

The Enemy Objectives Unit in World War II: Selecting Targets for Aerial Bombardment that Support the Political Purpose of War

**A Monograph
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Abstract

The Enemy Objectives Unit in World War II: Selecting Targets for Aerial Bombardment that Support the Political Purpose of War by Major Brian P. Ballew, U.S. Air Force, 50 pages.

In June of 1942, Eighth Air Force deployed to Great Britain and began preparation for a bombing campaign. However, during the initial planning efforts it became apparent the staff lacked the expertise needed to analyze and recommend bombing targets. Colonel Richard Hughes, the Chief Planner for American Air Forces in Europe, recognized this deficiency and requested a team to assist with target selection. The Enemy Objectives Unit (EOU), a team of civilian economists, began arriving in London in September 1942 to support the Eighth Air Force.

While formally assigned to the United States Embassy in London, for practical purposes the team worked for Colonel Hughes. Using their economic expertise, EOU members studied the German industrial complex to identify vulnerabilities and then recommend to planners and senior leaders those industries the United States Strategic Air Forces in Europe should target. Taking an effects-based approach, the team sought to maximize the efficiency and effectiveness of United States' airpower to produce the greatest effects on Germany's war economy.

The EOU's target selection methodology required intelligence data on enemy targets, an awareness of United States Army Air Forces bombing capabilities, and most importantly an understanding of military and political aims. To ensure selected targets aligned with military and political aims, the EOU regularly collaborated with air planning staffs and senior leaders. Three case studies highlight the interaction and collaboration that occurred between the EOU and Army Air Forces planners and leaders: prioritizing targets for Operation POINTBLANK, development of an Oil Plan following "Big Week" in February 1944, and the recommendation to strike bridges versus marshaling yards prior to Operation OVERLORD. Each of these case studies demonstrates that the integration and cooperation between the EOU and air force leaders and planning staffs ensured that targets selected for aerial bombardment supported political and military objectives.

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Introduction

With the declaration of war, the United States began mobilizing the United States Army Air Forces (USAAF) sending the Eighth Air Force to England in 1942. The initial strength of the Eighth Air Force was not sufficient to strike all desired enemy targets. Furthermore, the German Air Force was extremely capable and posed a significant threat to Allied aircraft flying over the continent. Thus, the lack of a robust air force and the lack of air superiority complicated air planners' efforts to select targets. To assist with this problem, Colonel Richard Hughes, the Chief planner for American Air Forces in Europe, assembled a team of economists in London, the Enemy Objectives Unit (EOU), to assist the Eighth Air Force in prioritizing target lists and selecting targets to strike. Using their economic expertise, the EOU recommended strategic targets to the Eighth Air Force that the team projected would have the greatest effect on the German war-making effort.

The question this monograph addresses is how did the EOU, in making these recommendations, ensure targets selected for aerial bombardment during World War II supported the political purpose of the war? The integration and constant collaboration between the EOU and USAAF leadership generated a common understanding of political and military objectives and ensured selected targets supported operational and strategic aims. This monograph demonstrates this integration by discussing the collaboration that occurred during the target selection process in support of the Casablanca Directive and Operation POINTBLANK, the development of the Oil Plan, and in preparation for Operation OVERLORD.

Specifically, Chapter 2 of this monograph provides a background for the study. First, it explains the historical context leading to the establishment of the EOU. Then, it provides an overview of the initial tasking given the EOU. Since the EOU members did not have military backgrounds, the first task was to introduce the EOU members to the military viewpoint and induce the EOU to look at the German industrial complex from a military perspective. The third

part of this chapter examines US airpower strategy and doctrine entering the war to show the framework from which the EOU tackled their problems.

Chapter 3 of this monograph begins with a discussion of the advent of operations research in military affairs during World War II and the important role operations research played in shaping military operations. At the tactical level, analysts used operations research to maximize the effectiveness of weapon system employment, while at the operational and strategic levels, planners employed operations research techniques during planning to identify enemy vulnerabilities. This paper discusses the effects-based approach used by the EOU to identify and select Axis targets for aerial bombardment. The difficulty in this selection stemmed from the United States' lack of intelligence. A common, thorough understanding of Axis vulnerabilities or of German industrial infrastructure did not exist. As a result, different organizations had conflicting ideas about which targets provided the greatest effect. The EOU, using their backgrounds in economics, were able to succeed in this uncertain environment. Through in-depth research, cooperation with outside organizations, and a sound methodology, the EOU developed prioritized targets for USAAF leadership that aligned with national strategic guidance.

In Chapter 4, the monograph explains how the integration of the EOU with USAAF leadership and their planning staffs ensured that targets selected aligned with military and national strategic objectives. The paper discusses the habitual relationship and constant coordination that occurred between the EOU and military planners and leaders. This relationship and constant collaboration produced a common understanding of why the EOU selected specific targets and how those targets supported political objectives.

Chapter 5 demonstrates the interaction between the EOU and the USAAF leadership through the review of three case studies. First, the paper examines the selection of targets following the Casablanca Conference, particularly targets selected in support of Operation POINTBLANK. A quick reflection on the methodology used by the EOU to select targets precedes a close examination of the interaction and collaboration that occurred between the EOU

and air force leaders. The paper highlights how this cooperation and integration produced a check and balance system to align aerial bombardment targets with political and military objectives. The second case study explores the Oil Plan recommended by the EOU. An in-depth review of the priorities identified by the EOU, and how these priorities aligned with strategic guidance follows. The third case study investigates the targets selected and the prioritization of targets in preparation for Operation OVERLORD. The paper emphasizes the EOU's effects-based approach and specifies how this approach produced a solution that garnered the backing of senior USAAF leaders.

The final chapter summarizes the findings of the monograph. The paper reviews the operations research techniques and effects-based methodology employed by the EOU before highlighting the importance of integration and cooperation between the EOU and USAAF leaders and planning staffs during WWII. This partnership ensured targets selected by the EOU for aerial bombardment supported political and military objectives.

Background of Study

Establishing the Enemy Objectives Unit

In May 1941, nearly two years after President Roosevelt convinced Congress to revise the Neutrality Law so the United States could provide materiel support to the Allies, seventy-nine percent of the American populace favored isolationism.¹ Fortunately, this popular sentiment did not prevent the President and Congress from preparing the US defense establishment for war. Beginning in 1938, the United States ramped up defense spending to address the shortfalls in the defense sector. This foresight was critical and gave industry a two-year head start to improve its military industrial base. While the US Government was taking action to remedy its military equipment and manpower shortfalls, President Roosevelt confronted another problem--the lack of a centralized system of intelligence.

The Office of Naval Intelligence, the Military Intelligence Division, and the State Department maintained their own empire of knowledge.² No central organization existed to collect and evaluate information collected. The lack of a centralized intelligence organization that synthesized intelligence data frustrated President Roosevelt. He felt blind to the situations in Europe and the Pacific, which made it difficult for the President to provide strategic guidance. These paralyzing uncertainties forced President Roosevelt to establish a national organization that could meet his comprehensive intelligence needs.³

On 11 July 1941, President Roosevelt established The Office of Coordinator of Information (COI) under the leadership of General William J. Donovan.⁴ This organization split

¹ Robert Dallek, *Franklin D. Roosevelt and American Foreign Policy, 1932 – 1945* (New York: Oxford University Press, 1995), 267.

² George C. Chalou, ed., *The Secrets War: The Office of Strategic Services in World War II* (Washington D.C.: National Archives and Records Administration, 1991), 13.

³ Ibid.

⁴ Kermit Roosevelt, *War Report of the OSS* (New York: Walker and Company, 1976), 5.

on June 13, 1942, with the Foreign Information Service falling under the Office of War Information while the remainder of COI became the Office of Strategic Services (OSS) under the direction of General Donovan.⁵ With the establishment of the OSS, the United States, for the first time in its history, had a single intelligence service engaged in all intelligence activities.⁶

One of the first branches General Donovan established in the OSS was the Research and Analysis (R&A) Branch. General Donovan tasked the R&A Branch to identify the strengths and weaknesses of the Axis powers. To fulfill this tasking and develop a comprehensive understanding of the Axis powers and their capabilities, the R&A Branch sought scholars from many different disciplines. At full strength, this Branch comprised 900 scholars from the following disciplines: historians, economists, political scientists, geographers, psychologists, anthropologists, and diplomats.⁷ Soon after its inception, the R&A Branch demonstrated its value with its thorough analysis of the German supply situation on the Eastern Front.

The R&A Branch began its study of the situation in the Soviet Union to determine what caused the German advance to stop, when it would resume, and to glean a better understanding of the supply requirements to sustain offensive operations.⁸ The R&A analysts' conclusions proved remarkably accurate. The analysts correctly projected that Hitler would resume the offensive in the south in order to capture the Caucasus oil fields, vice a move on Moscow. The analysts also correctly identified German rail transportation as the critical limiting factor and that German strength on the Eastern Front was significantly less in the spring of 1942 than it was in the

⁵ Roosevelt, *War Report of the OSS*, 27.

⁶ Central Intelligence Agency, "The Office of Strategic Services: Research and Analysis Branch," Central Intelligence Agency, <https://www.cia.gov/news-information/featured-story-archive/2010-featured-story-archive/oss-research-and-analysis.html> (accessed August 5, 2010).

⁷ *Ibid.*

⁸ Bryan Donald DeCoster, "OSS Estimate of German Logistics on the Eastern Front, 1941 – 1942: An Early Example of Strategic Warning," *Defense Intelligence Journal* 3, no. 1 (Spring 1994): 110.

summer of 1941.⁹ The accuracy of this study gave great credibility to the R&A Branch and highlighted the value of economic analysis to military decision makers as well as national policymakers. The R&A Branch's accurate portrayal of the German logistic situation on the Eastern Front garnered the branch much attention resulting in additional requests for products and support. One of these requests was to provide support to the Allied bombing campaign in Europe, and that became one of the most important contributions made by the branch during the war.

The Eighth Air Force deployed to Great Britain in June of 1942.¹⁰ Colonel Richard Hughes, Chief Planner for American Air Forces in Europe, recognized the USAAF lacked detailed intelligence analysis and the capability to analyze and recommend bombing targets.¹¹ He reached out to the OSS, asking for personnel to assist with the target selection process. In response to this request, General Donovan ordered a team of R&A Branch economists to London and established the EOU. The team members began arriving in London in September 1942. While formally assigned to the Economic Warfare Division of the US Embassy in London, for practical purposes, the team worked for Colonel Hughes.¹² In this capacity, the only individuals with access to the EOU were the American Ambassador and a few designated USAAF officers.¹³ The mission given to the EOU was to study German infrastructure and its industrial complex in order to determine the best methods for executing the strategic bombing campaign.

