shuttle Mission. Headquarters Eighth Air Force. #168.61-10. Maxwell AFB, AL: AFHRA, 30 August 1943.
- Babington Smith, Constance. *Air Spy: The Story of Photo Intelligence in World War II*. New York, NY: Harper, 1957.
- Bacevich, Dr. Andrew J. "Chaos in Iraq." By Bill Moyers. *Moyers & Company* (20 June 2014).
- Baker, Newton Diehl. Final Report of War Department Special Committee on Army Air Corps., United States Special Committee on Army Air Corps. Washington, DC: U.S. GPO, 18 July 1934.
- Barlow, Jane A., and Clinton C. Gardner. *World War II Remembered*. Hanover, NH: Kendal at Hanover Residents Association, 2012.
- Baumol, William J. *The Free-Market Innovation Machine: Analyzing the Growth Miracle of Capitalism*. Princeton, NJ: Princeton University Press, 2002.
- Bayer, John B., Jr. (S-2). Interrogation Form. Headquarters 4th Bombardment Wing. #527.332. Maxwell AFB, AL: AFHRA, 7 September 1943.
- Beaman, Major Bartlett. 'Progress Report, Air Intelligence Section'. War Department. #203-6. Maxwell AFB, AL: AFHRA, December 1, 1941.
- Bell, William Gardner. *Secretaries of War and Secretaries of the Army: Portraits & Biographical Sketches*. Edited by Center of Military History. Washington, DC: U. S. GPO, 2010.
- Benady, David. "Marketing Fear." *Marketing*, 2009 Aug 19 2009, 24-25.
- Bensusan-Butt, David M. Memorandum, Bomber Command: Night Photograph Analysis. Offices of the War Cabinet. AIR 8/1356. Great George Street, S.W.1: UK National Archives, KEW, 18 August 1941.
- Bentley, Stewart W., Jr. *The Touch of Greatness: Colonel William C. Bentley Jr., USAAC/USAF; Aviation Pioneer*. Bloomington, IN: AuthorHouse, 2010.

- Benton, Jeffrey C. *They Served Here: Thirty-Three Maxwell Men*. Maxwell Air Force Base, AL: Air University Press, 1999.
- Beyerchen, Alan. "Clausewitz, Nonlinearity, and the Unpredictability of War." *International Security* 17, no. 3 (1992-1993): 59-90.
- Biddle, Tami Davis. *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas about Strategic Bombing, 1914-1945*. Princeton Studies in International History and Politics. Princeton, NJ: Princeton University Press, 2002.
- Bissell, Clayton. Letter, Bissell to Eaker. War Department. #830.289v1. Maxwell AFB, AL: AFHRA, 3 December 1943.
- Blocher, Joseph. "Institutions in the Marketplace of Ideas." *Duke Law Journal* 57, no. 4 (2008): 821-889.
- Blunden, Margaret. "Geoffrey Vickers - An Intellectual Journey." In *The Vickers Papers*, edited by Open Systems Group. London: Harper & Row, 1984.
- Boog, Horst, Gerhard Krebs, and Detlef Vogel. *The Strategic Air War in Europe and the War in the West and East Asia 1943-1944/5*. Germany and the Second World War. Oxford: Clarendon Press, 2006.
- Borneman, Walter R. *The Admirals: Nimitz, Halsey, Leahy, and King--The Five-Star Admirals Who Won the War at Sea*. 1st ed., New York: Little, Brown and Co., 2012.
- Boyne, Walter J. "FW 190 Wurger." 92, no. 4 (2009): 80.
- Brauer, Jurgen, and Hubert P. Van Tuyl. *Castles, Battles, & Bombs: How Economics Explains Military History*. Chicago, IL: University of Chicago Press, 2008.
- Brett, General George. Memorandum from Chief of Air Corps to Military Intelligence Division, G-2: 'Non-Concurrence in G-2/271-A-ST'. War Department. #203-6. Maxwell AFB, AL: AFHRA, June 16, 1941.
- Brothers, Leroy A. "Operations Analysis in the United States Air Force." *Journal of the Operations Research Society of America* 2, no. 1 (1954): 1-16.
- Bruce, Howard. Memorandum for Asst Chief of Air Staff, A-2; Subject: Foreign Experts. #118-161. Maxwell AFB, AL: AFHRA, 12 Dec 1942.
- Bubb, Colonel Charles B. B. Memorandum: Directive to Section Chief, Operational Research Section. Headquarters VIII Bomber Command. #520.303-1. Maxwell AFB, AL: AFHRA, 23 October 1942.
- . Memorandum: Operation Research Section, to Commanding Officers, 1st, 2nd, 3rd Bomb Wings. Headquarters VIII Bomber Command. #520.303-1. Maxwell AFB, AL: AFHRA, 23 October 1942.
- Builder, Carl H. *The Masks of War: American Military Styles in Strategy and Analysis*. A Rand Corporation Research Study. Baltimore, MD: Johns Hopkins University Press, 1989.
- Bungay, Stephen. *The Most Dangerous Enemy: An Illustrated History of the Battle of Britain*. Minneapolis, MN: Zenith Press, 2010.
- Bush, George W. Remarks at an Independence Day Celebration in Philadelphia, Pennsylvania. 1009: Superintendent of Documents, 2001.
- Bush, Vannevar. Memorandum to Maj Walter B. Leach: Investigation and

- Report on Operations Analysis. Joint Committee on New Weapons and Equipment. #118.201-2. Maxwell AFB, AL: AFHRA, 7 July 1942.
- Cabell, Charles P. Letter, Cabell to Kuter. #145.81-140. Maxwell AFB, AL: AFHRA, 16 June 1944.
- . "Interview with Gen. Charles P. Cabell." By Henry L. Bowen and Alfred Goldberg. *US Air Force Oral History Interview* (15 January 1962): 6.
- Cabell, Charles P., and Charles P. Cabell Jr. *Memoirs of War, Peace, and the CIA*. Colorado Springs, CO: Impavide Publications, 1997.
- Cabell, Maj Charles P. Memorandum: Final Report of Military Air Observer to Great Britain to The Assistant Chief of Staff, G-2. War Department. #168.7026-2. Maxwell AFB, AL: AFHRA, 7 April 1941.
- . Interpretation of Aerial Photographs. #168.7026-2. Maxwell AFB, AL: AFHRA, 21 February 1941.
- . Aerial Photography: Organization and Operation of Photographic Reconnaissance Unit Number One/Benson, England. War Department. #168.7026-2. Maxwell AFB, AL: AFHRA, 21 February 1941.
- . Organization of the Central Interpretation Unit. War Department. #168.7026-2. Maxwell AFB, AL: AFHRA, 21 March 1941.
- . Night Aerial Photography. War Department. #168.7026-2. Maxwell AFB, AL: AFHRA, 25 February 1941.
- . Aerial Photography: Organization and Operation of Photographic Reconnaissance Unit No. 3. War Department, 3. #168.7026-2. Maxwell AFB, AL: AFHRA, 21 February 1941.
- Carmines, Edward G., and Richard A. Zeller. *Reliability and Validity Assessment*. Quantitative Applications in the Social Sciences. Edited by John L. Sullivan and Richard Niemi, G., Beverly Hills: Sage University Papers, 1987.
- Carter, Kit C., and Robert Mueller. U.S. Army Air Forces in World War II. Combat Chronology 1941-1945. Maxwell AFB, AL: AFHRA, 1991.
- Cawood, Ian, and David McKinnon-Bell. *The First World War*. London, UK: Routledge, 2001.
- Central Interpretation Unit. Immediate Interpretation Report No. K.1785. In *Locality: Schweinfurt*, Medmenham RAF Station. #520.365. Maxwell AFB, AL: AFHRA, 17 October 1943.
- . Immediate Interpretation Report No. K.1894. In *Eighth Air Force Mission No. 232*, RAF Medmenham. #520.332. Maxwell AFB, AL: AFHRA, 25 February 1944.
- . Interpretation Report No. SA. 1047. In *Eighth Air Force Mission No. 232*, RAF Medmenham. #520.332. Maxwell AFB, AL: AFHRA, 25 February 1944.
- . Immediate Interpretation Report No. K.1904. In *Eighth Air Force Mission No. 232*, RAF Medmenham. #520.332. Maxwell AFB, AL: AFHRA, 6 March 1944.
- . Interpretation Report No. K.1618. In *Damage Assessment*, Medmenham RAF Station. #520.365. Maxwell AFB, AL: AFHRA, 1 August 1943.

- . Immediate Interpretation Report No. K.1671. In *Eighth Air Force Mission No. 84*, RAF Medmenham. #520.331. Maxwell AFB, AL: AFHRA, 18 August 1943.
- . Immediate Interpretation Report No. K.S.124, Clearance and Reconstruction. In *Eighth Air Force Mission No. 84*, RAF Medmenham. #520.331. Maxwell AFB, AL: AFHRA, 10 October 1943.
- . Immediate Interpretation Report No. K.1587. In *Damage Assessment*, Medmenham RAF Station. #520.365. Maxwell AFB, AL: AFHRA, 22 June 1943.
- . Interpretation Report No. S.A. 493. Medmenham RAF Station. #527.332. Maxwell AFB, AL: AFHRA, 29 August 1943.
- . Interpretation Report No. K.1677. In *Eighth Air Force Mission No. 84*, RAF Medmenham. #520.331. Maxwell AFB, AL: AFHRA, 23 August 1943.
- . Preliminary Interpretation Report No. S.A.359. In *Attack on Synthetic Rubber Plant Hüls on 22.6.43*, Medmenham RAF Station. #520.365. Maxwell AFB, AL: AFHRA, 24 June 1943.
- . Interpretation Report No. K.S. 407, Regensburg. RAF Medmenham. #519.332. Maxwell AFB, AL: AFHRA, 3 February 1944.
- . Interpretation Report No. S.A. 538. #520.332. Maxwell AFB, AL: AFHRA, 8 September 1943.
- . Negative Damage Report No. S.A. 209. #520.332. Maxwell AFB, AL: AFHRA, 8 September 1943.
- . Interpretation Report S.A. 536. Medmenham RAF Station. #520.332. Maxwell AFB, AL: AFHRA, 9 September 1943.
- . Immediate Interpretation Report K.1710. Medmenham RAF Station. #520.332. Maxwell AFB, AL: AFHRA, 8 September 1943.
- . Interpretation Report No. S.A. 466. RAF Medmenham. #519.332. Maxwell AFB, AL: AFHRA, 17 August 1943.
- . Immediate Interpretation Report K.1728. Medmenham RAF Station. #520.332. Maxwell AFB, AL: AFHRA, 19 September 1943.
- . Interpretation Report KS.280. Medmenham RAF Station. #520.332. Maxwell AFB, AL: AFHRA, 14 January 1944.
- . Interpretation Report No. S.A. 602. Medmenham RAF Station. #525.332B. Maxwell AFB, AL: AFHRA, 29 September 1943.
- . Supplement to Interpretation Report No. K. 1756. RAF Medmenham. #527.332. Maxwell AFB, AL: AFHRA, 6 October 1943.
- . Immediate Interpretation Report No. K.1756. RAF Medmenham. #527.332. Maxwell AFB: AFHRA, 4 October 1943.
- . Approximate Bomb Plot No. SA 359. In *Synthetic Rubber Plant - Hüls*, Medmenham RAF Station. #520.365. Maxwell AFB, AL: AFHRA, 22 June 1943.
- . Immediate Interpretation Report No. K.1672. In *Eighth Air Force Mission No. 84*, RAF Medmenham. #520.331. Maxwell AFB, AL: AFHRA, 18 August 1943.
- . Interpretation Report S.A. 628. In *Attack on Schweinfurt Ball-Bearing*

