The Combined Bomber Offensive's Destruction of Germany's Refined-Fuels Industry

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In May 1944 after the initial Eighth Air Force raid on Germany's synthetic oil plant, Albert Speer recalled telling Adolf Hitler that "the enemy has struck us at one of our weakest points. If they persist at it this time, we will soon no longer have any fuel production worth mentioning. Our one hope is that the other side has an air force General Staff as scatterbrained as ours!" After two months of persistent bombing attacks against the oil industry, Speer explained once again to Hitler that "it would be pointless to have tanks if we could not produce enough fuel."

—Albert Speer, *Inside the Third Reich: Memoirs*

Revisionist historians have advanced the idea that the collapse of Germany's refined-fuels industry during World War Two resulted from Allied ground forces capturing the natural re-

sources needed for refined-fuel products as opposed to the Combined Bomber Offensive's (CBO) air attacks. An examination of the facts should enable Airmen to properly assess the CBO's effectiveness against the German oil industry and enable them to appreciate the joint nature of the fight to defeat Germany.

The initial, though controversial, history that addresses this matter—the United States Strategic Bombing Survey (USSBS)—concluded that air attacks caused the oil industry's demise and "heavily contributed to the collapse of the Third Reich."[1] Contrastingly, in his book *The Blitzkrieg Myth*, John Mosier states that the USSBS's conclusions are incorrect because the survey did not factor in the loss of natural resources—specifically, the Romanian oil fields captured by Allied land forces in August 1944.[2] Similarly, in *Bombing to Win*, Robert Pape claims that the loss of those oil fields and the ones in Hungary during 1945, not air attack, crippled German oil production.[3] However, when one examines the situation in depth, it becomes very apparent that air attacks disabled Germany's refined-fuels industry rather than the capture of resources by ground forces.

German industry had difficulty meeting the military's fuel needs throughout World War Two, despite having an enormous and growing synthetic fuels production capacity at the start of the war to supplement limited resources of domestic crude oil.[4] Fuel scarcity became evident when Germany rationed fuel from late 1940 through the spring of 1941 to build up stocks for Operation Barbarossa.[5] Concerned about the lack of fuel, Gen Walter Warlimont, head of the German military's operations staff, in June 1941 wrote "War Potential 1942," a paper in which he declared that the "oil supply will be one of the weakest points of our economy; it may well influence the operational capabilities of all three Services, the armaments industry, and deliveries to our allies."[6] British and American leaders were also aware of Germany's supply issue, realizing that a reduction in the enemy's fuel levels would incapacitate the German military's mechanized forces—on land, at sea, or in the air.

In January 1943, Prime Minister Winston Churchill and President Franklin D. Roosevelt met in Casablanca along with the British and American Combined Chiefs of Staff (CCS) to determine Allied strategy. The conference decided that the Allies would cross the English Channel and invade the Continent in 1944 and that sustained air operations should enable the invasion. To this end, the CCS issued what became known as the Casablanca Directive (i.e., CCS Directive 166/1/D) on 21 January 1943, which called for a bomber offensive from the United Kingdom.[7]

British and American Airmen's interpretations of this directive varied from the CCS's intent. The Royal Air Force's (RAF) Bomber Command thought the directive allowed an attack on the morale of the German people while the United States Army Air Forces thought it meant an attack on the industrial fabric of Germany that would lead to Germany's capitulation.[8] Air Chief Marshal Charles Portal, a member of the CCS and chief of the RAF's Air Staff, understood that the Casablanca Conference endorsed bombing Germany to make it vulnerable to land invasion.[9] In April 1943, in his capacity as CCS executive agent for the direction of the bomber offensive, Portal added a clarifying sentence at the end of the CCS Directive's mission statement: "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. This is so construed as meaning so weakened as to permit initiation of final combined operations on the continent."[10]

On 18 May 1943, the CCS then approved the CBO Plan implementing the CCS Directive. The plan added the defeat of the German fighter force as an intermediate objective and modified the prioritized CCS objectives from January. In order, these new priority systems included submarines, aircraft industry, ball-bearing production, oil, synthetic rubber, and military transport.[11] These objectives reflected the over-

whelming need to establish air superiority and to maintain control of the sea lanes in the Atlantic.