⁹ Ibid., 120 - 122.

¹⁰ Richard G. Davis, *Carl A. Spaatz and the Air War in Europe* (Washington D.C.: Smithsonian Institution Press, 1992), 82.

¹¹ James L. Tyson, "The EOU vs. Hitler's Mini-Missiles." *International Journal of Intelligence and Counterintelligence* 12, no. 1 (Spring 1999): 81.

¹² George C. Chalou, ed., *The Secrets War: The Office of Strategic Services in World War II* (Washington D.C.: National Archives and Records Administration, 1991), 48.

¹³ Ibid.

Initial Responsibility of the EOU

Colonel Hughes' experience and education made him the perfect choice to lead the EOU. He grew up in Great Britain and served as an officer in the British Army. As a graduate of Wellington and Sandhurst, Colonel Hughes trained in the principles of concentration of effort at the enemy's most vulnerable point and in the prompt and maximum follow through when friendly forces achieved breakthrough.¹⁴ However, upon marriage, his promising career in the British Army ended as he followed his wife to the United States. He became a US citizen and eventually joined the Army Air Corps at the onset of war. Colonel Hughes became the chief planner on General Carl Spaatz' staff, which led him back to London in 1942.¹⁵ Colonel Hughes recognized that the air planning staff lacked targeting expertise and thus, aspired to build a team that could meet this operational need. He needed a team that could skillfully analyze enemy targets for the strategic bombing campaign in order to determine which enemy targets would have the greatest impact on the German war effort. What was the enemy's greatest vulnerability and could the Allies exploit that vulnerability? The team Colonel Hughes received possessed the economic skills Colonel Hughes needed, but lacked military experience.

Therefore, before tasking the EOU to develop targets for the Allied bombing campaign, Colonel Hughes directed the team to develop aiming-point reports.¹⁶ The purpose of the aiming-point reports was to analyze German industrial plants and installations to determine their most vulnerable points.¹⁷ Additionally, from Colonel Hughes' perspective, this tasking induced the EOU members to think about industry as a military target and provided him an opportunity to evaluate the competence of the EOU members before launching them on the task of target

¹⁴ Walt W. Rostow, *Concept and Controversy: Sixty Years of Taking Ideas to Market* (Austin: University of Texas Press, 2003), 31.

¹⁵ *Ibid.*, 30.

¹⁶ Walt W. Rostow, *Pre-Invasion Bombing Strategy: General Eisenhower's Decision of March 25, 1944* (Austin: University of Texas Press, 1981), 19.

¹⁷ *Ibid.*, 20.

selection. Colonel Hughes and the Eighth Air Force specifically did not provide detailed guidance to the team on which industries they should focus their efforts. They wanted the full range of German industry open to this analysis.¹⁸

The EOU conducted detailed analysis of each industry in order to develop the thorough understanding required to populate the aiming point reports. According to the EOU's *War Diary*, the aiming point reports needed to answer "importance of plant within industry, function of buildings, vulnerability of processes, probable rate of recovery after successful attack, and the sections of the target which should constitute the proper objective of attack."¹⁹ Thus, the aiming point reports sought to demonstrate those targets whose destruction would have the greatest and most lasting effects on output.²⁰

In order to develop the aiming-point reports, EOU members had to become experts on German plants and installations in order to identify critical vulnerabilities. The EOU lacked an internal intelligence capability so they relied on outside agencies for intelligence support. Thus, in addition to learning to look at industry as a target system, the aiming point reports drove EOU members to forge relationships with outside organizations. Since the United States lacked a robust intelligence capability, the EOU relied heavily on British intelligence, particularly, the Ministry of Economic Warfare (MEW).²¹

While the EOU gladly accepted intelligence data from the MEW, it did not use any of the findings from the MEW's Enemy Branch target selection study.²² The MEW Enemy Branch held the same role for the Royal Air Force (RAF) Bomber Command as the EOU performed for the

¹⁸ Walt W. Rostow, "The Beginnings of Air Targeting," *Studies in Intelligence* 7, no. 1 (Winter 1963): A4.

¹⁹ Office of Strategic Services, Research and Analysis Branch, *War Diary, Volume 5*, Prepared by the Economic Outpost with Economic Warfare Division, 1945: 22.

²⁰ *Ibid.*

²¹ Nelson MacPherson, *American Intelligence in War-Time London: The Story of the OSS* (Portland: Frank Cass Publishers, 2003), 131.

²² *Ibid.*

USAAF. In 1940, the MEW Enemy Branch conducted a target selection study that resulted in RAF Bomber Command targeting German petroleum.²³ However, the intelligence community lacked precise information on Germany's oil infrastructure and the assessment overestimated the ability of the RAF bombers to strike German petroleum targets.²⁴ This produced a negative opinion of targeting by economic analysis in London. To prevent being cast in the same light as the MEW Enemy Branch, the EOU only used intelligence data provided by the MEW, electing to work independently during target analysis.

The intelligence the EOU collected came from ground reports, prisoners of war interrogations, and photographic interpretation.²⁵ While this information provided the economists key insights into German industrial capabilities, it did not provide the comprehensive understanding needed to complete the aiming point reports. To supplement the collected intelligence information, the EOU members travelled to similar plants in Britain.²⁶ These visits provided a more thorough understanding of the plant in question and provided key insights into how each plant figured into Germany's industrial system.

The EOU members spent their first few months working solely on producing aiming point reports and continued to generate them during the course of the war. By May 1944, the EOU produced 285 aiming point reports.²⁷ The Eighth Air Force and Fifteenth Air Force bomber commands used the aiming point reports as general intelligence summaries as well as for operational aiming points for attack.²⁸ Since US intelligence was lacking, these reports provided a badly needed means for organizing intelligence. The high quality of information contained in the

²³ MacPherson, *American Intelligence in War-Time London*, 127.

²⁴ *Ibid.*

²⁵ Office of Strategic Services, *War Diary, Volume 5*, 23.

²⁶ *Ibid.*, 21.

²⁷ *Ibid.*, 32.

²⁸ Rostow, "The Beginnings of Air Targeting," A5.

reports earned the EOU a favorable reputation in the Eighth Air Force and Fifteenth Air Force bomber commands.

The knowledge gleaned from generating the aiming point reports prepared the EOU for the more complicated, thought-provoking task of target selection and target prioritization. By the end of 1942, the EOU members allocated extensive time to studying the theory of target choice.²⁹ Nonetheless, in order to effectively study target choice theory and apply said theory to the air campaign in Europe, the EOU needed an understanding of USAAF doctrine and strategy.

US Airpower Strategy Entering World War II

While airpower played a significant role in World War I, it was not the determining factor in the outcome of that conflict. Nevertheless, military leaders and airpower advocates envisioned the potential role airpower would play in future conflicts. At first, the prevailing thought was that the purpose of airpower was to provide fire support to the troops on the ground.³⁰ Military leaders were looking for a way to return mobility to the battlefield in hopes of avoiding the stagnation and lethality of trench warfare. However, during the interwar years, noteworthy airpower theorists advocated using airpower in a strategic context to affect the enemy's will to fight. Three notable theorists, Billy Mitchell from the United States, Giulio Douhet from Italy, and Hugh Trenchard from Great Britain, advocated attacking enemy population centers to destroy enemy morale and force capitulation.³¹ These theorists, while recognizing that airpower maintained the critical role of supporting troops on the ground, viewed strategic bombing as the primary purpose of airpower.

²⁹ Rostow, "The Beginnings of Air Targeting," A5.

³⁰ Haywood S. Hansell Jr., *The Air Plan That Defeated Hitler* (Atlanta: Higgins-McArthur / Longino & Porter, 1972), 6.

³¹ Stephen L. MacFarland, *America's Pursuit of Precision Bombing, 1910 – 1945* (London: Smithsonian Institution Press, 1995), 77 - 79.

Shortly after the first World War, Great Britain established the independent RAF. Meanwhile in the United States, the air forces remained under the control of the US Army.³² Since the majority of US Army leadership visualized the primary role of airpower to support the troops on the ground, those advocating for strategic bombardment, including General William “Billy” Mitchell, struggled to have their voices heard.

General Mitchell was an outspoken airpower advocate who sought to demonstrate air force capabilities in a manner that resonated with civilian leadership and the American populace. Following the war, the United States adopted a foreign policy of isolationism. Therefore, to expand the role of airpower, the Air Corps had to demonstrate airpower’s capability as something different from what the Army and Navy could provide and do it in a fashion that left a favorable impression with the public and civilian leadership.³³ The sinking of the German battleship *Ostfriesland* accomplished that goal. This demonstration illustrated that airpower could fulfill the role of coastal defense.³⁴ In addition to demonstrating the value of airpower in the defense, the sinking of the *Ostfriesland* also fostered the belief that aircraft could precisely strike enemy targets.

While Douhet, Trenchard, and to a lesser extent, Mitchell viewed attacks on cities as the primary means for airpower to force the capitulation of the enemy, this perspective did not sit well with the US population. Many Americans viewed the intentional bombing of civilians as an immoral act that was unacceptable on ethical and humanitarian grounds.³⁵ Americans stood comfortably behind the use of airpower to attack machines and industry, but not people. This sentiment led to an airpower strategy centered on precision strategic bombing versus an area

³² Biddle, Tami Davis Biddle, *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas About Strategic Bombing, 1914 – 1945* (Princeton: Princeton University Press, 2002), 128.

³³ Hansell, *The Air Plan That Defeated Hitler*, 8 – 10.

³⁴ Ibid.

³⁵ MacFarland, *America’s Pursuit of Precision Bombing, 1910 – 1945*, 81.

bombing strategy targeting population centers.³⁶ With the decision made to pursue precision bombing rather than area bombing, the next debate for the Air Corps centered on whether low altitude or high altitude bombing was more effective.