- Industry on 14.10.43*, Medmenham RAF Station. #520.365. Maxwell AFB, AL: AFHRA, 16 October 1943.
- Chalou, George C. *The Secrets War: The Office of Strategic Services in World War II*. Washington, DC: NARA, 1994.
- Chart of Liaison System, Information Section, 11 Nov 1918. #106-87. Maxwell Field, AL: AFHRA, ca. 1 January 1954.
- Chiabotti, Stephen D. "Pensive Sword: Educating Officers in Austere Times." *Strategic Studies Quarterly* 8, no. 3 (Fall 2014): 30-37.
- Chun, Clayton K. S. *Aerospace Power in the Twenty-First Century: A Basic Primer*. Edited by Air University. 2001. Reprint, Maxwell Air Force Base, AL: U.S. Air Force Academy in cooperation with Air University Press, 2010.
- Clausewitz, Carl von. *On War*. Edited and translated by Michael Howard and Peter Paret. Princeton, NJ: Princeton University Press, 1984.
- Cline, Ray S. *Washington Command Post: The Operations Division*. Washington, DC: Office of the Chief of Military History, Dept. of the Army, 1951.
- Clodfelter, Mark. *Beneficial Bombing: The Progressive Foundations of American Air Power, 1917-1945*. Lincoln, NE: University of Nebraska Press, 2010.
- "The Clydesdale Horse--Dialogue." *The Farmers' Cabinet and American Herd-Book* V, no. 1 (15 August 1840).
- Coffey, Thomas M. *Decision over Schweinfurt: The U.S. 8th Air Force Battle for Daylight Bombing*. New York: Mckay, 1977.
- Cohen, Dr. Victor H. Air Intelligence. In USAFHS-87, USAF. #106-87. Maxwell AFB, AL: AFHRA, ca. 1 January 1954.
- Cole, Wayne S. *Roosevelt & The Isolationists, 1932-45*. Lincoln, NE: University of Nebraska Press, 1983.
- Combined Chiefs of Staff, Office of the. Sextant Conference, November-December 1943. In *Papers and Minutes of Meetings, Sextant and Eureka Conferences*. Washington, DC: Joint History Office, 1943.
- Combined Intelligence Objectives Sub-Committee, G-2 Division. Reich Ministry of Armaments and War Production. #506.620v.102. Maxwell AFB, AL: AFHRA, May-June 1945.
- Committee of Operations Analysts. Analysis of Bombardment Objectives in Western Europe. War Department. #118.02v2. Maxwell AFB, AL: AFHRA, 8 March 1943.
- . Western Axis Oil Industry as Bombardment Target. War Department. #118.02v2. Maxwell AFB, AL: AFHRA, 8 March 1943.
- . Report of Committee of Operations Analysts with Respect to Economic Targets Within the Western Axis. War Department. #118.04A-1. Maxwell AFB, AL: AFHRA, 8 March 1943.
- . Meeting Minutes. War Department. #118.151-8. Maxwell AFB, AL: AFHRA, 30 September 1943.
- . Outline of Proposed Study. War Department. #118.201-2. Maxwell AFB, AL: AFHRA, Ca. 4 December 1942.
- . Script. War Department. #118.04A-5. Maxwell AFB, AL: AFHRA, 1 April

- 1943.
- . Meeting Minutes. War Department. #118.151-11. Maxwell AFB, AL: AFHRA, 30 March 1943.
 - . Damage Assessment, Clippings. Headquarters Army Air Forces. #118.952-1 Folder #2. Maxwell AFB, AL: AFHRA, Ca. 1 January 1944.
 - . Brief Analysis of Target Systems for Maximum Short-Term Effect on Germany's War Effort. In *COA History (Tab A of Tab 68)*. #118.02v2. Maxwell AFB, AL: AFHRA, 11 October 1943.
 - . Summary of Position of France, Belgium, and Netherlands in Axis Aircraft Production. War Department. #118.04B-3. Maxwell AFB, AL: AFHRA, 2 August 1943.
 - . Report of Committee of Operations Analysts with Respect to Economic Targets Within the Western Axis. War Department. #118.02v2. Maxwell AFB, AL: AFHRA, 8 March 1943.
 - . Meeting Minutes. War Department. #118.151-5B. Maxwell AFB, AL: AFHRA, 18 September 1943.
 - . Past Effectiveness and Future Prospects of Eighth Air Force Effort Under Pointblank. War Department. #118.01v2. Maxwell AFB, AL: AFHRA, 11 August 1943.
- Company, Minneapolis-Honeywell Regulator. *Here's How: Operation of the C-1 Autopilot*. Edited by Aeronautical Division. Minneapolis, MN: Minneapolis-Honeywell, 1944.
- Congress, United States. Hearings Before the United States Joint Committee on the Investigation of the Pearl Harbor Attack, Seventy-Ninth Congress, Second Session. Part 14. Joint Committee on the Investigation of the Pearl Harbor Attack, 1946.
- Copp, DeWitt S. *Forged in Fire: Strategy and Decisions in the Air War over Europe, 1940-45*. 1st ed., Garden City, NY: Doubleday, 1982.
- Crang, Jeremy A. "The Revival of the British Women's Auxiliary Services in the Late Nineteen-Thirties." *Historical Research* 83, no. 220 (2010): 343-357.
- Craven, Wesley Frank, and James Lea Cate, eds., *The Army Air Forces in World War II*. vol. 1, *Plans and Early Operations, January 1939 to August 1942*. Washington, DC: Office of Air Force History, 1983.
- , eds., *The Army Air Forces in World War II*. vol. 2, *Europe: Torch to Pointblank, August 1942 to December 1943*. Washington, DC: Office of Air Force History, 1983.
- , eds., *The Army Air Forces in World War II*. vol. 3, *Europe: Argument to V-E Day, January 1944 to May 1945*. Washington, DC: Office of Air Force History, 1983.
- , eds., *The Army Air Forces in World War II*. vol. 6, *Men and Planes*. Washington, DC: Office of Air Force History, 1983.
- Culton, Colonel H. G., Adjutant General. Memorandum, Subject: "CROSSBOW". Headquarters Eighth Air Force, Office of the Commanding General. #520.431A. Maxwell AFB, AL: AFHRA, 16 December 2017.
- D'Aniello, Dana. "Old Spies Tell Some Tales: Office of Strategic Services

- Predated CIA, Special Forces." *Washington Post*, 31 May 2004, A21.
- D'Olier, Franklin. Letter, D'Olier to Honorable Louis Johnson. War Department. #168.7024-18. Maxwell AFB, AL: AFHRA, 23 August 1949.
- Daft, Richard L., and Karl E. Weick. "Toward a Model of Organizations as Interpretation Systems." In *New Thinking in Organizational Behaviour: from Social Engineering to Reflective Action*, edited by Haridimos Tsoukas, xi, 254 p. Oxford; Boston: Butterworth-Heinemann, 1994.
- Daggett, Stephen. Costs of Major U.S Wars. Congressional Research Service. Washington, DC, 29 June 2010.
- Davies, Peter. "Geoffrey Vickers and Lessons from the Ministry of Economic Warfare for Cold War Defence Intelligence." *Intelligence and National Security* 31, no. 6 (2016/09/18 2016): 810-828.
- Davis, Richard G. *Bombing the European Axis Powers: A Historical Digest of the Combined Bomber Offensive, 1939-1945*. Maxwell Air Force Base, AL: Air University Press, 2006.
- . *Carl A. Spaatz and the Air War in Europe*. Edited by The Center for Air Force History. Washington, DC: U.S. GPO, 1993.
- Deac, Wil. "Australian Maverick Frederick Sidney Cotton Took an Innovative Approach to Aerial Reconnaissance." *Aviation History* 10, no. 6 (July 2000): 12.
- Department of Defense. Joint Publication 2-01: Joint and National Intelligence Support to Military Operations. 05 January 2012.
- . Joint Publication 3-03: Joint Interdiction. 9 September 2016.
- Director of Intelligence, Office of the. Minutes, Meeting of A-2s of American Air Forces in Europe. Headquarters United States Strategic Air Forces in Europe. #519.6041-1. Maxwell AFB, AL: AFHRA, 23 January 1945.
- Director of National Intelligence, Office of. "U.S. Intelligence Community Budget." DNI, Accessed 8 August 2016, <https://www.dni.gov/index.php/intelligence-community/ic-policies-reports/ic-policies-2>.
- Douhet, Giulio. *The Command of the Air*. Edited by Joseph P. Harahan and Richard H. Kohn. Translated by Dino Ferrari. 1942. Reprint, Tuscaloosa, AL: The University of Alabama, 1998.
- Downing, Taylor. *Spies in the Sky: The Secret Battle for Aerial Intelligence During World War II*. London, England: Little, Brown, 2011.
- Draft Memorandum: Intelligence Officers on Temporary Duty in Washington. War Department. #266.1. Washington, DC: United States Army Air Force, Ca. October 1942.
- Eaker, Ira. Letter, Eaker to Bissell. War Department. #830.289v1. Maxwell AFB, AL: AFHRA, 15 December 1943.
- . The Bomber Offensive From the United Kingdom (undated draft). Combined Chiefs of Staff. #168.61-10. Maxwell AFB, AL: AFHRA, ca. April 1943.
- . Message Arnold to Eaker. Manuscript Division. Washington, DC: Library of Congress, 15 December 1943.