Subsequent American air attacks in 1943 failed to attain their CBO objectives due to the diversion of bombers to other theaters and the lack of long-range fighter escorts.[12] Oil targets, a low-priority objective, received only scant and infrequent attention despite the much-publicized American raid on the Romanian oil refineries at Ploesti in August 1943. The harsh truth as 1943 drew to a close was that the Germans were maintaining air superiority over Germany and preserving their fighter force's strength in order to contest the expected cross-channel invasion.

With the invasion date coming ever closer and the CBO yet to achieve the intermediate objective, on 13 February 1944, the CCS modified the CBO objective to focus air attacks on the attainment of air superiority.[13] The revised mission statement read as follows: "The progressive destruction and dislocation of the German military, industrial, and economic systems, the disruption of vital elements of lines of communication and the material reduction of German air combat strength, by the successful prosecution of the Combined Bomber Offensive from all convenient bases."[14]

This final modification to the CBO's objectives made German fighter production, ball bearings, and aviation-support facilities the top-priority objectives followed by the German vengeance missiles (V-1 and V-2). The next priority objective included Berlin and other industrial targets when Allied forces could not attack the first two priorities. Mediterranean-based bombers were to attack fighter production and support facilities or, if that proved impossible, to strike Mediterranean area targets or land-support targets.[15] The CBO did not even list oil as a priority objective.

Anticipating the defeat of the German fighter force by April 1944, in February 1944, Lt Gen Carl Spaatz, commander of United States Strategic Air Forces (USSTAF) in Europe, directed his staff to prepare plans for USSTAF support of Operation Overlord, the cross-channel invasion of France.[16] To ensure air superiority and to hamper the German mili-

tary's response to the invasion, the USSTAF staff thought that air attacks should be conducted in priority order on the oil industry, emphasizing gasoline production, fighter and ball-bearing industries, rubber production, bomber production, and, if weather prevented precision attacks on the first four target categories, transportation centers.[17] By the end of March 1944, the USSTAF, by killing or disabling Luftwaffe fighter pilots, had won the battle for air superiority and was ready to move on to attack the German oil industry.[18]

By March 1944, German refined fuels from crude oil primarily came from five sources: oil fields in the vicinity of Hamburg, Germany; the Prinzendorf field in the Vienna Basin; the Hungarian fields near Lake Balaton; the fields near Ploesti, Romania; and small fields in Estonia, Albania, and Poland.[19] These crude oil resources remained on track to provide 2.048 million tons of finished fuel products in 1944.

In addition to the limited refined products based on crude oil, Germany in 1944 was producing liquid refined fuel from coal, using the Bergius hydrogenation process and the Fischer-Tropsch synthesis process.[20] The Bergius hydrogenation process produced high-quality gasoline suitable for use as an aviation fuel, while the Fischer-Tropsch synthesis process produced high-quality diesel fuel, lubricating oil, and some low-quality gasoline that, when mixed with benzol or benzene, became suitable fuel for cars and trucks.[21] In 1944 Bergius hydrogenation plants stood ready to produce 3.780 million tons of fuel for the year, and the Fischer-Tropsch synthesis plants would add another .508 million tons of fuel.[22] Additionally, the Germans expected 65 benzol plants located near coal mines to produce 704,000 tons of benzol in 1944, over half designated for use as a fuel additive to increase gasoline octane levels and the remainder for use in the nitrogen, ammunition, and synthetic rubber industries.[23] Germany anticipated synthetic production of 4.920 million tons of finished fuel products. From both its synthetic plants and refined crude, it expected to produce 7.040 million tons of refined fuels in 1944.[24]

However, the USSTAF sent its plan to Gen Dwight Eisenhower for approval rather than to Air Chief Marshal Portal. In accordance with the Cairo conference decision by the CCS in December 1943, General Eisenhower, commander of the Allied Expeditionary Force, received control of the USSTAF and Bomber Command on 15 April 1944 and retained this control until 14 September 1944.[25] He disapproved the USSTAF plan in favor of the Allied Expeditionary Air Force's plan for the bombers to attack transportation networks in France and Germany west of the Rhine.[26] General Eisenhower chose to strike these networks to ensure that the Germans could not rapidly reinforce their defenses and possibly defeat the invasion. However, Eisenhower did indicate he would consider elements of General Spaatz's plan to attack the oil industry.