In the mid to late 1920s, when the question on high versus low altitude bombing arose, common sense led many to believe that low altitude bombing was superior. Although the low altitude bombers faced greater risk from enemy anti-aircraft artillery, the perceived improvement in accuracy more than made up for this risk.³⁷ However, with improvements in technology and the modernization of Army bombsights, accuracy improved at higher altitudes. Airpower advocates asked the question: was low altitude bombing truly more accurate than high altitude bombing?

After conducting tests in 1931, results indicated that, in fact, high altitude bombing proved more effective than low altitude bombing. At higher altitudes, aircraft were less susceptible to enemy anti-aircraft weapons. Furthermore, in a surprise, the test results indicated that low-level bombing was not very effective. At low levels, the bombs tended to ricochet off the ground and miss their targets. Additionally, the low angle of impact made the fuzes more liable to fail or the bombs tended to detonate on their side, which reduced the effectiveness of the explosion and resulting fragmentation.³⁸ Conversely, the tests illustrated that the best destruction occurred from the “mining effect” achieved when a bomb buried itself in the earth.³⁹ Dropping from higher altitudes provided the kinetic energy needed to penetrate the earth, increasing the effectiveness of the bombs. Consequently, high altitude, precision bombing was adopted into Army Air Corps doctrine during the interwar years.

³⁶ MacFarland, *America's Pursuit of Precision Bombing, 1910 – 1945*, 82.

³⁷ *Ibid.*, 85.

³⁸ *Ibid.*, 86.

³⁹ *Ibid.*

Army Air Corps leaders codified this doctrine under the pretense that the bomber would always get through. The thought was that by flying at high altitudes the bombers would avoid most enemy anti-aircraft weapon systems while the built-in defenses of the bomber formations would prevent the bombers from falling prey to enemy fighter aircraft.⁴⁰ Army Air Corps leaders maintained this position even when faced with evidence to the contrary.

Colonel Carl Spaatz, later to become the commander of Eighth Air Force and then commander of USAAF in the European Theater of Operations, travelled to England in 1940 to observe Royal Air Force operations against Germany.⁴¹ Despite British and German experience, Colonel Spaatz remained convinced that self-defended bombers could effectively strike targets without the aid of escorts. Spaatz' reports reinforced Army Air Corps thinking at the time and influenced how the service spent its money. The production of bombers remained the Air Corps' top priority while prominent airpower leaders viewed fighter escorts as an unnecessary capability. Thus, in June 1941, when the Air Corps became the United States Army Air Forces, airpower doctrine centered on high-altitude, daylight, precision bombing.

While the RAF entered the war with this same philosophy, early results dictated a change in philosophy. From the outset of war, the RAF struggled to employ their bombers effectively against German targets. Not only were the bombing raids failing to have any significant impact on the German industrial base, the RAF's small force size could not sustain the losses they were taking.⁴² To preserve the force, the RAF transitioned to a philosophy of nighttime area bombing of cities hoping to undermine the German workforce's productivity and morale.⁴³ This change in philosophy set the stage for the establishment of the Combined Bomber Offensive after the United States entered the war.

⁴⁰ Biddle, *Rhetoric and Reality in Air Warfare*, 165.

⁴¹ *Ibid.*, 205.

⁴² *Ibid.*, 176.

⁴³ Biddle, *Rhetoric and Reality in Air Warfare*, 177.

While the RAF had switched to nighttime area bombing against cities, the USAAF remained steadfastly committed to high-altitude, daylight, precision bombing. When President Roosevelt and Prime Minister Churchill met in Casablanca on January 14, 1943, the two parties agreed on a combined approach to keep the pressure on Germany.⁴⁴ The Casablanca Directive endorsed a “sustained and unremitting air offensive, calling for a Combined Bomber Offensive.”⁴⁵ The USAAF and their doctrine of high-altitude, precision bombing struck targets by day while the RAF used area bombing to strike targets at night. It was under this pretense, that the EOU selected targets for the USAAF, particularly for the Eighth Air Force and Fifteenth Air Force.

⁴⁴ Hansell, *The Air Plan That Defeated Hitler*, 149.

⁴⁵ *Ibid.*

Operations Research, Effects-Based Operations and the EOU

While producing the aiming point reports, EOU members also developed a sound understanding of USAAF doctrine. This understanding of USAAF doctrine coupled with the experience gleaned from producing aiming point reports provided the EOU members the foundation needed to develop a theory on and methodology for target selection. Nevertheless, before addressing EOU methodology, this paper explores two significant areas of study that shaped operations during the war and figured prominently into the processes used by the EOU. First, the monograph examines the role of operations research before addressing the significance behind the concept of Effects-Based Operations (EBO) and its impact on planning in World War II.

Operations Research in World War II

Operations Research is the application of advanced analytical methods to help make better decisions.⁴⁶ The use of these principles in the military realm first arose during the first World War, but was not fully adopted by militaries and incorporated into military organizations until the second World War. For the purpose of military operations, operations research analysts used scientific and mathematical methods to help make military operations more efficient and effective.⁴⁷ Although the influence of operations research spanned all facets of the military during the war, it significantly influenced the application of airpower at all levels of war. Both the RAF and USAAF developed operations research sections in their headquarters with the goal of improving the effectiveness of their strategic bombing campaign.

⁴⁶ The OR Society, "OR and its Applications: Introduction – What is OR?" [http://www.theorsociety.com/orshop/\(avqkza45ronghormrhs42lrg\)/orcontent.aspx?inc=about.htm](http://www.theorsociety.com/orshop/(avqkza45ronghormrhs42lrg)/orcontent.aspx?inc=about.htm) (accessed November 10, 2010).

⁴⁷ Phillip S. Meilinger, "The Question of What to Target," *Air Force Magazine* 93, no. 6 (June 2010), <http://www.airforce-magazine.com/MagazineArchive/Pages/2010/June%202010/0610target.aspx> (accessed August 5, 2010).

At the tactical level, operations research analysts provided many significant contributions that increased the effectiveness of bombing operations. Within Eighth Air Force, the Operations Research Section analyzed different aspects of aerial bombardment to include bombing accuracy, bombs and fuses, general mission analysis, radar and radio countermeasures, and loss and battle damage.⁴⁸ Of particular interest to Major General Ira Eaker, the Eighth Air Force commander, was improving bombing accuracy and minimizing loss rates.

The Bombing Accuracy Subsection in Eighth Air Force assumed responsibility for improving bombing accuracy and immediately challenged existing procedures. Entering the war, standard operating procedures dictated that each bombardier chose his own drop point.⁴⁹ Nevertheless, after thorough analysis, the operations research analysts concluded that to improve accuracy only the lead aircraft in the formation should perform a sighting operation. The rest of the bombardiers in the combat box released their bombs when the lead bombardier released. Eighth Air Force used this approach during the attack on Vegesack and achieved remarkable results.⁵⁰ Bomber Command adopted this procedure immediately.

In addition to improving accuracy by changing procedures to have all bombers drop on the lead bombardier's command, operations research analysts discovered that evasive action over a target negatively affected bombing accuracy. Colonel Curtis Lemay, Commander of the 305th Bombardment Group, understood that evasive maneuvers over the target were negatively affecting accuracy resulting in crews having to restrike a target.⁵¹ He ordered his pilots to ignore the threat of flak and approach the targets straight and level in their group formations. Through

⁴⁸ Charles W. McArthur, *Operations Analysis in the U.S. Army Eighth Air Force in World War II*, (Providence: American Mathematical Society, 1990), viii.

⁴⁹ Meilinger, "The Question of What to Target," *Air Force Magazine* 93, no. 6 (June 2010).

⁵⁰ Leslie H. Arps, Bissell Alderman, Edwin Hewitt, and G. Bailey Price, *Operations Analysis in the Eighth Air Force, 1942 - 1945: 4 Contemporary Accounts*, edited by Hugh J. Miser (Maryland: INFORMS, 1997), 41.

⁵¹ MacFarland, *America's Pursuit of Precision Bombing, 1910 - 1945*, 170.

their analysis, the Operations Research Section proved this approach was more effective and greatly improved bombing accuracy.

Not only did this method improve accuracy, but it also minimized loss rates of aircraft and aircrew. Operations research analysts discovered that evasive maneuvers did not improve the bombers chance of avoiding flak while it increased the chance of midair collision. Further, maintaining a tight formation improved the formations' defensive capability since it provided overlapping fields of fire. Overall, these tight formations improved the aircrews' chance of survival and decreased the number of times aircrews had to restrike targets. While the tight formations provided many positives, they also increased the risk of fratricide.

In their search to find ways to minimize losses, the Losses and Battle Damage Subsection discovered that the waist gunners were shooting up their own aircraft and identified the vulnerability of the hydraulic and electrical systems in the B-17 and B-24.⁵² Another major finding from the analysis was that the aircraft engines were extremely susceptible to catching fire from enemy anti-aircraft artillery. To improve the survivability of the aircraft, the analysts recommended modifications to the aircraft such as additional armor around the engines.⁵³ The USAAF concurred with the recommendations and incorporated the changes in the aircraft production facilities. These few examples provide a solid illustration of the tactical impact the Operations Research Section had on Eighth Air Force bombing operations.

In addition to affecting operations at the tactical level, operations research also impacted operational and strategic planning. General "Hap" Arnold, commanding general of the USAAF, established the Committee of Operations Analysts (COA) to examine which targets would erode German strength sufficiently to allow for an Allied invasion.⁵⁴ While military planners knew how

⁵² Arps, *Operations Analysis in the Eighth Air Force, 1942 - 1945*, 52 - 53.

⁵³ Meilinger, "The Question of What to Target," *Air Force Magazine* 93, no. 6 (June 2010).

⁵⁴ Hansell, *The Air Plan That Defeated Hitler*, 149.

to destroy targets, they needed help from operations research analysts to know which targets to hit. Without all the data available at the tactical level and without a complete understanding of the German economy, analysts addressed this problem at a higher level of abstraction.⁵⁵ As opposed to the EOU, which searched for industrial targets that would grind Germany's war making capacity to a halt, the COA focused on targeting munitions plants and war materials to limit Germany's ability to defeat an allied invasion.⁵⁶ Consequently, although their objectives were different, both the COA and EOU incorporated operations research in their target selection methodologies.