- Eaker, Maj Gen Ira C. Memorandum to Commanding General, ETOUSA: Plan for Build-up and Employment of the Bomber Offensive, Eighth Air Force. In *Personal Collection of Gen Henry H. Arnold part 3 of 6*. MICFILM 28253. Maxwell AFB, AL: AFHRA, 18 April 1943.
- . Letter, Eaker to Arnold. #168.491v1. Maxwell AFB, AL: AFHRA, 30 January 1943.
- . Suggested Commentary... for The Combined Bomber Offensive From the United Kingdom. In *Personal Collection of Gen Henry H. Arnold part 3 of 6*. MICFILM 28253. Maxwell AFB, AL: AFHRA, ca. 16 April 1943.
- . Letter, Eaker to Perera; Subject: Response to Memorandum of 30 January 1943. War Department. #118.1511. Maxwell AFB, AL: AFHRA, 3 February 1943.
- . Presentation: Plan for Combined Bomber Offensive From the United Kingdom. In *Personal Collection of Gen Henry H. Arnold part 3 of 6*, Joint Chiefs of Staff (277). MICFILM 28253. Maxwell AFB, AL: AFHRA, 29 April 1943.
- . Personal Letter: Eaker to Kuter. War Department. #187.1-18. Maxwell AFB, AL: AFHRA, 22 July 1943.
- . Presentation of Combined Bomber Operations - United Kingdom. Headquarters Eighth Air Force. #168.61-10. Maxwell AFB, AL: AFHRA, ca. April 1943.
- . Letter of Instructions. Eighth Air Force. #168.61-10. Maxwell AFB, AL: AFHRA, 2 April 1943.
- . Letter, Eaker to McClelland. Manuscript Division. Washington, DC: Library of Congress, 10 January 1943.
- . Letter, Eaker to Arnold. Manuscript Division. Washington, DC: Library of Congress, 30 January 1943.
- . Letter, Eaker to Arnold. Manuscript Division. Washington, DC: Library of Congress, 15 October 1943.
- . Letter, Eaker to Arnold. Manuscript Division. Washington, DC: Library of Congress, 12 July 1943.
- . Letter, Eaker to Arnold. Manuscript Division. Washington, DC: Library of Congress, 12 June 1943.
- . Letter, Eaker to Arnold. Manuscript Division. Washington, DC: Library of Congress, 18 July 1943.
- . Letter, Eaker to Giles. War Department. AAG 312.1, Operations Letters, RG 18. Washington, DC: NA, 15 September 1943.
- . Letter, Eaker to Giles. AAG 312.1-H, Operations Letters, RG 18. Washington, DC: NARA, 29 June 1943.
- Ehlers, Robert. *Targeting the Third Reich: Air Intelligence and the Allied Bombing Campaigns*. Modern war studies. Lawrence, KS: University Press of Kansas, 2009.
- Ehlers, Robert S. "BDA: Anglo-American Air Intelligence, Bomb Damage Assessment, and the Bombing Campaigns Against Germany, 1914-1945." Dissertation, The Ohio State University, 2005.

- Eighth Air Force, A-2. Semi-monthly Report of Bombing Results, 1 August through 15 August 1943. Headquarters Eighth Air Force. #520.307. Maxwell AFB, AL: AFHRA, 28 August 1943.
- . Semi-monthly Report of Bombing Results, 16 September through 30 September 1943. Headquarters Eighth Air Force. #520.307. Maxwell AFB, AL: AFHRA, ca 1 October 1943.
- . Semi-monthly Report of Bombing Results, 16 August through 31 August 1943. Headquarters Eighth Air Force. #520.307. Maxwell AFB, AL: AFHRA, 2 September 1943.
- . Semi-monthly Report of Bombing Results, 1 October through 15 October 1943. Headquarters Eighth Air Force. #520.307. Maxwell AFB, AL: AFHRA, 26 October 1943.
- . Bi-monthly Report of Bombing Results, for the period of July 16 through July 31. Headquarters Eighth Air Force. #520.307. Maxwell AFB, AL: AFHRA, ca. 1 August 1943.
- Eighth Air Force, Headquarters. Summary by Target Categories. In *Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: First Phase*. #168.61-10. Maxwell AFB, AL: AFHRA, 1 July 1943.
- . Eighth Air Force Narrative of Operations, 233rd Operation. #520.332. Maxwell AFB, AL: AFHRA, 24 February 1944.
- . Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: August, 2nd Month of Second Phase. In *Heavy Bomber Operations*. #168.61-10. Maxwell AFB, AL: AFHRA, 1 October 1943.
- . Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: August, 2nd Month of Second Phase. In *Summary by Target Categories*. #168.61-10. Maxwell AFB, AL: AFHRA, 1 October 1943.
- . Summary by Target Category. In *Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: First Phase*. #168.61-10. Maxwell AFB, AL: AFHRA, 1 August 1943.
- . Effort Against Individual Targets. In *Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: First Phase*. #168.61-10. Maxwell AFB, AL: AFHRA, July 1943.
- . Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: September, 3rd Month of Second Phase. #168.61-10. Maxwell AFB, AL: AFHRA, 1 October 1943.
- . Bombing Accuracy. In *Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: First Phase*. #168.61-10. Maxwell AFB, AL: AFHRA, July 1943.
- . Statistical Summary of Eighth Air Force Operations, European Theater, 17 August 1942 - 8 May 1945. #520.308-1. Maxwell AFB, AL: AFHRA, 10 June 1945.
- . Review of Operational Considerations. In *Summary of Eighth Air Force*

- Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: First Phase.* #168.61-10. Maxwell AFB, AL: AFHRA, July 1943.
- . Reduction of Losses and Battle Damage: A Summary and Analysis of the Defensive Experience of VIII Bomber Command 17 August 1942 - 31 December 1943. Operational Research Section. #520.310-6. Maxwell AFB, AL: AFHRA, 12 February 1944.
- . B-17 Statistics. In *Summary of Eighth Air Force Heavy Bomber Operations as Called For in Combined Bomber Offensive Plan: First Phase.* #168.61-10. Maxwell AFB, AL: AFHRA, July 1943.
- Eighth Air Force, Office of the Director of Intelligence. Target Priorities of the Eighth Air Force, A Resume of the Bombardment Directives and Concepts Underlying Them. Headquarters Eighth Air Force. #520.323-1. Maxwell AFB, AL: AFHRA, 15 May 1945.
- Eisenhower, Dwight D. "Address 'The Chance for Peace' Delivered Before the American Society of Newspaper Editors." *The American Presidency Project* (16 April 1953).
<http://www.presidency.ucsb.edu/ws/index.php?pid=9819>.
- . *Crusade in Europe*. Garden City, NY: Doubleday, 1948.
- Ellis, C.D., Chairman of the Rocket Sub-committee. Memorandum for Colonel T.R.B. Sanders. In *Report by the Sanders Mission the Chairman of the Crossbow Committee*, The War Office. #505.58-32. Maxwell AFB, AL: AFHRA, 12 October 1944.
- Enemy Branch, Foreign Office, and Ministry of Economic Warfare. Appendix IX, Summary of Specific Commercial consignments passing to and from Balkan countries, March, 1944. In *Enemy Inland Transport Notes, No. 4.* #512.6111D. Maxwell AFB, AL: AFHRA, 17 July 1944.
- Enemy Objectives Unit. F.W. 190 Production at Bremen. #118.04-12. Maxwell AFB, AL: AFHRA, 30 June 1943.
- . Handbook of Target Information. Office of Strategic Services. #118.042-2. Maxwell AFB, AL: AFHRA, May 1943.
- Erwin, Sandra. "Joint-Service War Games Aim to Shape Pentagon Programs." *National Defense* 84, no. 558 (2000): 34-35.
- Eubank, Brig Gen Harper. Letter, Harper to Eaker. Manuscript Division. Washington, DC: Library of Congress, 31 March 1943.
- Faber, David. *Munich, 1938: Appeasement and World War II*. New York, NY: Simon & Schuster, 2009.
- Finney, Robert T. *History of the Air Corps Tactical School, 1920-1940*. USAF historical studies. Washington, DC: Center for Air Force History, 1992.
- . *History of the Air Corps Tactical School, 1920-1940*. Maxwell AFB, AL: Research Studies Institute, USAF Historical Division, Air University, 1955.
- Ford, Corey. *Donovan of OSS*. 1st ed., Boston, MA: Little, 1970.
- Fowler, H. W., F. G. Fowler, H. G. Le Mesurier, and James A. H. Murray. *The Concise Oxford Dictionary of Current English*. Oxford, England: Clarendon Press, 1938.

- Frank, Isaiah. Revised Statement on Grinding Wheel Plants and Objectives. War Department. #118.02v2. Maxwell AFB, AL: AFHRA, 22 January 1943.
- Futrell, Robert Frank. *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force*. Maxwell AFB, AL: Air University Press, 1989.
- Gartner, Scott Sigmund. *Strategic Assessment in War*. New Haven, CT: Yale University Press, 1997.
- Gaston, James C. *Planning the American Air War: Four Men and Nine Days in 1941: An Inside Narrative*. Washington, DC: National Defense University Press, 1982.
- Gates, Byron E. Memorandum, Analysis of Bombardment Objectives in Axis Europe. War Department. #118.161. Maxwell AFB, AL: AFHRA, 23 December 1942.
- . Memorandum for Sorensen, Motion pictures to supplement Committee report. War Department. #118.04A-5. Maxwell AFB, AL: AFHRA, 26 March 1943.
- . Memorandum to Maj Gen Fairchild. War Department. #118.161. Maxwell AFB, AL: AFHRA, 15 December 1942.
- German Economic Department, Foreign Office. Economic Intelligence Weekly. Landsdowne House. #512.611B. Maxwell AFB, AL: AFHRA, 1 August 1945.
- Giles, Maj Gen Barney M. Letter, Arnold to Eaker. AAG 312.1-G, Operations Letters, RG 18. Washington, DC: NARA, 11 June 1943.
- Gilpin, Robert, and Jean M. Gilpin. *Global Political Economy: Understanding the International Economic Order*. Princeton, NJ: Princeton University Press, 2001.
- Glynn, Mary Ann, and Rikki Abzug. "Institutionalizing Identity: Symbolic Isomorphism and Organizational Names." *The Academy of Management Journal* 45, no. 1 (2002): 267-280.
- Goodman, Dr. Michael S. "The Foundations of Anglo-American Intelligence Sharing." *Studies in Intelligence* 59 (June 2015): 2.
- Gouré, Daniel I. "Overview of the Competitive Strategies Initiative." In *Competitive Strategies for the 21st Century: Theory, History, and Practice*, edited by Thomas G. Mahnken. Stanford, CA: Stanford University Press, 2012.
- Grandstaff, Mark R. "Muir Fairchild and the Origins of Air University, 1945-46." *Airpower Journal* XI, no. 4 (1997, Winter).
- Grant, Rebecca. "Eisenhower, Master of Airpower." *Air Force Magazine* 83, no. 1 (2000): 62-67.
- Gray, Colin S. *Airpower for Strategic Effect*. Air University Series on Airpower and National Security. Maxwell Air Force Base, AL: Air University Press, February 2012.
- Green, Capt Norman E. Photo Interpretation. Combat Operations AAF School of Applied Tactics. #248.261-5. Maxwell AFB, AL: AFHRA, June 1945.
- Greer, Thomas H. *The Development of Air Doctrine in the Army Air Arm, 1917-*