Effects-Based Operations in World War II

EBO did not officially enter US military lexicon until the Persian Gulf War in 1991, but its origins go back to the second World War.⁵⁷ EBO, as defined in US Air Force doctrine, are "operations that are planned, executed, assessed, and adapted to influence or change systems or capabilities in order to achieve desired outcomes."⁵⁸ Simplified, EBO focus on the results, desired outcomes, achieved through action, not on the means, or platforms, weapons, and methods.⁵⁹ Thus, from an airpower perspective, EBO provide a methodology for determining which targets produce the greatest effects in line with military and political means.

During World War II, airpower strategists attempted to prioritize targets based on the expected impact destroying a target would have on the German war economy. However, since the USAAF lacked in-depth intelligence on all German industries, the planners had to avoid falling into the trap of the 'blueprint availability syndrome.' With this 'syndrome,' planners

⁵⁵ Meilinger, "The Question of What to Target," *Air Force Magazine* 93, no. 6 (June 2010).

⁵⁶ Faber, Peter. "Competing Theories of Airpower: A Language for Analysis." *Aerospace Power Chronicles*. <http://www.au.af.mil/au/awc/awcgate/au/faber.htm> (accessed 10 November, 2010).

⁵⁷ Phillip S. Meilinger, "A History of Effects-Based Air Operations," *The Journal of Military History* 71, no. 1 (January, 2007): 140.

⁵⁸ Air Force Doctrine Document 2, *Operations and Organization*, 3 April 2007, 13.

⁵⁹ Meilinger, "A History of Effects-Based Air Operations," 140.

overemphasize the importance of targets on which they have information at the expense of targets where information is lacking.⁶⁰ To help overcome this pitfall, air planners placed great emphasis on gathering as much intelligence as possible on German industries. As air planners learned about specific German industries, they became more adept at anticipating and projecting first, second, and third order effects. This allowed them to develop the measures of effectiveness needed to assess whether bombing attacks produced the intended effects. Upon adopting this effects-based approach, airpower strategists in the United States and Britain developed three overarching philosophies for aerial bombardment.

The RAF adopted a philosophy of area bombing against cities. This philosophy was partially born out of the fact that the RAF could not sustain precision daylight bombing operations due to the heavy losses they were taking. However, many in RAF Bomber Command, including Air Marshall ‘Bomber’ Harris, believed nighttime area attacks against German cities would destroy German morale and bring an expedient end to the war.

The second philosophy centered on the idea of striking the major plants in a variety of industries.⁶¹ This ‘Gross National Product’ theory was short lived. This method proposed that precision attacks would lower Germany’s Gross National Product and thus the theory focused on the civilian economy rather than the German war effort.⁶² Additionally, the USAAF and the RAF lacked the bombers necessary to create the intended effects on the German economy.⁶³ As a result of these circumstances, air planners discarded this theory before application.

⁶⁰ Phillip S. Meilinger, “The Origins of Effects-Based Operations,” *Joint Force Quarterly*, no. 35 (Summer, 2003): 117 - 118.

⁶¹ Rostow, “The Beginnings of Air Targeting,” A6.

⁶² Ibid.

⁶³ Office of Strategic Services, *War Diary, Volume 5*, 3.

The third philosophy focused on concentrating bombing efforts on whole target systems.⁶⁴ Rather than striking major targets from multiple industries, this approach pursued persistent attacks on multiple targets from a single industry. To achieve the greatest effect, analysts studied German industries to determine which industries, if attacked holistically, would have the greatest impact on the German war effort. Recognizing that the German economy was extremely robust with much redundancy built in, the analysts searched for those industries where the destruction of the minimum number of targets would have the greatest effect.⁶⁵ As with the second philosophy, limited numbers of Allied aircraft forced air planners to consider only those industries they could persistently strike in its entirety. With a preference of targeting industry and infrastructure over cities and people, US military leadership stood behind this philosophy rather than the area bombing philosophy used by the RAF. This philosophy became the foundation from which the EOU built their methodology for selecting targets for aerial bombardment.

EOU's Target Selection Methodology

Operations research and EBO stand at the core of the EOU's target selection methodology. In simplified terms, the EOU sought to maximize the efficiency and effectiveness of US airpower using limited US bomber assets in order to produce the greatest effect on Germany's war economy. While the EOU garnered a great understanding of specific targets during the production of aiming point reports, that assignment did not provide the members a systemic understanding of the German industrial complex. Thus, in adopting a targeting philosophy centered on conducting persistent attacks on multiple targets within a single industry, the EOU needed to develop a better understanding of German industrial systems to create a formal methodology that helped the unit prioritize targets.

⁶⁴ Rostow, *Concept and Controversy*, 33.

⁶⁵ Ibid.

To improve their knowledge on German industry and be able to compare one industry versus another, EOU members engaged British intelligence agencies to collect the necessary data. In particular, the EOU needed a quantitative grasp of stocks, production, and consumption of key war elements from multiple industries.⁶⁶ Since perfect information was unavailable, the EOU produced order of magnitude estimates that facilitated the systematic comparison of target systems.⁶⁷ With a more complete understanding of German target systems, the EOU generated their theory of target selection. In general, the EOU functioned as the bridge that connected intelligence and operations.

The EOU, in agreement with US bombing strategy, preferred precision bombing to area bombing. The EOU did not think area bombing would produce decisive results nor did it align with military and political aims. Specifically, they felt the Allies lacked the capability to create social catastrophe in enough cities simultaneously to create national disruption and grind the German war economy to a halt.⁶⁸ Accordingly, the EOU committed to precision, daylight bombing attempting to identify those targets that would have the greatest effect on Germany's military power and would affect Germany's war effort in a reasonably brief period of time.⁶⁹ The relatively slow build-up of forces pressed the EOU to focus on efficient targeting to create the biggest effect. It was this shortage of resources that compelled the EOU to pursue those German industries where only a small number of targets needed to be attacked to achieve the desired effects. While the EOU took into account the strategic and economic importance of particular industries to Germany, the primary factor when looking at German industries was the military

⁶⁶ Rostow, "The Beginnings of Air Targeting," A6.

⁶⁷ Office of Strategic Services, *War Diary, Volume 5*, 42.

⁶⁸ Rostow, "The Beginnings of Air Targeting," A9.

⁶⁹ Economic Warfare Division, *Handbook of Target Information* (London: Enemy Objectives Unit, 1943), 1.

indispensability of an industry's products.⁷⁰ This overarching theory provided the foundation from which the EOU developed a detailed methodology to analyze and assess the feasibility and suitability of different target systems.

In analyzing and assessing the merits of competing target systems, the EOU was careful to avoid long-term specialization.⁷¹ The EOU did not want its members to become wed to the targets they studied, which could produce biased recommendations. Therefore, the members migrated from one target system to another to develop a more well-rounded appreciation of the enemy's industrial capabilities.

Nevertheless, when studying a target system, the EOU expected its members to become experts on that particular system. Specifically, the team examined eleven different factors, listed below, for each target system.

1. Importance of the product to war production.
2. Specialization of use pattern.
3. Importance of individual plant.
4. Importance of indirect effect.
5. Tightness of supply situation.
6. Ease of repair.
7. Possibility of substitution.
8. Vulnerability of plant.
9. Size of target.
10. Ease of locating target.
11. Strength of defenses at target and en route.⁷²

With respect to the second factor, specialization of use pattern, the EOU worked under the assumption that it is better to target those industries where the output goes into essential uses vice a wide variety of uses.⁷³ For the fourth factor of importance of indirect effect, the EOU favored those industries that, if targeted, would produce widespread effects rather than a single

⁷⁰ Economic Warfare Division, *Handbook of Target Information*, 14.

⁷¹ Rostow, *Concept and Controversy*, 33.

⁷² Office of Strategic Services, *War Diary, Volume 5*, 36.

⁷³ *Ibid.*

isolated effect.⁷⁴ The sixth and seventh factors addressed the amount of redundancy, or ‘cushion’ as the EOU coined it, in a particular German industry. If the Germans could repair the industry quickly or another plant could quickly make up for the loss, then it was not as attractive a target. Factors eight through ten addressed the ease of striking the target. Would the USAAF be able to find the target and if found and struck, would the attack significantly damage the plant? The last factor addressed the risk associated with pursuing a particular target. This essentially became a cost-benefit analysis of whether striking a certain target was worth the risk to aircrews. A thorough understanding of each of these factors provided the source of comparison between target systems.

To compare the different industries the EOU members assigned a score (e.g. a number from 0 to 10) to each of the factors.⁷⁵ However, the EOU recognized that target selection was more complicated than a simple mathematical equation. They understood the inherent flaw of arbitrarily assigning numbers to each of the factors and knew senior leaders would not select targets based on the scores. Further, it was not a simple additive process. The targets had to satisfy three simple tests to be considered:

1. You must be able to reach it and drop bombs on it.
2. You must be able to damage it when you do hit it.
3. You must be able to impair the war effort, directly or indirectly, when you damage it.⁷⁶

Therefore, even if a target received high scores for two of the tests, if it could not satisfy one of the tests, then the EOU removed that target from consideration.⁷⁷ In general, while recognizing the limitation of quantifying each targets’ potential, the scores provided a source of discussion and a means to compare various targets and target systems.

⁷⁴ Office of Strategic Services, *War Diary, Volume 5*, 36.

⁷⁵ *Ibid.*, 37.

⁷⁶ *Ibid.*, 37 – 38.

⁷⁷ *Ibid.*, 38.

The EOU members not only needed to be experts on each target within a target system, they also needed to understand the interrelationships within an industry. Only with a broad understanding of these interrelationships could the EOU grasp the effect bombing a particular industry would produce.⁷⁸ This boiled down to being able to answer four questions:

1. How large an attack's effect would be within its own sector of the economy or military system?
2. How quickly would the effect be felt in frontline strength?
3. How long the effect would last?
4. What the attacks direct military, as opposed to economic, consequences would be?⁷⁹

Answering these questions demanded rigorous intellectual work. As Walt Rostow recounted from his time in the EOU, "It required taking fully into account the extent to which the military effect of an attack could be cushioned by the Germans by diverting civilian output or services to military purposes or buying time for repair by drawing down stocks of finished products in the pipeline."⁸⁰ The team had to anticipate Germany's response, appreciating that they were facing an adaptive enemy with a robust industrial complex.