1941. Special studies. Washington, DC: Office of Air Force History, U.S. Air Force, 1985.
- Griffith, Charles. *The Quest: Haywood Hansell and American Strategic Bombing in World War II*. Maxwell Air Force Base, AL: Air University Press, 1999.
- Griffith, Thomas E. *MacArthur's Airman: General George C. Kenney and the War in the Southwest Pacific*. Modern War Studies. Lawrence, KS: University Press of Kansas, 1998.
- Gropman, Alan L. *Mobilizing U.S. Industry in World War II: Myth and Reality*. McNair Paper. Edited by National Defense University. Institute for National Strategic Studies., Washington, DC: U.S. G.P.O., 1996.
- Gruen, Adam L. *Preemptive Defense: Allied Air Power Versus Hitler's V-weapons, 1943-1945*. Washington, DC: U.S. GPO, 1998.
<http://purl.access.gpo.gov/GPO/LPS47668>.
- Guerlain SA Département Internet. "L'Heure Bleue." Accessed 19 April 2017, <https://www.guerlain.com/us/en-us/fragrance/womens-fragrances/lheure-bleue>.
- Haas, Major Frederick. Factors in Germany's Defeat. Prisoner of War Intelligence Section Headquarters Mediterranean Allied Air Forces. #168.7026-7. Maxwell AFB, AL: AFHRA, 11 July 1945.
- Hall, David Ian. *Strategy for Victory: The Development of British Tactical Air Power, 1919-1943 (Praeger Studies in Diplomacy and Strategic Thought)*. Praeger, 2008.
- Hansell, Brig Gen Haywood S. Lecture to Air War College: "The Development of the United States Concept of Bombardment Operations". In *MS 6, Hansell Papers*. Series 3, Box 4, Folder 1. USAFA, CO: Clark Special Collections Branch, 16 February 1951.
- . Letter, Hansell to Sorensen. In *MS 6, Hansell Papers*. Series 2, Box 2, Notebook 1. USAF Academy, CO: Special Collections Branch, 11 February 1943.
- . Letter, Hansell to Fairchild. In *MS 6, Hansell Papers*. Series 2, Box 2, Notebook 1. USAF Academy, CO: Special Collections Branch, 11 February 1943.
- Hansell, Haywood S. *The Strategic Air War Against Germany and Japan: A Memoir*. Washington, DC: Office of Air Force History, 1986.
- . *The Air Plan that Defeated Hitler*. Atlanta, GA: Printed by Higgins-McArthur/Longino & Porter, 1972.
- Harlan, John M. The Operational Research Section at the Eighth Air Force. Headquarters Eighth Air Force. #520.303-1. Maxwell AFB, AL: AFHRA, 18 July 1944.
- Harris, Air Chief Marshal Sir Arthur T. Personal letter to Eaker. In *Personal Collection of Gen Henry H. Arnold part 3 of 6*, Headquarters Bomber Command. MICFILM 28253. Maxwell AFB, AL: AFHRA, 15 April 1943.
- Harris, Arthur Travers. *Despatch on War Operations, 23rd February 1942 to 8th May 1945*. Portland, OR: F. Cass, 1995.
- . *Bomber Offensive*. South Yorkshire, England: Pen & Sword Military

- Classics, 2005.
- Harris, Danielle. "GRU professor inducted into Morehouse College's Collegium of Scholars." Augusta University, Accessed 10 January 2017, <https://jagwire.augusta.edu/archives/15381>.
- Harrison, Gordon A. *Cross-Channel Attack*. Washington, DC: Department of the Army, 1951.
- Harwood, Jeremy. *World War Two From Above: An Aerial View of the Global Conflict*. Wollombi, AUS: Exisle Publishing, 2014.
- Hastings, Max. *Bomber Command*. Zenith Military Classics. Minneapolis, MN: Zenith Press, 2013.
- Headquarters 4th Bombardment Wing. Summary of Operations, Target: Kiel. #520.332. Maxwell AFB, AL: AFHRA, 13 June 1943.
- Herrmann, Hajo. *Eagle's Wings*. Stillwater, MN: Motorbooks International, 1991.
- Heuer, Richards J., Jr. *Psychology of Intelligence Analysis*. Center for the Study of Intelligence. Washington, DC: Central Intelligence Agency, 1999.
- Hinsley, F. H., and Michael Howard. *British Intelligence in the Second World War*. Vol. 1, New York, NY: Cambridge University Press, 1979.
- Hohn, Uta. "The Bomber's Baedeker - Target Book for Strategic Bombing in the Economic Warfare against German Towns 1943-45." *GeoJournal* 34, no. 2 (1994): 213-230.
- Holland, Colonel Harvey, H. Progress Report. Headquarters Air Intelligence School. #266.1. Maxwell AFB, AL: AFHRA, ca. 10 March 1943.
- Horne, John. *State, Society, and Mobilization in Europe During the First World War*. Studies in the Social and Cultural History of Modern Warfare. Cambridge: University Press, 1997.
- Houghton, Capt Arthur A. Jr. Memorandum, "Indoctrination Course". Headquarters Air Intelligence School. 266.1. Maxwell AFB, AL: AFHRA, 4 February 1943.
- Howard, Michael. *War in European History*. Updated ed., New York, NY: Oxford University Press, 2009.
- Hughes, Col Richard D'Oyly. Memoirs: Chapter VIII, 1941-1945. USAF. #520.056-234. Maxwell AFB, AL: AFHRA, 1957.
- Hull, Lt Col Harris B. Personal Letter to Colonel Lucius P. Ordway, Assistant Chief of Staff, A-2. Headquarters VIII Bomber Command. #520.6031. Maxwell AFB, AL: AFHRA, 13 December 1942.
- . Organization Chart, Asst. Chief of Staff, A-2. In *Report of Lt Col John T. McCall on Eighth Air Force*, Headquarters VIII Bomber Command. #520.601C V.1. Maxwell AFB, AL: AFHRA, ca. December 1942.
- . Memorandum to Commanding General, VIII Bomber Command, Subject: Organization of the Intelligence Section. In *Report of Lt Col John T. McCall on Eighth Air Force*, Headquarters VIII Bomber Command. #520.601C V.1. Maxwell AFB, AL: AFHRA, ca. December 1942.
- Hutchison, Maj D. W. Morale-Welfare of R.A.F., War Department. #168.7026-3. Maxwell AFB, AL: AFHRA, 27 October 1941.

- . The Photographic Reconnaissance Unit. War Department. #168.7026-3. Maxwell AFB, AL: AFHRA, 27 October 1941.
- . Central Interpretation Unit Training. War Department. #168.7026-3. Maxwell AFB, AL: AFHRA, 27 October 1941.
- . Photographic Training. War Department. #168.7026-3. Maxwell AFB, AL: AFHRA, 27 October 1941.
- Iklé, Fred Charles. *Every war must end*. 2nd rev. ed., New York: Columbia University Press, 2005.
- Intelligence Officer, 94th Bombardment Group. Memorandum for Commanding General, 4th Bombardment Wing, Subject: Resubmission of Claim for Encounter with E/A. Captain Joseph G. Butterworth. #527.332. Maxwell AFB, AL: AFHRA, 15 July 1943.
- Jervis, Robert. *Perception and Misperception in International Politics*. Princeton, NJ: Princeton University Press, 1976.
- Johnsen, William Thomas. *The Origins of the Grand Alliance: Anglo-American Military Collaboration from the Panay Incident to Pearl Harbor*. Battles and Campaigns. Lexington, KY: The University Press of Kentucky, 2016.
- Johnson, David E. *Fast Tanks and Heavy Bombers: Innovation in the U.S. Army, 1917-1945*. Ithaca, N.Y.: Cornell University Press, 1998.
- . *Modern U.S. Civil-Military Relations Wielding the Terrible Swift Sword*. Washington, DC: Institute for National Strategic Studies, National Defense University, 1997.
- Johnson, Lt Col L.W. Investigation -- AAF Air Intelligence School. Army Air Forces Technical Training Command (Greensboro Headquarters First District, North Carolina). #266.152-1. Maxwell AFB, AL: AFHRA, 18 March 1943.
- . Investigation of Conditions at AAF Air Intelligence School. AAF Technical Training Command. #266.152-1. Maxwell AFB, AL: AFHRA, 16 February 1943.
- Joint Chiefs of Staff. Joint Publication (JP) 1-02, Department of Defense Dictionary of Military and Associated Terms. Department of Defense, 8 November 2010 (amended 15 February 2016).
- Joint Intelligence Sub-Committee. Effects of Bombing Offensive on German War Effort. In *J.I.C. (43) 294 (Final)*, War Cabinet. #118.04-12. Maxwell AFB, AL: AFHRA, 22 July 1943.
- Joint Warfighting Center. Commander's Handbook for Joint Battle Damage Assessment. Office of the Secretary of Defense Joint Battle Damage Assessment Joint Test and Evaluation. Suffolk, VA: United States Joint Forces Command, 1 June 2004.
- Jones, R. V. *The Wizard War: British Scientific Intelligence, 1939-1945*. 1st American ed., New York, NY: Coward, McCann & Geoghegan, 1978.
- Kahn, David. "The Intelligence Failure of Pearl Harbor." *Foreign Affairs* 70, no. 5 (1991): 138.
- Kalb, Deborah, Gerhard Peters, and John T. Woolley. *State of the Union: Presidential Rhetoric from Woodrow Wilson to George W. Bush*.

- Washington, DC: CQ Press, 2007.
- Karl, Barry D. "Louis Brownlow." *Public Administration Review* 39, no. 6 (1979): 511-516.
- Katz, Barry. *Foreign Intelligence: Research and Analysis in the Office of Strategic Services, 1942-1945*. Cambridge, MA: Harvard University Press, 1989.
- Kaysen, Carl. Notes on Strategic Air Intelligence in World War II (ETO). The RAND Corporation. Santa Monica, Calif.: Project RAND, October 1949.
- Kerr, Paul K., Mary Beth D. Nikitin, and Steven A. Hildreth. "Iran-North Korea-Syria Ballistic Missile and Nuclear Cooperation." *Current Politics and Economics of the Middle East* 5, no. 1 (2014): 1-16.
- Kim, Susanna M. "Dual Identities and Dueling Obligations: Preserving Independence in Corporate Representation." *Tennessee Law Review* 68, no. 2 (Winter 2001): 80.
- Kindleberger, Charles Poor. Memorandum for Colonel R.D. Hughes, Subcommittee Reports to the Committee of Operational Analysts. In *Personal Collection of Gen Henry H. Arnold part 3 of 6*, American Embassy Office of Strategic Services, Economic Warfare Division. MICFILM 28253. Maxwell AFB, AL: AFHRA, 7 April 1943.
- . Letter to Chandler Morse and Phil Coombs. Office of Strategic Services. #118.04-12. Maxwell AFB, AL: AFHRA, 30 June 1943.
- . "Oral History Interview with Charles P. Kindleberger." By Richard D. McKinzie (16 July 1973).
- . *The World in Depression, 1929-1939*. Berkeley, CA: University of California Press, 1986.
- Knight, Charlotte. "Ask Them Another." *Air Force* 28, no. 8 (1945): 30-31, 34, 60.
- Koenig, Colonel E. F. Final Report to Commanding General, First District, AAFTTC. (PA) Headquarters Air Intelligence School (Harrisburg. #266.1-1. Maxwell AFB, AL: AFHRA, 30 September 1942.
- Komrower, Shirley. "IWM Interview, Oral History." By David Mander. *Second World War*, no. #22107 (2001).
- Kozak, Warren. *LeMay: The Life and Wars of General Curtis LeMay*. Washington, DC: Regenery Pub., 2009.
- Kreis, John F. *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II*. Bolling AFB, Washington, DC: Air Force History and Museums Program, 1996.
- Kuhn, Thomas S. *The Structure of Scientific Revolutions*. International Encyclopedia of Unified Science Foundations of the Unity of Science, v 2, no 2. 3rd ed., Chicago, IL: University of Chicago Press, 1996.
- Kuter, Laurence S. Personal Letter: Kuter to Eaker. War Department. #187.1-18. Maxwell AFB, AL: AFHRA, 6 July 1943.
- . Memorandum, Kuter to Arnold. War Department. #118.201-6. Maxwell AFB, AL: AFHRA, 6 August 1943.
- . Memorandum, AC/AS Plans to AC/AS Intelligence; Subject: Combined Bomber Offensive. #145.81-140. Maxwell AFB, AL: AFHRA, 25 October

- 1943.
- . Letter, Kuter to Hansell. In *MS 6, Hansell Papers*. Series 2, Box 2, Notebook 1. USAF Academy, CO: Clark Special Collections Branch, 28 January 1943.
- . Address to Air War College: Organization of Top Echelons in World War II. In *MS 18, Kuter Papers*. USAF Academy, CO: Clark Special Collections Branch, 28 February 1949.
- Landauer, Carl. "A Break in Keynes's Theory of Interest." *The American Economic Review* 27, no. 2 (1937): 260-266.
- Larrabee, Eric. *Commander in Chief: Franklin Delano Roosevelt, His Lieutenants, and Their War*. 1st Touchstone ed., New York: Simon & Schuster, 1988.
- Leff, Mark H. "The Politics of Sacrifice on the American Home Front in World War II." *The Journal of American History* 77, no. 4 (1991): 1296-1318.
- LeMay, Colonel Curtis E. Tactical Reports of Mission, Hls, Germany, 22 June 1943 to Commanding General, VIII Bomber Command. 4th Bombardment Wing Headquarters. #520.332. Maxwell AFB, AL: AFHRA, 29 June 1943.
- . Memorandum, Subject: Difficulties encountered on Shuttle Raid, Landing at North Africa Bases. 4th Bombardment Wing Headquarters. #168.61-10. Maxwell AFB, AL: AFHRA, 29 August 1943.
- Levine, Alan J. *The Strategic Bombing of Germany, 1940-1945*. Westport, CT: Praeger, 1992.
- Lewis, David E. "Presidents and the Politics of Agency Design: Political Insulation in the United States Government Bureaucracy, 1946-1997." (2003).
- Lewis Powell Dies. In *All Things Considered*, 1. Washington, DC: NPR, 25 August 1998.
- Liddell Hart, Basil Henry. *Paris or The Future of War*. Today and Tomorrow Series. Edited by Oliver Wendell Holmes. New York, NY: E.P. Dutton, 1925.
- . *Strategy*. 2nd rev. ed., New York, NY: Meridian, 1991.
- Lockwood, John Hoyt. *Western Massachusetts, A History, 1636-1925*. 3 vols. Vol. 3, New York, NY & Chicago, IL: Lewis Historical Publ. Co., 1926.
- Loutzenheiser, Joe L. Memorandum, AC/AS Plans to AC/AS Intelligence. #145.81-144v2. Maxwell AFB, AL: AFHRA, 4 March 1944.
- Lowe, Captain James T. Memodandum for General Sorensen, Western Axis Rubber Position 1943. Committee of Operations Analysts. #187.2. Maxwell AFB, AL: AFHRA, 2 July 1943.
- . Memo for General Sorensen; Subject: Bomb Damage Assessments. War Department. #187.1-18. Maxwell AFB, AL: AFHRA, 6 July 1943.
- Luttwak, Edward. *Strategy: The Logic of War and Peace*. Rev. and enl. ed., Cambridge, MA: Belknap Press of Harvard University Press, 2001.
- MacIsaac, David. *Strategic Bombing in World War Two: The Story of the United States Strategic Bombing Survey*. New York: Garland Pub. Co., 1976.
- MacPherson, Nelson. *American Intelligence in War-Time London: The Story of the*

- OSS. Portland, OR: Frank Cass Publishers, 2003.
- Magee, John Gillespie, Jr. "High flight." *All Hands*, Apr 2003, 7.
- March, James G. "How We Talk and How We Act: Administrative Theory and Administrative Life." In *New Thinking in Organizational Behaviour: from Social Engineering to Reflective Action*, edited by Haridimos Tsoukas, xi, 254 p. Oxford ; Boston: Butterworth-Heinemann, 1994.
- Mark, Eduard Maximilian. *Aerial Interdiction: Air Power and the Land Battle in Three American Wars*. Washington, DC: Center for Air Force History, 1994.
- Marshall, General George C. Military Education: The Air Corps Intelligence School. War Department. #266.1. Maxwell AFB, AL: AFHRA, undated.
- Marshall, George Catlett. "We Cannot Delay," *July 1, 1939-December 6, 1941*. The Papers of George Catlett Marshall. Edited by Larry I. Bland and Sharon Ritenour Stevens. Vol. 2, Baltimore, MD: Johns Hopkins University Press, 1986.
- . "Aggressive and determined leadership," *June 1, 1943-December 31, 1944*. The Papers of George Catlett Marshall. Edited by Larry I. Bland and Sharon Ritenour Stevens. Vol. 4, Baltimore, MD: Johns Hopkins University Press, 1996.
- Mason, Dr. Edward S. Memorandum, Proposed Selection on European Industrial Targets. Committee of Operations Analysts. #118.04W. Maxwell AFB, AL: AFHRA, 19 January 1943.
- Matloff, Maurice. *The 90-Division Gamble*. Washington, DC: Center of Military History, U.S. Army, 1990.
- . *Strategic Planning for Coalition Warfare, 1943-1944*. Washington, DC: Office of the Chief of Military History, Dept. of the Army, 1959.
- , ed. *United States Army in World War II. Strategic Planning for Coalition Warfare*. Washington, DC: United States Army Center of Military History, 1994.
- Maurer, Maurer. *The U.S. Air Service in World War I*. 4 vols., Maxwell AFB, AL: AFHRA, 1978.
- McArthur, Charles W. *Operations Analysis in the U.S. Army Eighth Air Force in World War II*. History of Mathematics. Providence, RI: American Mathematical Society, 1990.
- McClelland, Brig Gen H. M. Letter, McClelland to Eaker. Manuscript Division. Washington, DC: Library of Congress, 15 February 1943.
- McClendon, Earl A. *Autonomy of the Air Arm*. Air Force History Support Office. Bolling AFB, Washington, DC, 1996.
- McCloskey, Joseph F. "The Beginnings of Operations Research: 1934-1941." *Operations Research* 35, no. 1 (1987): 143-152.
- McFarland, Stephen Lee. *America's Pursuit of Precision Bombing, 1910-1945*. Smithsonian History of Aviation Series. Washington: Smithsonian Institution Press, 1995.
- McFarland, Stephen Lee, and Wesley Phillips Newton. *To Command the Sky: The Battle for Air Superiority Over Germany, 1942-1944*. Tuscaloosa, AL:

- The University of Alabama Press, 2006.
- McNarney, Brigadier General Joseph T. Memorandum from Acting Assistant Chief of Staff, War Plans Division, to the Assistant Chief of Staff, G-2: 'Responsibility of the Military Intelligence Division for Air Intelligence'. War Department. #203-6. Maxwell AFB, AL: AFHRA, 24 April 1941.
- Meilinger, Phillip S. "Air Strategy: Targeting for Effect." 13, no. 4 (1999): 48.
- . "A History of Effects-Based Air Operations." *The Journal of Military History* 71, no. 1 (2007): 139-167.
- Air Force History and Museums Program. *Ten Propositions Regarding Air Power*, 1995.
- . *Bomber: The Formation and Early Years of Strategic Air Command*. Maxwell Air Force Base, AL: Air University Press, 2012.
- Merrifield, Ralph. "IWM Interview, Oral History." By Barrington Grey. *Second World War*, no. #23159 (1971).
- Mets, David R. *The Air Campaign: John Warden and the Classical Airpower Theorists*. Rev. ed., Maxwell, AL: Air University Press, 1999.
- . *Master of Airpower: General Carl A. Spaatz*. Novato, CA: Presidio Press, 1988.
- Meyer, John W., and Brian Rowan. "Institutionalized Organizations: Formal Structure as Myth and Ceremony." *American Journal of Sociology* 83, no. 2 (1977): 340-363.
- Middle East Interpretation Unit, Wing Commander Commanding. Photographs - Ninth Bomber Command. #533.923-1. Maxwell AFB, AL: AFHRA, 12 August 1943.
- Middlebrook, Martin. *The Schweinfurt-Regensburg Mission*. U.S. ed., New York: Scribner, 1983.
- Mierzejewski, Alfred C. *The Collapse of the German War Economy, 1944-1945: Allied Air Power and the German National Railway*. Chapel Hill, NC: University of North Carolina Press, 1988.
- Miles, Brig Gen Sherman. Memorandum from Military Intelligence Division, G-2 to the Chief of Staff, War Department: "Delineation of responsibility for intelligence studies between the Air Corps and the Military Intelligence Division". #203-6v.5 part 2. Maxwell AFB, AL: AFHRA, May 14, 1941.
- . Memorandum from Military Intelligence Division, G-2 to the Chief of Staff, War Department: 'Delineation of Responsibility for Intelligence Studies Between the Air Corps and the Military Intelligence Division, W.D.G.S.'. War Department. #203-6v.5 part 2. Maxwell AFB, AL: AFHRA, 11 August 1941.
- . Memorandum from Military Intelligence Division, G-2 to the Chief of Staff, War Department: "Responsibility of the Military Intelligence Division for Air Intelligence". #203-6v.5 part 2. Maxwell AFB, AL: AFHRA, 18 April 1941.
- Milner, Fred C. Operations Analysis Memorandum to all Commanding Generals, All Air Forces, All Army Forces Commands. USAAF. Maxwell AFB, AL: AFHRA, 24 Oct 1942.