Overall, the EOU's methodology to select targets for aerial bombardment was time intensive but thorough. This approach allowed the EOU to assign a value to each target and the various target systems. While these numerical values provided the basis for comparison and facilitated discussion on the merits of one industry vice another, EOU members knew the final decision on which targets to attack and in what prioritized order had to be made based on judgment.⁸¹

The production of the aiming point reports and the analysis that went into the assessment of various German industries provided the EOU a solid understanding of the German industrial

⁷⁸ Office of Strategic Services, *War Diary, Volume 5*, 39.

⁷⁹ Walt W. Rostow, "Waging Economic Warfare From London" *Studies in Intelligence* 36, no. 5 (1992): 74.

⁸⁰ Ibid.

⁸¹ Economic Warfare Division, *Handbook of Target Information*, 20.

base. Additionally, the team knew and supported the USAAF doctrine of daylight, precision bombing. The EOUs knowledge of USAAF doctrine coupled with their experience gathered generating aiming point reports laid the foundation for developing a methodology to select and prioritize targets. Although EOU members were economists, they did not seek targets for economic or political purposes. Rather, they targeted industries that satisfied explicitly defined military aims.⁸² In sum, the EOU's methodology was "a doctrine of warfare, not of economics or politics."⁸³

⁸² Office of Strategic Services, *War Diary, Volume 5*, 54.

⁸³ *Ibid.*, 55.

Ensuring Targets Align with Military and Political Aims

The EOU's target selection methodology was an intellectual process that required intelligence on enemy targets, an understanding of USAAF bombing capabilities, and a sense of military and political aims.⁸⁴ The EOU did not develop this methodology solely in the confines of their office. This doctrine of warfare emerged from the interplay between the EOU, Colonel Hughes, and USAAF planners and leaders.⁸⁵ The EOU understood the importance of personal and professional relationships and thus, sought to build relationship with all US and British organizations involved in the Allied bombing campaign. Consequently, to ensure selected targets aligned with military and political aims, the EOU regularly collaborated with the air planning staffs and top USAAF leaders.

Integration with Air Planning Staffs

General Donovan, of the OSS, established the EOU out of necessity. The Eighth Air Force did not have the internal capacity to analyze Axis target information and select German targets for aerial bombardment.⁸⁶ Therefore, the EOU's main purpose stood to assist US Strategic Air Forces with target selection. While the primary mission was to support the Allied bombing campaign, the unit was formally assigned to the US Embassy in London. This afforded the EOU the opportunity to develop independently their doctrine for target selection.⁸⁷ However, without military backgrounds it was important for EOU members to collaborate regularly with military officers to get a better understanding of their mission. Therefore, Colonel Hughes assigned USAAF officers to work inside the EOU.

⁸⁴ Office of Strategic Services, *War Diary, Volume 5*, 54.

⁸⁵ Chalou, *The Secrets War*, 50.

⁸⁶ Office of Strategic Services, *War Diary, Volume 5*, 1.

⁸⁷ MacPherson, *American Intelligence in War-Time London*, 131.

The purpose of these military liaison officers was to foster the relationship between the EOU and Eighth Air Force.⁸⁸ These liaison officers were critical for many reasons. The liaison officers helped the EOU members transform their perspectives on industry as an economic system to industry as a target system. Further, they educated the EOU on the USAAF's doctrine of high-altitude daylight precision bombing so that EOU members understood the capabilities and limitations of Allied airpower. Third, as the EOU members became more comfortable with USAAF doctrine and developed a better understanding of German industry as a target system, the liaison officers provided the necessary sounding board to ensure the targets selected by the EOU aligned with military guidance. Finally, the liaisons helped the EOU establish points of contact within other organizations involved in the Allied bombing campaign.

The EOU aggressively sought to develop relationships with all organizations, both US and British, involved in the Allied bombing campaign. Not only did the EOU need to pursue these relationships to obtain the intelligence data needed to generate the aiming point reports, and select and prioritize targets, but they also saw this as a great opportunity for like organizations to share and test their ideas. The EOU members and their channels of communication reached out all over London.⁸⁹ In fact, there was no Allied 'air war discourse' in which the EOU was not a participant.⁹⁰ This interaction with other organizations coupled with the professional aiming point reports they produced gave the EOU a good reputation. US air and ground leaders requested the presence of EOU members on their staffs.

⁸⁸ Chalou, *The Secrets War*, 48.

⁸⁹ Rostow, *Pre-Invasion Bombing Strategy*, 18.

⁹⁰ Christof Mauch, *The Shadow War against Hitler: The Covert Operations of America's Wartime Secret Intelligence Service*, translated by Jeremiah Riemer (New York: Columbia University Press, 2003), 96.

Operation Octopus

Having established credibility, the EOU assigned its analysts to branches of the US air and ground staffs to help guide the execution of the air offensive.⁹¹ Additionally, the EOU sent members to the British Air Ministry to share information and synchronize efforts. The EOU members coined this effort Operation Octopus. This operation was critical for the EOU as it allowed EOU members to develop close ties with planners and leaders in the USAAF and planners in the British Air Ministry.⁹²

All in all, besides the umbilical ties to Eighth and Fifteenth Air Force, EOU personnel were sent to Twenty-first and Twelfth Army Group, Allied Expeditionary Air Force Headquarters, the intelligence branch of Supreme Headquarters Allied Expeditionary Force, Mediterranean Allied Air Forces Headquarters, and the British Air Ministry.⁹³ According to Walt Rostow, one of the EOU members, "... EOU probably had its greatest operational impact through Operation Octopus."⁹⁴ With the knowledge gained producing the aiming point reports and developing their target selection theory, the EOU used Operation Octopus to share their findings and influence others as to the best way to hurt the Germans.⁹⁵ Further, through discourse, they hoped to learn other perspectives.

While the EOU members were spread out to all these organizations, they made sure to maintain close communication with each other to harmonize their efforts and share findings. By maintaining close contact with each other and the air planning staffs, the EOU ensured that its efforts and selected targets aligned with military and political objectives. Not only did the EOU

⁹¹ Rostow, "The Beginnings of Air Targeting," A3.

⁹² Rostow, *Pre-Invasion Bombing Strategy*, 16.

⁹³ Chalou, *The Secrets War*, 50.

⁹⁴ Rostow, "Waging Economic Warfare From London," 74.

⁹⁵ Barry M. Katz, *Foreign Intelligence: Research and Analysis in the Office of Strategic Services, 1942-1945*, (Cambridge: Harvard University Press, 1989) 120 - 121.

develop relationships with the US and British air planning staffs, but they also worked closely with USAAF leadership.

Collaboration with Army Air Force Leadership

The most effective way to ensure targets meet military and political aims is to present those targets to leadership and get senior leader approval. Colonel Hughes, as a lead air planner for Eighth Air Force and later US Strategic Air Forces was the link between the EOU and USAAF leadership. Colonel Hughes passed strategic guidance to the EOU to help guide their planning and target selection process.⁹⁶ The EOU selected targets in accordance with explicitly defined military objectives and if the targets linked to the overall war strategy. To ensure a relation between bombing operations and war strategy, the EOU reviewed the history of existing directives and evaluated targets against those directives.⁹⁷

Moreover, many times Colonel Hughes had the EOU members present their findings directly to USAAF leadership. EOU members felt very comfortable in those settings to speak their mind and offer suggestions on the best way to carry out aerial bombardment against Germany.⁹⁸ Through these interactions, EOU members developed professional relationships with many USAAF leaders, to include General Carl Spaatz and General Fred Anderson.

General Spaatz began the war as the Eighth Air Force commander. It was during this initial assignment that General Spaatz became familiar with the EOU. In effect, the EOU became the *de facto* target planning staff for the Eighth Air Force.⁹⁹ When the Eighth Air Force started bombing EOU recommended targets, the EOU felt a great sense of satisfaction and pride in their

⁹⁶ Davis, *Carl A. Spaatz and the Air War in Europe*, 300.

⁹⁷ Office of Strategic Services, *War Diary, Volume 5*, 78.

⁹⁸ Rostow, "Waging Economic Warfare From London," 78.

⁹⁹ Davis, *Carl A. Spaatz and the Air War in Europe*, 300.

work and it proved that their proposed targets aligned with military objectives.¹⁰⁰ When General Spaatz returned from North Africa to take command of US Strategic Air Forces, he and his deputy, General Fred Anderson, again relied on the expertise of the EOU to assist with target selection. The EOU was an acknowledged part of the team that shaped policy for the heavy bombers in Europe.¹⁰¹

Overall, to ensure targets selected met established guidance, the EOU first studied existing directives. Nonetheless, it was the constant collaboration and integration of the EOU with military leaders and planners that ensured selected targets supported military and political objectives. While discussed in general terms in this chapter, the following chapter provides three detailed examples during the war where the cooperation between the EOU and USAAF leaders and planners ensured EOU targets supported military and political aims.

¹⁰⁰ Mauch, *The Shadow War against Hitler*, 99.

¹⁰¹ Office of Strategic Services, *War Diary, Volume 5*, 5.

Case Studies

Casablanca Directive and Operation Pointblank

From 14 January to 24 January 1943, British Prime Minister Winston Churchill, President Franklin Roosevelt, and their Combined Chiefs of Staff met at Casablanca, in French Morocco, to take a fresh look at the Allies' war efforts.¹⁰² With the US involvement in the war reaching a year, the Casablanca Conference provided the venue for both Roosevelt and Churchill to settle the Western Alliance's war strategy for 1943. The Casablanca Directive closely reflected Roosevelt's and Churchill's wishes and outlined the top five priorities for 1943: (1) secure sea communications in the Atlantic Ocean, (2) provide assistance to Russia, (3) continue operations in the Mediterranean Sea, (4) conduct bombing operations from the United Kingdom, and (5) carry out operations in the Pacific theater.¹⁰³ In general, the Allies planned to continue the war efforts in the Mediterranean and put off a cross channel invasion until 1944. Even though there would be no cross channel invasion in 1943, the Casablanca Directive provided guidance for the execution of bombing operations from the United Kingdom

Prior to the Casablanca Conference, British military leaders tried to convince Churchill to pressure the USAAF to change from precision daylight bombing to area bombing, as carried out by the RAF. Part of the reason this argument gained steam is that the US bomber force had failed to drop a single bomb on the German homeland in the thirteen months since joining the war.¹⁰⁴ However, at the conference, General Eaker, the new Eighth Air Force commander, convinced Churchill of the merits of daylight bombing. Churchill agreed to give the USAAF more time to prove their case.¹⁰⁵ The Casablanca Directive stated,

¹⁰² Davis, *Carl A. Spaatz and the Air War in Europe*, 155.