- Ministry of Economic Warfare. M.E.W. Intelligence Weekly. #512.607A. London, England: AFHRA, 12 August 1943.
- . M.E.W. Intelligence Weekly. #512.607A. London, England: AFHRA, 8 July 1943.
- . M.E.W. Intelligence Weekly. #512.607A. London, England: AFHRA, 29 February 1944.
- . M.E.W. Intelligence Weekly. #512.607A. London, England: AFHRA, 22 July 1943.
- . Memorandum, Detailed Commentary on 'Report of the Committee of Operations Analysis: March 8th 1943'. In *Personal Collection of Gen Henry H. Arnold part 3 of 6*. MICFILM 28253. Maxwell AFB, AL: AFHRA, 4 April 1943.
- . The Bomber's Baedeker. In *Guide to the Economic Importance of German Towns & Industries*, Enemy Branch. #512.611-39. Maxwell AFB, AL: AFHRA, January 1943.
- Ministry of Home Security. Reconstruction Report, Messerschmitt A G Regensburg - Prufening, Germany. Research and Experiments Department. #519.332. Maxwell AFB, AL: AFHRA, 12 October 1943.
- . Raid Assessment Report, Ball Bearing Plants, Schweinfurt, Germany. Research and Experiments Department. #519.332. Maxwell AFB, AL: AFHRA, undated, ca. 17 August 1943.
- Miser, Hugh J. "The Easy Chair: Is OR/MS a Profession?". *Interfaces* 31, no. 4 (2001): 17-21.
- Moltke, Helmuth Graf von. *Moltke on the Art of War: Selected Writings*. Novato, CA: Presidio Press, 1993.
- Morgan, Gareth. "Organizations as Flux and Transformation." Chap. 7 In *New Thinking in Organizational Behaviour: from Social Engineering to Reflective Action*, edited by Haridimos Tsoukas, xi, 254 p. Oxford ; Boston: Butterworth-Heinemann, 1994.
- Morse, Chandler. Letter, Morse to Perera. Office of Strategic Services. #118.042-2. Maxwell AFB, AL: AFHRA, 22 May 1943.
- National Security Agency, and Central Security Service. *ULTRA: History of U.S. Strategic Air Force Europe vs. German Air Force*. Vol. SRH-013, Washington, D.C.: Held by AFHSO, June 1945.
- Nelson, Colonel O. L. . Memorandum for Commanding General, AAF: Revision of the Current Military Program. War Department. #187.1-18. Maxwell AFB, AL: AFHRA, 1 July 1943.
- Norcross, Lt Col Carl, H. Memorandum for the Assistant Chief of Staff, A-2: Army Air Force Intelligence School. D.C.) Headquarters War Department (Washington. 266.1-1. Maxwell AFB, AL: AFHRA, 22 January 1943.
- . Additional Briefing Material on Target GH 5477. 3rd Bombardment Division. #527.332. Maxwell AFB, AL: AFHRA, 26 September 1943.
- Notes on Meeting with General Andrews. Eighth Air Force. #168.61-10. Maxwell AFB, AL: AFHRA, 8 April 1943.
- Notes on Meeting with General Eaker. Eighth Air Force. #168.61-10. Maxwell

- AFB, AL: AFHRA, 5 April 1943.
- Notes on Meeting with General Eaker. Eighth Air Force. #168.61-10. Maxwell AFB, AL: AFHRA, 3 April 1943.
- OCAC, A-2. Memorandum from Intelligence Division, Office of the Chief of Air Corps to Assistant Chief of Staff, G-2: 'Digest of Information Received'. War Department. #203-6. Maxwell AFB, AL: AFHRA, February 13, 1941.
- Odom, William E. *Fixing Intelligence: For a More Secure America*. New Haven, CT: Yale University Press, 2003.
- Offer, Avner. *The First World War: An Agrarian Interpretation*. New York: Oxford University Press, 1989.
- Office Chief of Air Service (OCAS), A-2. Basis for Air Intelligence for an Air Estimate of the Situation - Europe. 10. #203-6v5 part 2. Maxwell AFB, AL: AFHRA, March 22, 1941.
- Office of Statistical Control. Army Air Forces Statistical Digest - World War II. United States Air Force, 313. Maxwell AFB, AL: AFHRA, 1945.
- Office of Strategic Services. Bomb Assessment (Draft). War Department. #187.1-19. Maxwell AFB, AL: AFHRA, 22 July 1943.
- . Strategic Air Bombardment Evaluation (Basic Considerations). OSS. #187.2-30. Maxwell AFB, AL: AFHRA, undated ca. July 1943.
- . Bomb Damage Report. War Department. #187.2-16. Maxwell AFB, AL: AFHRA, 19 August 1943.
- . Bomb Damage Report. War Department. #187.2-16. Maxwell AFB, AL: AFHRA, 25 October 1943.
- . Bomb Damage Report. War Department. #187.2-16. Maxwell AFB, AL: AFHRA, 18 September 1943.
- Officer, Lawrence H. Review of International Monetary Economics, 1870-1960: Between the Classical and the New Classical., M. June Flanders. *The Journal of Economic History* 50, no. 3 (1990): 779-781.
- Olsen, John Andreas. *John Warden and the Renaissance of American Air Power*. Washington, DC: Potomac Books, 2007.
- Operational Analysis Section. Report on Bombing Accuracy, Eighth Air Force, 1 September 1944 to 31 December 1944. Headquarters Eighth Air Force. #520.310v9. Maxwell AFB, AL: AFHRA, 20 April 1945.
- Operational Research Section. Operations Analysis Report: Memorandum on Methods of Analysis and Reliability of Measures Employed by ORS, Eighth Air Force, in the Study of Bombing Accuracy. Headquarters Eighth Air Force. #520.310. Maxwell AFB, AL: AFHRA, 4 October 1944.
- . Memorandum on Salvo and Intervalometer Releases. Headquarters Eighth Air Force. #520.310v.7. Maxwell AFB, AL: AFHRA, 16 September 1944.
- Operational Research Section, Eighth Air Force. ORS Interrogation of Evaders. #520.362. Maxwell AFB, AL: AFHRA, 28 January 1944.
- Ordnance, Office of Chief of. Power of Demolition Bombs. Air Corps Tactical School. #248-6892-14. Maxwell AFB, AL: AFHRA, 18 August 1927.
- Overy, R. J. *The Air War, 1939-1945*. Cornerstones of Military History. 1980.

- Reprint, Washington, DC: Potomac Books, Inc., 2005.
- Paret, Peter, Gordon Alexander Craig, Felix Gilbert, and Gordon A. Craig. *Makers of Modern Strategy: From Machiavelli to the Nuclear Age*. Princeton, NJ: Princeton University Press, 1986.
- Parton, James. *Air Force Spoken Here: General Ira Eaker and the Command of the Air*. Edited by Air Force Historical Foundation. Reprint ed., Maxwell Air Force Base, AL: Air University Press, 2000.
- Pearson, Colonel William F. Memorandum for Colonel Westover. Office of the Director of Air Service Administrative Executive. #203-6v2. Maxwell AFB, AL: AFHRA, 7 April 1920.
- Perera, Col Guido R. Memoirs: Washington and War Years. #168.7042. Maxwell AFB, AL: AFHRA, 1973.
- . Memo for Major General Eaker; Subject: General Kuter's letter of 6th July. War Department. #187.1-18. Maxwell AFB, AL: AFHRA, 20 July 1943.
- . Personal Letter to Brigadier General Lawrence Kuter. War Department. #187.1-18. Maxwell AFB, AL: AFHRA, 22 July 1943.
- . Memorandum for Brig Gen Gates. War Department. #118.111. Maxwell AFB, AL: AFHRA, 15 July 1943.
- . Memorandum for Maj Gen Eaker. War Department. #118.1511. Maxwell AFB, AL: AFHRA, 30 January 1943.
- . History of the Organization and Operations of the Committee of Operations Analysts. 122. #118.01 v.1. Maxwell AFB, AL: AFHRA, 1944.
- . HQ AAF Routing and Record Sheet, Overtime for Civilian Employees. HQ AAF. #118.161. Maxwell AFB, AL: AFHRA, 16 January 1943.
- . Memorandum of Conference with Major General I. C. Eaker. In *Meeting at Widewings (COA History Tab 18)*, Committee of Operations Analysts. #118.02v2. Maxwell AFB, AL: AFHRA, 4 February 1943.
- Perera, Col Guido R., and Lt Col W. B. Leach. Memorandum to General Fairchild, Timing of Economic Effect of Attacks Contemplated by Eighth Air Force Plan: Submarines. Committee of Operations Analysts. #118.04-4 V.1. Maxwell AFB, AL: AFHRA, 5 May 1943.
- Perera, Col Guido R., Lt Col W. B. Leach, and Brig Gen Byron E. Gates. Suggested Bombardment Program in Preparation for Overlord. In *COA History (Tab 68)*, Committee of Operations Analysts. #118.02v2. Maxwell AFB, AL: AFHRA, 25 October 1943.
- Perera, Col Guido R., Lt Col W. B. Leach, and Fowler Hamilton. Memorandum of Conference with Mr. O. L. Lawrence, Chief of Objectives Department, Ministry of Economic Warfare. In *COA History (Tab 14)*, Committee of Operations Analysts. #118.02v2. Maxwell AFB, AL: AFHRA, 2 February 1943.
- Perret, Geoffrey. *Winged Victory: The Army Air Forces in World War II*. 1st ed., New York, NY: Random House, 1993.
- Portal, Air Chief Marshal Sir Charles. Enclosure 'A', Plan for the Combined Bomber Offensive from the United Kingdom. Whitehall Air Ministry.

- #118.04W. Maxwell AFB, AL: AFHRA, 15 April 1943.
- Posen, Barry. *The Sources of Military Doctrine: France, Britain, and Germany Between the World Wars*. Cornell Studies in Security Affairs. Ithaca: Cornell University Press, 1984.
- Powaski, Ronald E. *The Cold War: The United States and the Soviet Union, 1917-1991*. New York, NY: Oxford University Press, 1998.
- Powell, Lewis F, Jr. "Interview with Justice Lewis F. Powell, Jr." By Richard H. Kohn and Diane T. Putney. *Air Force Oral History* (23 January 1985).
- . Notes on Operational Intelligence Division of Directorate of Intelligence, USSTAF. A-2 United States Strategic Air Forces in Europe. #519.600. Maxwell AFB, AL: AFHRA, ca. May 1945.
- Powys-Lybbe, Ursula. *The Eye of Intelligence*. London, England: W. Kimber, 1983.
- Price, G. Bailey. "Gremlin Hunting in Eighth Air Force." In *Operations Analysis in the Eighth Air Force, 1942-1945: Four Contemporary Accounts*, edited by Hugh J. Miser. Linthicum, MD: INFORMS, 1997.
- Price, G. Baley. A Mathematician Describes His Work as an Operations Analyst with the Eighth Air Force. Headquarters Eighth Air Force. #520.310-7. Maxwell AFB, AL: AFHRA, Winter 1945-1946.
- Putney, Diane T., ed. *USAF War Studies. ULTRA and the Army Air Forces in World War II: An Interview with Associate Justice of the U.S. Supreme Court Lewis F. Powell, Jr.* Office of Air Force History: Washington, DC, 1987.
- RAF. Photographic Reconnaissance, May 1941-Aug 1945. The National Archives. Kew, England: PRO, 1948.
- Rast, Vicki J. *The Air University Pantheon of Air, Space, and Cyberspace Power Thinkers*. Maxwell AFB, AL: Air University Press, 2009.
- Reisman, Arnold, and Muhittin Oral. "Soft Systems Methodology: A Context within a 50-Year Retrospective of OR/MS." *Interfaces* 35, no. 2 (2005): 164-178.
- Richards, Denis. *Portal of Hungerford: The Life of Marshal of the Royal Air Force Viscount Portal of Hungerford KG, GCB, OM, DSO, MC*. New York, NY: Holmes & Meier, 1977.
- Riddell, P. J. A. "Photographic Reconnaissance and Intelligence." *Royal United Services Institution. Journal* 90, no. 557 (1945/02/01 1945): 79-92.
- Rigg, Brian Mark. "Half-Jewish Field Marshal Erhard Milch." *World War II*, Jan 2004 2004, 72-72,74,76,96.
- Robbins, R. F. Memorandum as to Conversation with Mr. Frank of Office of Strategic Services and his Memo with Reference Thereto. War Department. #118.02v2. Maxwell AFB, AL: AFHRA, 7 June 1943.
- "Robot Nemesis a Woman: WAAF Photo Interpreter First Spotted Bomb 18 Months Ago." *New York Times*, 10 September 1944.
- Rosen, Stephen Peter. *Winning the Next War: Innovation and the Modern Military*. Cornell Studies in Security Affairs. Ithaca: Cornell University Press, 1991.

- . "Competitive Strategies: Theoretical Foundations, Limits, and Extensions." In *Competitive Strategies for the 21st Century: Theory, History, and Practice*, edited by Thomas G. Mahnken. Stanford, CA: Stanford University Press, 2012.
- Ross, Stewart Halsey. *Strategic Bombing by the United States in World War II: the Myths and the Facts*. Jefferson, NC: McFarland & Co., 2003.
- Rostow, W. W. "Waging Economic Warfare from London." *Studies in Intelligence* 7, no. 1 (1992): 73-79.
- . OSS War Diary Vol. 5, 13 September 1942 - 30 April 1945. In *Economic Outpost With Economic Warfare Division R&A Branch*. #520.056-167. Maxwell AFB, AL: AFHRA, ca. 30 April 1945.
- . "Oral History Interview #364 with Walt W. Rostow." *Project Corona Harvest*, no. Document Number 0016244 (17 October 1970): 6.
- . *The Beginnings of Air Targeting*. Central Intelligence Agency. College Park, MD: National Archives, 1963.
- . *Pre-Invasion Bombing Strategy: General Eisenhower's Decision of March 25, 1944*. Ideas and action series. 1st ed., Austin, TX: University of Texas Press, 1981.
- Rouch, John T. "Assessing Airpower's Effects: Capabilities and Limitations of Real-Time Battle Damage Assessment." 2002.
- Royal Geographical Society. *Everest: Summit of Achievement*. New York, NY: Simon & Schuster, 2003.
- Ruskin, John. *The Seven Lamps of Architecture*. London, England: Chiswick Press, 1880.
- Sanders, Colonel Terence R.B. Investigation of the 'Heavy' Crossbow Installations in Northern France. In *Report by the Sanders Mission the Chairman of the Crossbow Committee*. #505.58-32. Maxwell AFB, AL: AFHRA, 21 February 1945.
- Schein, Edgar H. "The Role of the Founder in Creating Organizational Culture." *Readings in Managerial Psychology* 278 (1989).
- School, Army Air Forces Air Intelligence. *Photo Intelligence for Combat Aviation*. Harrisburg, PA: United States Army Air Forces, 1942.
- Sedgwick, A. "Ploesti Smashed - 300 Tons Rain on Major Gasoline Source of Reich Air Force." *The New York Times*, 2 August 1943.
- Shiner, John F. *Foulois and the U.S. Army Air Corps, 1931-1935*. Washington, DC: AFHSO, 1984.
- Shrader, Charles R. *History of Operations Research in the United States Army*. CMH pub. Edited by Office of the Deputy Under Secretary of the Army for Operations Research. Washington, DC: U.S. Army, 2006.
- Singer, Benjamin D. "Crazy Systems and Kafka Circuits." *Social Policy* 11, no. 2 (1980): 46-54.
- Sink, 1st Lt William F., Base Photographic Officer. Mission Camera Report. 3rd Bombardment Division. #527.332. Maxwell AFB, AL: AFHRA, 27 September 1943.
- . Photo & Bomb Plotting Report. 3rd Bombardment Division. #527.332.

- Maxwell AFB, AL: AFHRA, 27 September 1943.
- Slany, William Z., Richardson Dougall, United States Department of State, and Office of the Historian. "Foreign Relations of the United States, 1943." (1970).
- Slessor, John Cotesworth. *Air Power and Armies*. Tuscaloosa, AL: University of Alabama Press, 2009.
- Sorensen, Edgar P. Memorandum to All Eighth Air Force Subordinate Commanding Generals. HQ AAF War Department. #520.603-1. Maxwell AFB, AL: AFHRA, 3 October 1942.
- . Letter, Sorensen to MacDonald. HQ AAF War Department. #520.603-1. Maxwell AFB, AL: AFHRA, 2 October 1942.
- . Memorandum, Cooperation with the Office of Assistant Chief of Staff, G-2. War Department. 203-6v6. Maxwell AFB, AL: AFHRA, 6 September 1943.
- . Memorandum, The Method of Computing Sortie Requirements. War Department. #118.04-9A. Maxwell AFB, AL: AFHRA, 20 March 1943.
- . Letter, Sorensen to Kuter. In *MS 6, Hansell Papers*. Series 2, Box 2, Notebook 1. USAF Academy, CO: Clark Special Collections Branch, 3 January 1943.
- Spaatz, Carl A. Letter, Spaatz to Arnold. #145.81-140. Maxwell AFB, AL: AFHRA, 5 February 1944.
- . Comments on Air Intelligence Items. War Department. #203-6. Maxwell AFB, AL: AFHRA, 11 July 1941.
- . Letter, Spaatz to Eisenhower. Headquarters United States Strategic Air Forces in Europe. #519.6041-1. Maxwell AFB, AL: AFHRA, ca. 23 January 1945.
- . Letter, Spaatz to Arnold. #145.81-140. Maxwell AFB, AL: AFHRA, 20 April 1944.
- . Letter, Spaatz to Arnold. #145.81-140. Maxwell AFB, AL: AFHRA, 5 April 1944.
- Spellman, Barbara A. "Individual Reasoning." In *Intelligence Analysis: Behavioral and Social Scientific Foundations*, edited by Baruch Fischhoff and Cherie Chauvin. Washington, DC: National Academies Press, 2011.
- Staff, War Department General. *Field Service Regulations, United States Army, 1923*. Washington, DC: War Department, 1924.
- Stanley, Roy M. *V-Weapons Hunt: Defeating German Secret Weapons*. Barnsley: Pen & Sword Military, 2010.
- . *World War II Photo Intelligence*. New York, NY: Scribner, 1981.
- States, United. *Administrative Management: Report of the President's Committee.*, Washington, DC: U.S. GPO, 1937.
- Statistical Control Division. AAF Bombing Accuracy. USAAF. #134.71-83. Maxwell AFB, AL: AFHRA, 31 March 1945.
- Stewart, Richard W. *American Military History*. Army Historical Series. Vol. 2, Washington, D.C.: United States Army Center of Military History, 2005.
- Stratemeyer, Maj Gen George E. Personal Letter to Ira Eaker. HQ AAF.

- Washington, DC: AFHSO, 23 March 1943.
- Straubel, Lt Col James H. "Cross Country." *Air force: Official Service Journal of the U.S. Army Air Forces*. 26, no. 10 (1942).
- Strong, George V. Memorandum by Direction of the Secretary of War to the Chief of the Air Corps: 'Air Corps Intelligence'. War Department. #203-6. Maxwell AFB, AL: AFHRA, October 5, 1939.
- . Memorandum, Organization of Military Intelligence Division. War Department. 203-6v6. Maxwell AFB, AL: AFHRA, 30 August 1943.
- Sui, Daniel Z. *Geospatial Technologies and Homeland Security: Research Frontiers and Future Challenges*. The GeoJournal Library. Dordrecht, Netherlands: Springer, 2008.
- Supreme Headquarters Allied Expeditionary Force, G-2 (Intelligence) Division. Evaluation of Rail Centre Attacks. #168.7026-6. Maxwell AFB, AL: AFHRA, 20 May 1944.
- Symposium, Military History. "The Intelligence Revolution: A Historical Perspective." Paper presented at the Proceedings of the Thirteenth Military History Symposium, U.S. Air Force Academy, Colorado Springs, CO, 1991 October 12-14, 1988.
- Tedder, Arthur William. *Air Power in War*. Tuscaloosa, AL: University of Alabama Press, 2010. Originally published: London: Hodder and Stoughton, 1947.
- Tedder, Arthur William Tedder. *With Prejudice: The War Memoirs of Marshal of the Royal Air Force, Lord Tedder*. Boston, MA: Little, Brown, 1967.
- The Command and General Staff School. Conference: Effectiveness of Demolition Bombs Against Specified Objectives. War Department. #118.201-6. Maxwell AFB, AL: AFHRA, 14 September 1938.
- The Rockefeller Foundation. Annual Report. New York, NY: The Rockefeller Foundation, 1935.
- The White House. "Remarks by the President at the NAACP Conference." news release, 14 July 2015, <https://www.whitehouse.gov/the-press-office/2015/07/14/remarks-president-naacp-conference>.
- Thornhill, Paula G. *"Over Not Through": The Search for a Strong, Unified Culture for America's Airmen*. Occasional Paper. Edited by Project Air Force. Santa Monica, CA: Rand Corporation, 2012.
- Thorpe, Nick, and King of Romania Michael I. "Nobody Lifted a Finger." *Hungarian Review*, no. 06 (2011): 29-36.
- Trachtenberg, Marc, David Rosenberg, and Stephen Van Evera. "An Interview with Carl Kaysen." Working Papers, *MIT Security Studies Program* (1988). http://web.mit.edu/ssp/publications/working_papers/Kaysen_working_paper.pdf.
- Troy, Thomas F. *The Coordinator of Information and British Intelligence (An Essay on Origins)*. Central Intelligence Agency. College Park, MD: NARA, 1974.
- . *Wild Bill and Intrepid: Donovan, Stephenson, and the Origin of CIA*. New Haven, CT: Yale University Press, 1996.