¹⁰³ Dallek, *Franklin D. Roosevelt and American Foreign Policy, 1932 – 1945*, 372.

¹⁰⁴ Davis, *Carl A. Spaatz and the Air War in Europe*, 157.

¹⁰⁵ Herman S. Wolk, *Strategic Bombing: The American Experience*, (Manhattan: MA / AH Publishing, 1981), 21.

“You should take every opportunity to attack Germany by day, to destroy objectives that are unsuitable for night attack, to sustain continuous pressure on German morale, to impose heavy losses on the German day fighter force, and to contain German fighter strength away from the Russian and Mediterranean theaters of war.”¹⁰⁶

The Casablanca Conference then, established a joint concept for the Allies’ bombing offensive. The directive implied day-night cooperation between the RAF and USAAF; this became known as the Combined Bomber Offensive. The directive provided some overarching guidance.

“Your primary object will be 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.”¹⁰⁷

The Casablanca Directive went on to announce the five primary targets for air attack, prioritized as follows:

1. German submarine construction yards and bases.
2. The German aircraft industry.
3. Transportation.
4. The German oil industry.
5. Other targets in enemy war industry.¹⁰⁸

The directive purposely did not stipulate specific methods of cooperation between the RAF and USAAF nor did it list specific targets.¹⁰⁹ Instead, it left a good deal of latitude for interpretation to the field commanders. The RAF Commanders felt it endorsed their nighttime area raids while the United States understood the guidance as an endorsement of its philosophy of precision daylight bombing. Nonetheless, the directive prescribed the purpose of the air offensive against Germany and governed both its planning and prosecution.¹¹⁰ As the Eighth Air Force commander, General Eaker understood the success of this plan hinged on achieving air

¹⁰⁶ Thomas M. Coffey, *Decision over Schweinfurt: The U.S. 8th Air Force Battle for Daylight Bombing*, (New York: David McKay Company, 1977), 189 - 190.

¹⁰⁷ Ibid.

¹⁰⁸ Office of Strategic Services, *War Diary, Volume 5*, 57.

¹⁰⁹ Coffey, *Decision over Schweinfurt*, 204.

¹¹⁰ Hansell, *The Air Plan That Defeated Hitler*, 153.

superiority. Taking into account General Eaker's priority of achieving air superiority, the EOU began examining the guidance in the directive.

Upon inspection, the EOU felt the priorities required modification in order to fit with political and military aims and USAAF capabilities.¹¹¹ Understanding the strategic goals, the EOU thought changes were necessary to achieve those goals. For one, the attacks on the submarine yards needed to be drastically reduced or eliminated. Not only were the Allies successfully dealing with German submarines at sea, but attacks on production and bases were not making a significant difference.¹¹² Since the submarines had an extremely long production interval, effects from bombing submarine production would not be felt for months.¹¹³ Conversely, attacks on aircraft production would have a more immediate effect.

The EOU determined attacks on aircraft industry should focus on single-engine fighters. The single-engine fighters were Germany's primary hope for maintaining air superiority over Germany and were responsible for many friendly losses. In order to prosecute targets in other industries, the United States had to marginalize the German single-engine fighter force. Additionally, in order to conduct a landing on the continent, the Allies required air superiority. Through their analysis, the EOU determined aircraft engines stood as the best target system to reduce German aircraft production.¹¹⁴

From the EOU's analysis on essential German war industries, the ball bearing industry stood out as a key industry that could affect German war production as a whole.¹¹⁵ The ball bearing industry did not appear to be robust and thus provided an economically, feasible target. Without a robust bomber force in theater, the Allies needed to attack those industries where the

¹¹¹ Rostow, "The Beginnings of Air Targeting," A12.

¹¹² Ibid.

¹¹³ Economic Warfare Division, *Handbook of Target Information*, 24 - 26.

¹¹⁴ Office of Strategic Services, *War Diary, Volume 5*, 72.

¹¹⁵ Rostow, "The Beginnings of Air Targeting," A12.

fewest number of targets would create the greatest effects. For this reason, ball bearings became an important target. In early 1943, the Allies did not have the forces in place to attack the vast number of transportation and oil targets. Both of these target systems were beyond the operational grasp of the Allied bomber force.¹¹⁶ With these assessments, the EOU began developing an alternative approach for the Allies.

On February 26, 1943, the EOU produced an informal draft air plan that emphasized targeting German fighter aircraft.¹¹⁷ Colonel Hughes lobbied hard for the EOU's plan and convinced military leaders of its validity. As proof, the POINTBLANK Directive released on June 7, 1943 closely reflected the recommendations presented by the EOU.¹¹⁸ Operation POINTBLANK, its military codename, sought to sustain attacks on the Luftwaffe, with the aim of drastically reducing the strength of the German Air Force and its production capability. With aircraft as the top priority, ball bearings received a secondary priority since they played a large role in aircraft production.¹¹⁹ The wording in the POINTBLANK Directive highlighted the importance of aggressively pursuing German fighter aircraft: "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 the ultimate decisive action by our combined forces on the continent..."¹²⁰

The POINTBLANK Directive was critical since German single-engine fighter production had risen from 381 aircraft in January 1943, to 1,050 in July 1943.¹²¹ At this rate, the Allies' plan

¹¹⁶ Ibid.

¹¹⁷ Office of Strategic Services, *War Diary, Volume 5*, 61.

¹¹⁸ Mauch, *The Shadow War against Hitler*, 99.

¹¹⁹ William R. Emerson, *Operation Pointblank: A Tale of Bombers and Fighters*, (The Harmon Memorial Lectures in Military History, Number 4. Colorado Springs: United States Air Force Academy, 1962), 1.

¹²⁰ Mauch, *The Shadow War against Hitler*, 99.

¹²¹ Rostow, "Waging Economic Warfare From London," 74.

of conducting a cross channel landing in 1944 would be in jeopardy. The increased focus on the German aircraft industry began paying dividends by the end of the year as German aircraft production in December 1943 fell to 560.¹²²

On the whole, the incorporation of the EOU's proposed targets into the POINTBLANK Directive represented a major success for the EOU. By producing this directive, Allied leadership bought off on the EOU's targeting philosophy that a high degree of destruction in a few essential industries produced a greater effect than a small degree of destruction in many industries.¹²³ Most importantly, it validated that the targets proposed were valid objectives, and that they aligned with military and political aims. The POINTBLANK Directive established the relation between the EOU's target recommendations and the war strategy as a whole.

The "Oil Plan"

The POINTBLANK Directive guided the application of Allied air power into early 1944. For most of 1943, the Allies did not have the number of aircraft necessary to achieve the objectives outlined in the directive. With the continuous influx of bombers, the strategic bombing campaign began gaining momentum toward the close of 1943 and the USAAF in Europe had reached its full strength and capabilities in February 1944.¹²⁴ With these numbers and cooperation from the weather, the Allies executed an aggressive week-long bombing campaign against the German Air Force. "Big Week" was a great success, resulting in the tactical defeat of the German fighter force over its own bases, and necessitating a change in the Allies' bombing strategy.¹²⁵

General Spaatz, the commander of US Strategic Air Forces in Europe believed the Allies' success during "Big Week" signaled that the destruction of other German industries was not only

¹²² Ibid.

¹²³ Robin Neillands, *The Bomber War: The Allied Air Offensive Against Nazi Germany*, (New York: The Overlook Press, Peter Mayer Publishers, 2001), 264.

¹²⁴ Mauch, *The Shadow War against Hitler*, 95.

¹²⁵ Office of Strategic Services, *War Diary, Volume 5*, 77.

feasible, but also desirable.¹²⁶ The EOU, hearing this guidance, began looking at alternative target systems to determine which industry the strategic bombing campaign should pursue next.

Specifically, Colonel Hughes directed the EOU to review existing directives and evaluate target systems that fall within that guidance.¹²⁷ From their research, the EOU decided on oil as the most lucrative target system that could substantially hinder the German war effort.

The Allies always viewed oil as a worthwhile target system, but before 1944, the oil target system lay beyond the air force's capacity.¹²⁸ By February 1944, the Allies had a sufficient number of aircraft to attack the German oil industry and significantly degrade the German war economy in a relatively short time.¹²⁹ With the oil industry now within the realm of USAAF capabilities, the EOU recommended a way ahead for the strategic bombing campaign.

The EOU proposed the following priorities for the strategic bombing effort: 1) completion of POINTBLANK and the destruction of the German Air Force; 2) tactical support if absolutely required; 3) execution of the attack on the oil target system since among the remaining targets, oil offers the best opportunity to bring the German war effort to a close.¹³⁰ The EOU recognized the importance of continuing to put pressure on the German Air Force to ensure the Allies had air superiority for the invasion of Europe. Thus, Operation POINTBLANK remained the number one priority. Secondly, to support the amphibious landing and assist soldiers on the ground, tactical support received the next priority. Oil was the logical next step.

Not only did oil affect all German war production, but it also limited the fighting capacity of German air, ground, and sea forces.¹³¹ In the EOU's view, destruction of oil refineries and

¹²⁶ Davis, *Carl A. Spaatz and the Air War in Europe*, 345.

¹²⁷ Office of Strategic Services, *War Diary, Volume 5*, 77.

¹²⁸ Mauch, *The Shadow War against Hitler*, 101.

¹²⁹ Rostow, "The Beginnings of Air Targeting," A10.

¹³⁰ Mauch, *The Shadow War against Hitler*, 102.

¹³¹ Rostow, *Pre-Invasion Bombing Strategy*, 31.

storage facilities would bring the entire German war machine to a halt. With an overwhelming number of bomber aircraft available, the Allies could systematically attack the twenty-three synthetic plants and thirty-one refineries that accounted for over ninety percent of the total Axis refinery and synthetic oil output.¹³² Moreover, from a targeting standpoint, oil refineries seemed unusually vulnerable as they were easily identifiable from the air and were located in open areas away from densely populated towns.¹³³ From the findings of this research, the EOU generated a memorandum on 28 February 1944 titled, “The Use of Strategic Air Power after 1 March 1944,” that they staffed through USAAF leadership.¹³⁴

The plan aligned with guidance provided by General Spaatz and was well received by USAAF planners.¹³⁵ The plan discussed the strategic importance of oil, vulnerability to attack, and the anticipated effects of striking specific targets.¹³⁶ Colonel Hughes hurried the plan through the staffing process and presented the plan to General Spaatz on 5 March 1944.¹³⁷ General Spaatz recognized that the EOU’s plan was essentially an ‘Oil Plan’ and he agreed that a radical reduction of German oil supplies would substantially degrade the fighting capability of German ground and air forces.¹³⁸ General Spaatz immediately accepted the draft plan and directed his staff to prepare it for presentation to General Eisenhower, the Supreme Commander of Allied Forces in Europe. The final plan submitted to General Eisenhower contained only minor changes to the EOU’s original plan and included the EOU appendices in their entirety.¹³⁹

¹³² Rostow, “The Beginnings of Air Targeting,” A10.