- Tsoukas, Haridimos. *New Thinking in Organizational Behaviour: From Social Engineering to Reflective Action*. Management Readers. Oxford,: Butterworth-Heinemann, 1994.
- Tyson, James L. "The EOU vs. Hitler's Mini-Missiles." *International Journal of Intelligence and CounterIntelligence* 12, no. 1 (1999/03/01 1999): 80-87.
- U.S. Census Bureau. "Historical National Population Estimates: July 1, 1900 to July 1, 1999." Population Division, Accessed 22 December 2016, <https://www.census.gov/population/estimates/nation/popclockest.txt>.
- . *Historical Statistics of the United States, Colonial Times to 1957*. Washington, DC: U.S. GPO, 1960.
- United States Air Force. Annex 3-60 Targeting. 115. Maxwell AFB, AL: Curtis E. LeMay Center for Doctrine Development and Education., 2014.
- United States Air Forces in Europe, A-2. History of Directorate of Intelligence USSTAF, January 1944 - May 1945. #519.600. Maxwell AFB, AL: AFHRA, 8 September 1945.
- United States Congress. Report of the Joint Committee on the Investigation of the Pearl Harbor Attack Including the Minority report. Joint Committee on the Investigation of the Pearl Harbor Attack. New York: Da Capo Press, 1972.
- United States Strategic Bombing Survey. Howaldtswerke Shipyards at Hamburg Germany. In *Plant Report No. 50*, Physical Damage Division. #137.311-50. Maxwell AFB, AL: AFHRA, August 1945.
- . Valentin Submarine Assembly Plant, Farge Germany. In *Plant Report No. 47*, Physical Damage Division. #137.311-47. Maxwell AFB, AL: AFHRA, 26 October 1945.
- . Blohm and Voss Shipyards, Hamburg Germany. In *Plant Report No. 51*, Physical Damage Division. #137.311-51. Maxwell AFB, AL: AFHRA, 8 October 1945.
- . *The United States Strategic Bombing Survey: Summary Report (European War)*. 7th ed. 1987. Reprint, Maxwell AFB, AL: Air University Press, 2001. 30 September 1945.
- . *Over-all Report (European War)*. Vol. 2, Washington: US GPO, 30 September 1945.
- . *The German Abrasives Industry*. No. 51. Edited by Equipment Division. Second ed., Washington, DC: USSBS, 1947.
- . *The German Anti-Friction Bearings Industry*. No. 53. Edited by Equipment Division. 2nd ed., Washington, DC: USSBS, 1947.
- . *Bremer Vulcan, Vegesack, Germany*. No. 100. 2nd ed., Washington, DC: USSBS, 1947.
- . *Renault Motor Vehicles Plant, Billancourt, Paris*. No. 80. Edited by Munitions Division. 2nd ed., Washington, DC: USSBS, 1947.
- . *Blohm and Voss Shipyards, Hamburg, Germany*. No. 94. Edited by Submarine Branch Munitions Division. 2nd ed., Washington, DC: USSBS, 1947.
- . *Aircraft Division Industry Report*. No. 4. Second ed., Washington, DC:

- USSBS, January 1947.
- . *Huels Synthetic Rubber Plant*. In *No. 128*, Oil Division. Washington, DC: USSBS, 1947.
- . *Oil Division Final Report*. No. 124. Edited by Oil Division. 2nd ed., Washington, DC: USSBS, 1947.
- . *V-Weapons (Crossbow) Campaign*. No. 60. Edited by Military Analysis Division. 2nd ed., Washington, DC: USSBS, 1947.
- . *Focke Wulf Aircraft Plant, Bremen, Germany*. No. 10. Edited by Aircraft Division. 2nd ed., Washington, DC: USSBS, 1947.
- . *Messerschmitt AG Augsburg, Germany, Part B*. No. 11. Edited by Aircraft Division. 2nd ed., Washington, DC: USSBS, 1947.
- . *German Electric Utilities Industry Report*. In *No. 205*, Utilities Division. Washington, DC: USSBS, 1947.
- United States War Department. *Operations in the Field*. War Report, Office of Strategic Services. Edited by Strategic Services Unit History Project. Vol. 2, Washington, DC: US Government Printing Office, 1949.
- . *Washington Organization*. War Report, Office of Strategic Services. Edited by Strategic Services Unit History Project. Vol. 1, Washington, DC: US Government Printing Office, 1949.
- USAF Air Command and Staff School. *Air Intelligence*. AC&SS Pamphlet. Montgomery, AL: Air University, 1948.
- USAF Historical Division. *Organization of the Army Air Arm, 1935-1945*. USAF Historical Studies: No. 10. Maxwell AFB, AL: Air University, Research Studies Institute, 1956.
- Van Creveld, Martin. *The transformation of war*. New York: Free Press, 1991.
- Van Tuyll, Hubert. "Augusta University Faculty and Staff." Augusta University, Accessed 11 January 2017, <http://www.augusta.edu/pamplin/hist-anth-phil/faculty/hvantuyll.php>.
- Vaught, Wilma L. "In Defense of America: Women Who Serve." *USA Today Magazine* 122, no. 2586 (1994): 86.
- Vickers, C. G. Memorandum, (untitled) MEW views on the document entitled 'Report of the Committee of Operations Analysis: March 8th 1943'. In *Personal Collection of Gen Henry H. Arnold part 3 of 6*, Ministry of Economic Warfare. MICFILM 28253. Maxwell AFB, AL: AFHRA, 3 April 1943.
- VIII Bomber Command, Headquarters. Report of Operations. In *Mission No. 92-93*, Eighth Air Force. #520.332. Maxwell AFB, AL: AFHRA, 7 September 1943.
- . Flash Report - Operation No. 106. #527.332. Maxwell AFB, AL: AFHRA, 2 October 1943.
- . Bomber Command Narrative of Operations, Mission No. 84. #519.332. Maxwell AFB, AL: AFHRA, 17 August 1943.
- . Flash Report - 104 Operation. #527.332. Maxwell AFB, AL: AFHRA, 27 September 1943.
- . Tactical Mission Report. In *Eighth Air Force Mission No. 84*, Eighth Air

- Force. #520.331. Maxwell AFB, AL: AFHRA, 17 August 1943.
- . Bomber Command Narrative of Operations, 92nd Operation. #145.81-140. Maxwell AFB, AL: AFHRA, 7 September 1943.
- . Bomber Command Narrative of Operations, Day Operation - 22 June, 1943. #520.332. Maxwell AFB, AL: AFHRA, 29 June 1943.
- . Bomber Command Narrative of Operations, 104th Operation. #145.81-140. Maxwell AFB, AL: AFHRA, 27 September 1943.
- . Bombing Data. In *Tactical Mission Report, Brussels/Evere*. #520.332. Maxwell AFB, AL: AFHRA, 10 September 1943.
- VIII Bomber Command, S-3. A-3 Section, Comments on Report of Raid on Bremen and Kiel - 13 June 1943. In *Tactical Mission Report, Field Order No. 174*. #520.332. Maxwell AFB, AL: AFHRA, 25 June 1943.
- "WAAF Tells of Aid in Saving New York." *New York Times*, 6 October 1945.
- Wakelam, Randall T. *The Science of Bombing: Operational Research in RAF Bomber Command*. Toronto, Canada: University of Toronto Press, 2009.
- Wall, Richard, and J. M. Winter. *The Upheaval of War: Family, Work, and Welfare in Europe, 1914-1918*. 1st pbk. ed., Cambridge: Cambridge University Press, 2005.
- Warden, John A. *The Air Campaign: Planning for Combat*. National Defense University Press. Washington, DC: National Defense University Press, 1990.
- Warner, Michael. *The Office of Strategic Services: America's First Intelligence Agency*. Washington, DC: Central Intelligence Agency, 2002.
- . *The Rise and Fall of Intelligence: An International Security History*. Washington, DC: Georgetown University Press, 2014. doi:99958675099.
- Watkins, Ralph J. Feasibility of Air Attack on European Axis Transport. In *COA History (Tab 14)*, Committee of Operations Analysts. #118.04-4 V.1. Maxwell AFB, AL: AFHRA, 21 January 1943.
- Watts, Barry D. *The Foundations of US Air Doctrine: The Problem of Friction in War*. Maxwell AFB, AL: Air University Press, 1985.
- Weaver, Michael E. "International Cooperation and Bureaucratic In-fighting: American and British Economic Intelligence Sharing and the Strategic Bombing of Germany, 1939-41." *Intelligence and National Security* 23, no. 2 (April 2008): 153-175.
- Webster, Charles K., and Noble Frankland. *The Strategic Air Offensive Against Germany, 1939-1945*. History of the Second World War United Kingdom Military Series. 4 vols., London, England: H. M Stationery Office, 1961.
- Webster, Noah. *Webster's New Modern English Dictionary*. Chicago, IL: Consolidated Book Publishers, 1922.
- Weigley, Russell Frank. *The American Way of War: A History of United States Military Strategy and Policy*. Bloomington, IN: Indiana University Press, 1977.
- Welter, Capt. George, Div. Photo-interpreter. Memorandum to A-2 Section. Headquarters 1st Bombardment Division. #525.332. Maxwell AFB, AL: AFHRA, 27 September 1943.

- Westwood, H. C. "IWM Interview, Oral History." By David Mander. *Second World War*, no. #22103 (2001).
- White, Thomas D. Memorandum, AC/AS Intelligence to AC/AS Plans. #145.81-140. Maxwell AFB, AL: AFHRA, 7 May 1944.
- Williams, Allan. *Operation Crossbow: The Untold Story of Photographic Intelligence and the Search for Hitler's V Weapons*. London, England: Preface, 2011.
- Winant, John G. Telegram: American Embassy, London to Secretary of State, Washington. #145.81-144v2. Maxwell AFB, AL: AFHRA, 26 February 1944.
- Winton, Harold R., and David R. Mets. *The Challenge of Change: Military Institutions and New Realities, 1918-1941*. Studies in War, Society, and the Military. Lincoln, NE: University of Nebraska, 2000.
- Wohlstetter, Roberta. *Pearl Harbor: Warning and Decision*. Stanford, CA: Stanford University Press, 1962.
- Wolk, Herman S. "Decision at Casablanca." *Air Force Magazine* 86, no. 1 (January 2003 2003): 78-82.
- . *The Struggle for Air Force Independence, 1943-1947*. Bolling AFB, DC: Air Force History Support Office, 1997.
- Wright, Captain L.B. "Three-Dimension View of the Enemy." *Air Force, Official Journal of the U.S. Army Air Forces* 26, no. 2 (February 1943).
- Wylie, J. C. *Military strategy: A General Theory of Power Control*. Annapolis, MD: Naval Institute Press, 1989.
- Yarger, Harry R. *Strategy and the National Security Professional: Strategic Thinking and Strategy Formulation in the 21st Century*. Westport, CT: Praeger Security International, 2008.
- Yenne, Bill. *Big Week: Six Days that Changed the Course of World War II*. Six Days that Changed the Course of World War II. 1st ed. ed., New York, NY: Berkley Books, 2013.