¹³³ Hansell, *The Air Plan That Defeated Hitler*, 83.

¹³⁴ Office of Strategic Services, *War Diary, Volume 5*, 78.

¹³⁵ Davis, *Carl A. Spaatz and the Air War in Europe*, 347.

¹³⁶ Office of Strategic Services, *War Diary, Volume 5*, 81 - 82.

¹³⁷ Office of Strategic Services, *War Diary, Volume 5*, 92.

¹³⁸ Rostow, “Waging Economic Warfare From London,” 75.

¹³⁹ Rostow, *Pre-Invasion Bombing Strategy*, 32.

At a 25 March 1944 meeting with General Eisenhower and his deputy, Air Chief Marshal Tedder, General Spaatz presented his plan. He argued that oil yielded the biggest strategic utility and saw it as a bottleneck in the German war machine.¹⁴⁰ Further, intelligence reports suggested that after the Allies success during “Big Week,” the Germans intended to conserve their aircraft and pilots in preparation for an Allied invasion.¹⁴¹ General Spaatz contended that going after oil would force the Germans to alter their plan.

According to General Spaatz, German aircraft would have to remain in central Germany to protect their fuel sources rather than move west to repel an Allied invasion.¹⁴² Further, the attacks on oil would corner the German Air Force into a difficult situation. If they elected to preserve their fighters, the Allies would face little resistance as they destroyed a key strategic resource needed by the Germans to sustain their war effort. With that option unacceptable, the German Air Force would interdict Allied bombing missions and with the arrival of a long-range fighter escort, the Allies would inflict intolerable losses on the German fighter force. While many agreed with General Spaatz’s presentation, General Eisenhower did not select the ‘Oil Plan’ since it could neither guarantee success nor that these attacks would have an effect on German strength in the West prior to D-Day.¹⁴³

The EOU was very forthright in their plan, acknowledging that due to their storage capacity, if Germany chose to allocate stocks to the Western Front, attacks on oil would not affect the opening stages of Operational OVERLORD through D+30.¹⁴⁴ This fact led General Eisenhower to select a course of action that focused solely on striking marshaling yards, thinking it would have a more immediate effect in support of the Allied invasion. As the date of invasion

¹⁴⁰ Biddle, *Rhetoric and Reality in Air Warfare*, 237.

¹⁴¹ Davis, *Carl A. Spaatz and the Air War in Europe*, 396.

¹⁴² Hansell, *The Air Plan That Defeated Hitler*, 187.

¹⁴³ Rostow, “The Beginnings of Air Targeting,” A10 – A11.

¹⁴⁴ Office of Strategic Services, *War Diary, Volume 5*, 83.

came closer, General Eisenhower focused on actions that would assist troops in establishing a beachhead.¹⁴⁵ Therefore, attacks on oil would not occur until after the Allies established lodgment in Northern Europe. General Spaatz vehemently disagreed with this decision as he thought attacks on marshaling yards would have diffuse, generalized effects but would not interdict military supplies because of redundancy and Germany's ability to repair damaged lines overnight.¹⁴⁶

Approaching General Eisenhower, General Spaatz felt so strongly that the Allies should pursue oil targets that he threatened to resign.¹⁴⁷ In response, General Eisenhower gave General Spaatz two good weather days to pursue oil targets. The attacks on oil proved very successful and messages intercepted by intelligence showed that the attacks caused panic in Germany and resulted in the Germans elevating their defenses of oil production to top priority.¹⁴⁸ The Germans were so concerned about their oil situation that they transferred anti-aircraft guns from their cities to their synthetic oil plants.¹⁴⁹ While supporting Operation OVERLORD remained the top priority, Germany's reaction to the attacks on their oil industry convinced the Allies that the oil industry was, in fact, a lucrative strategic target.

The German Air Force desperately defended oil targets taking huge losses and was in no position to contest the Allies' invasion on D-Day.¹⁵⁰ In addition to directly reducing Germany's ability to defend against the Allies invasion from the air, the strategic attacks on German oil targets greatly affected the German war effort by the end of the summer. In March 1944, Germany was producing 180,000 metric tons of fuel, but by September, fuel production was

¹⁴⁵ Hansell, *The Air Plan That Defeated Hitler*, 185.

¹⁴⁶ Rostow, "Waging Economic Warfare From London," 75.

¹⁴⁷ Chalou, *The Secrets War*, 52.

¹⁴⁸ *Ibid.*, 53.

¹⁴⁹ Biddle, *Rhetoric and Reality in Air Warfare*, 237.

¹⁵⁰ Wolk, *Strategic Bombing*, 26.

down to only 10,000 tons.¹⁵¹ Additionally, in that same period, Allied bombing reduced German fuel supplies from 981,000 tons to 281,000 tons.¹⁵² Overall, the attacks on oil severely hampered the German war effort and validated the recommendations provided by the EOU

The EOU was behind the decision of the USAAF to attack oil. In helping guide the decision to pursue oil and in developing a system of comparative target analysis that indicated oil as the optimum target, the EOU was more useful to the strategic bombing campaign in the weeks following “Big Week” than at any other point during the war.¹⁵³ The EOU took General Spaatz’s guidance and reviewed existing documentation before selecting the oil industry as the most lucrative target system.

The EOU staffed a memorandum through USAAF leadership to ensure the German oil industry aligned with strategic objectives. The fact that the text in the final version of the plan drew heavily on the EOU memorandum and used the EOU appendices in their entirety illustrates how successful the EOU was in selecting a target that aligned with military and political objectives. The next problem for the EOU revolved around whether the Allies should target bridges or marshaling yards to obstruct the Germans from sending reinforcements to counter Operation OVERLORD.

Bridges versus Marshaling Yards

Concurrent with their analysis and research on how best to use the strategic bomber force following “Big Week,” the EOU received a tasking from Colonel Hughes to determine how best to use allied tactical air power to support Operation OVERLORD.¹⁵⁴ In particular, Hughes wanted the EOU to review Professor Solly Zuckerman’s, Air Chief Marshal Tedder’s scientific

¹⁵¹ Chalou, *The Secrets War*, 53.

¹⁵² *Ibid.*

¹⁵³ Rostow, “The Beginnings of Air Targeting,” A11.

¹⁵⁴ Charles P. Kindleberger, “Zuckerman’s Bomb: World War II Strategy.” *Encounter* (November 1978): 40.

advisor, plan for attacking marshaling yards. Professor Zuckerman believed marshaling yards offered the greatest opportunity to degrade the flow of German resources and limit Germany's ability to move forces to counter the Allies' invasion.¹⁵⁵ Air Chief Marshal Leigh-Mallory, who controlled the tactical air forces as the commander of Allied Expeditionary Air Force, also supported the marshaling yard plan. Air Chief Marshal Tedder, Air Chief Marshal Leigh Mallory, and Professor Zuckerman felt a combined effort by strategic and tactical forces on marshaling yards would have the greatest effect on the German transportation network. Thus, there was a lot of momentum behind the marshaling yard plan. Nonetheless, with Colonel Hughes' guidance, the EOU entered the tactical arena and immediately conducted in-depth research to determine if there were more advantageous targets than marshaling yards.

During their initial analysis of the marshaling yard plan, the EOU identified two main weaknesses. First, the excess capacity that existed in marshaling yards would allow the Germans to manipulate civilian rail to ensure higher priority military traffic made it through.¹⁵⁶ Second, with all this excess capacity, it only took a short time to repair the bombed tracks.¹⁵⁷ Therefore, the slack in the rail yards prevented the yards from being great targets. Hitting the rail yards, the EOU argued, would not significantly affect the German war effort since the Germans could fix the lines relatively quickly in order to allow essential military trains to get through. To support this claim, the EOU looked to operations in Italy.

The EOU read the "Sicily Report" in detail in February 1944 and discovered that the Allies achieved success attacking bridges in Italy in October and November of 1943.¹⁵⁸ Specifically, the results from Operation STRANGLE, the systematic interdiction of supply lines north of Rome, highlighted that the best way to cut lines of communication was by attacks on

¹⁵⁵ Office of Strategic Services, *War Diary, Volume 5*, 98.

¹⁵⁶ Rostow, *Pre-Invasion Bombing Strategy*, 37.

¹⁵⁷ Rostow, *Pre-Invasion Bombing Strategy*, 37.

¹⁵⁸ Rostow, *Concept and Controversy*, 48.

bridges.¹⁵⁹ These findings led the EOU to favor bridges over marshaling yards. They felt bridges were superior because it would accomplish the disruption of military supply movements more thoroughly than attacks on marshaling yards. The EOU teamed with operations research units to determine if bombers could effectively target and destroy bridges.¹⁶⁰

The findings from this research indicated that bridges were not as difficult to hit as originally thought, especially when using medium rather than heavy bombers.¹⁶¹ Second, whereas it only took days to repair marshaling yards, it took weeks to repair bridges. The EOU focused on effects rather than bombing efficiency. They reasoned, if only one bomb out of a thousand hit a bridge and dropped it, that was more preferable than having every bomb hit a marshaling yard and leaving a single line intact.¹⁶² The objective was to stop trains and bridges provided the best opportunity to achieve that objective. Finally, since medium bombers were the best asset to use to strike bridges, this would free the heavy bombers to pursue strategic targets such as oil.¹⁶³ Therefore, the EOU argued for a bridge campaign as they felt it provided the greatest opportunity to fulfill policy objectives.

From the EOU's perspective, the best hope for the Allies to seal off the invasion area was the complete destruction of the bridges leading to northern France.¹⁶⁴ This required a major effort by the EOU to gather intelligence on the different routes and bridges in France. The EOU sought to identify which targets would prevent German reinforcements from reaching the beachhead. In addition to passing their findings to Colonel Hughes, the EOU produced papers and attended

¹⁵⁹ Rostow, *Pre-Invasion Bombing Strategy*, 58.

¹⁶⁰ Kindleberger, "Zuckerman's Bomb: World War II Strategy," 40.

¹⁶¹ Meilinger, "The Origins of Effects-Based Operations," 120.

¹⁶² *Ibid.*, 121.

¹⁶³ Office of Strategic Services, *War Diary, Volume 5*, 103.

¹⁶⁴ Rostow, *Pre-Invasion Bombing Strategy*, 58.

briefings and conferences to share their findings and convince those in charge that bridges were more lucrative targets than marshaling yards.¹⁶⁵

On 17 February 1944, the EOU produced a plan entitled “Outline Plan for Air Support to OVERLORD” that they staffed to General Spaatz.¹⁶⁶ The plan argued that bridges stood as more lucrative targets than marshaling yards. Bridges were cheaper in terms of effort and the effects from destroying a bridge lasted longer than blocks on marshaling yards. Specifically, the EOU’s analysis indicated that a bridge blockage required 196 tons while a marshaling yard required 456 tons to stop traffic.¹⁶⁷ Thus, to provide maximum support to Operation OVERLORD, the EOU recommended isolating the Normandy battlefield by taking out three rings of bridges above the Seine-Loire complex.¹⁶⁸ Medium bombers and fighter-bombers would take out the bridges freeing up the strategic bombers to strike oil. The plan resonated with General Spaatz, but since he did not have operational control over the tactical forces, he did not feel comfortable presenting the ‘Bridge Plan’ to General Eisenhower.¹⁶⁹

At the 25 March 1944 meeting with General Eisenhower, General Spaatz only lobbied for the strategic bombing of oil targets. From a professional standpoint, he felt it was wrong to propose how to employ forces not under his control. While General Spaatz argued for attacks on oil targets at this meeting, Professor Zuckerman presented a course of action that focused on marshaling yards.

Despite the mounting evidence in Italy, Professor Zuckerman claimed that bombing accuracy was not exact enough to strike and destroy bridges without using an excessive number

¹⁶⁵ Office of Strategic Services, *War Diary, Volume 5*, 118.

¹⁶⁶ *Ibid.*, 104.

¹⁶⁷ *Ibid.*, 102.

¹⁶⁸ Rostow, “Waging Economic Warfare From London,” 76.

¹⁶⁹ Davis, *Carl A. Spaatz and the Air War in Europe*, 350.

of aircraft.¹⁷⁰ Further, he stated that while only a direct hit counts on a bridge, any bomb on a railway center causes damage and since marshaling yards were expansive, bombers were more likely to hit something of value.¹⁷¹ Since Operation OVERLORD stood as General Eisenhower's number one priority, General Eisenhower chose the marshaling yard plan since he felt it would have a greater immediate impact on Germany's ability to counter the Allies' invasion. This decision disappointed General Spaatz and the EOU, yet they continued their research and analysis to determine which tactical targets would have the greatest effect on German movement in Northern France.

The EOU continued to collect and analyze data from Italy that supported the bombing of bridges. Towards the end of April 1944, General Spaatz and his deputy, General Anderson, went to Italy and saw first-hand that a modest number of bombers could successfully destroy bridges.¹⁷² Upon returning from the trip, General Spaatz was strongly behind the bridge plan even though it was a tactical vice strategic target. He took the view that attacks on marshaling yards would not provide the lasting effects needed to prevent German reinforcements from reaching Northern France. In early May, General Spaatz presented General Eisenhower an alternative to the marshaling yards plan and recommended experimental attacks to prove the effectiveness of bombers against bridges.¹⁷³

On 7 May 1944, the Ninth Air Force conducted experimental attacks on six Seine bridges with less than fifty P-47 fighter-bombers.¹⁷⁴ The attacks proved unexpectedly successful with three bridges badly damaged and a fourth dropped into the river.¹⁷⁵ Air planners placed pictures

¹⁷⁰ Kindleberger, "Zuckerman's Bomb: World War II Strategy," 40.

¹⁷¹ Rostow, *Concept and Controversy*, 86.

¹⁷² Davis, *Carl A. Spaatz and the Air War in Europe*, 404.

¹⁷³ Davis, *Carl A. Spaatz and the Air War in Europe*, 403 - 404.

¹⁷⁴ Chalou, *The Secrets War*, 53.

¹⁷⁵ *Ibid.*

depicting the bridge dropped into the river on the desk of every major figure concerned with the bombing business and shortly thereafter, the bridge campaign began in earnest.¹⁷⁶

The bridges turned out to be extraordinarily efficient objectives and made a major contribution toward obstructing the German war effort. By D-Day, the interdiction of the Seine was complete, significantly impeding Germany's efforts to reinforce its forces in Normandy from the Calais area and elsewhere.¹⁷⁷ Additionally, as the EOU intended, the effectiveness of the bridge campaign enabled the heavy bombers to pursue the oil targets.¹⁷⁸

Once again, the EOU took higher guidance, conducted thorough research and analysis, and developed a plan outlining targets that best aligned with higher objectives. While in this instance the EOU focused on tactical rather than strategic targets, they understood the strategic importance of establishing a beachhead in Northern France, and thus sought to identify the target system that would best support that operation. To ensure their recommendations aligned with military and political objectives, the EOU worked closely with Colonel Hughes and the rest of General Spaatz's staff. Although not adopted initially, the EOU's ability to understand the environment, conduct in-depth research and analysis, and develop detailed plans resulted in General Eisenhower choosing to execute the bridge campaign a month prior to D-Day. Through constant coordination and seamless integration with the USAAF leaders and planners, the EOU ensured the targets they selected supported military and political objectives.

¹⁷⁶ Rostow, *Pre-Invasion Bombing Strategy*, 61.

¹⁷⁷ Chalou, *The Secrets War*, 54.

¹⁷⁸ Rostow, "The Beginnings of Air Targeting," A20.

Conclusion

The EOU played a critical role in shaping the strategic bombing campaign during WWII. Although the civilian economists arrived in London in September 1942 lacking an understanding of military operations and target selection, in less than six months they had become experts on the German industrial complex and had gained the respect of US air planners and leaders. Colonel Hughes, the Chief planner for USAAF in Europe, served as the conduit between the USAAF planning staff and the EOU. In this capacity, Colonel Hughes provided direction to the EOU.

Colonel Hughes' first task directed the EOU members to generate aiming point reports. In addition to helping the members become familiar with German industry, this task sought to change the way EOU members looked at industry. Rather than viewing industry from an economists' perspective, the EOU members would have to look at industry from a military viewpoint since the purpose of the aiming point reports was to determine the most vulnerable point of each German plant or installation.¹⁷⁹ In generating nearly 285 aiming point reports, the EOU became experts on the German industrial complex and were prepared to assist USAAF planners with target selection and prioritization.

The EOU took an effects-based approach in identifying and prioritizing targets. Lacking a robust air capability at the beginning of 1943, the EOU understood the need to maximize the efficiency and effectiveness of US airpower using limited available bomber assets to produce the greatest effect on the German war economy. In the EOU's estimation, multiple strikes on targets within a single industry would have a greater effect on Germany's war production than striking a key target in multiple industries.¹⁸⁰ Taking this approach, the EOU pursued those industries where the minimum number of targets would have the greatest effect on the German war effort.¹⁸¹

¹⁷⁹ Rostow, *Pre-Invasion Bombing Strategy*, 20.

¹⁸⁰ Office of Strategic Services, *War Diary, Volume 5*, 56.

¹⁸¹ *Ibid.*, 55.

While this methodology allowed the EOU to prioritize targets based on what they thought would have the greatest effect, only through coordination and integration did the EOU ensure the targets they selected aligned with political and military objectives.

The EOU understood the importance of personal and professional relationships and thus sought to establish and build relationships with all organizations involved in the Allies' bombing campaign. During Operation Octopus, the EOU sent its members to branches of the US air and grounds staffs in England as well as the British Air Ministry to share information and synchronize efforts. Even with its members spread out to different organizations, the EOU members maintained close contact with one another to ensure all were operating from the same page. While the EOU interacted and coordinated with all units involved in the bombing campaign, the primary organization it worked with was Eighth Air Force, which later combined with Fifteenth Air Force to become US Strategic Air Forces in Europe. While formally assigned to the US Embassy in London, in reality the EOU supported Eighth Air Force efforts to prosecute a strategic bombing campaign. This chain of command offered opportunities as well as challenges.

By not falling directly under the command of Eighth Air Force, the EOU could independently develop its target selection methodology.¹⁸² However, since EOU members lacked military experience, Colonel Hughes assigned liaison officers to work inside the EOU and foster the relationship between the two organizations. The liaison officers proved extremely beneficial. Not only did they relay military guidance and help the EOU members understand USAAF doctrine, but they also facilitated the interaction between EOU members and senior USAAF leaders and planners.

Overall, it was this integration and constant collaboration between the EOU and USAAF leadership that resulted in a shared understanding of political and military objectives and ensured EOU's target recommendations and priorities supported strategic goals. Both the POINTBLANK

¹⁸² MacPherson, *American Intelligence in War-Time London*, 131.

Directive and the “Oil Plan” support this assertion. The incorporation of the EOU’s proposed targets into the POINTBLANK Directive demonstrated that the EOU’s recommendations aligned with military and political aims. With respect to the “Oil Plan”, the fact that the text in the final version of the plan closely resembled the EOU memorandum and used the EOU appendices in their entirety illustrates how successful the EOU was in selecting targets that aligned with military and political objectives. The extensive collaboration and coordination between the EOU and USAAF leaders resulted in synchronized planning and ensured EOU’s selected targets supported strategic goals.

As in World War II, collaboration and coordination remain critical in today’s operating environment to synchronize efforts and align operations with political objectives. The US fields the world’s best army, navy, marines, and air force, yet the ability of these services to integrate and conduct joint operations truly makes the United States the world’s greatest military power. While interaction and collaboration between the military services has been mostly excellent, the wars in Iraq and Afghanistan have highlighted the need to improve coordination and integration between the Department of Defense and other US departments, particularly the Department of State. The collaboration, cooperation, and integration between the EOU and the United States Army Air Forces in World War II stands as the gold standard that US government agencies should emulate today.

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