In the days that followed, German fighters did not contest the transportation attacks, and German attrition rates declined. Therefore, General Spaatz was able to persuade General Eisenhower that Allied attacks on vital oil targets would cause the Luftwaffe to fight and die. Spaatz received permission to hit synthetic oil plants during two days of good bombing weather to gauge the German response. After a delay due to bad weather (aircraft had to engage oil targets visually to attain acceptable accuracy), 649 bombers from Eighth Air Force attacked five synthetic oil plants on 12 May 1944, followed by strikes against seven synthetic plants by 410 of the Eighth's bombers on 28 May, including reattacks on plants at Leuna, Zeitz, and Lutzkendorf.[27] These two attacks prompted a vigorous Luftwaffe reaction to protect the oil plants. Furthermore, after the strikes, the Germans rushed more assets to defend the oil installations, curtailed training of ground units, and accelerated the conversion of oil-consuming vehicles to less-effective alternative fuels.[28] Albert Speer, minister of armaments and war production, reported to Adolph Hitler that the production of aviation fuel for May decreased for the first time, falling 14,000 tons short of planned Luftwaffe consumption. Speer considered the oil attacks significant and believed that continued strikes could lead to failure of the German military.[29]

Encouraged by the results, General Spaatz on 13 June 1944 proposed attacking the oil industry, concentrating on gasoline, to General Eisenhower and his deputy commander, Air Chief Marshal Arthur Tedder. General Spaatz thought that this approach would most dramatically reduce Germany's combat capability in all areas. Eisenhower did not back down from his emphasis on transportation attacks but agreed to allow Spaatz to go against the German oil industry.[30] At this point, a sustained and determined attack began on that objective, joining those already begun by the USSTAF's Fifteenth Air Force on the refineries in Ploesti, Romania.

Frustrated with the CCS requirement not to strike oil-production facilities in Romania, General Spaatz directed Fifteenth Air Force to attack the three marshalling yards in Ploesti, knowing full well that many bombs would hit the 10 refineries surrounding the town, seven of them within one mile of the yards.[31] These refineries produced 25 percent of the Axis power's refined oil products; thus, denying this fuel to the enemy was critical to the Allied war effort.[32] Because of these "marshalling yard attacks," Ploesti production dropped by 44 percent during April 1944.[33] Subsequently, General Spaatz persuaded Air Chief Marshal Portal and General Eisenhower that Fifteenth Air Force had sufficient bomber strength to strike transportation targets in support of ground operations as well as oil targets, obtaining their permission on 1 May 1944 to strike Ploesti.[34] The attacks generated dramatic results, dropping production from 186,000 tons a month to 81,000 tons in May. Twenty-four missions spanning the summer months involving 5,633 bomber sorties destroyed the Ploesti refineries, which ceased production prior to the Russian occupation on 22 August 1944.[35] The destruction of Ploesti accelerated the shortage of refined oil products that had already crippled the Luftwaffe and that was in the process of reducing the German army's mobility.[36]

US Air Force photo

Remains of the Merseburg-Leuna synthetic oil plant, 10 April 1945

The success of the attacks on Ploesti and Germany's crude-oil-based industry as well as its synthetic fuel industry confirmed General Spaatz's conviction that such action would inflict immediate and growing harm on the German war effort. In June 1944, air attacks reduced refined oil production from 734,000 tons to 511,000 tons. Aviation fuel production continued to drop, down to 53,000 tons. Diesel fuel also decreased from the April tally of 88,900 tons to 66,000 in June.[37] German training and operations suffered as a result of this Allied effort. According to decrypted Luftwaffe message of 5 June 1944, fuel supplies had become so low that the air arm had to tap its strategic reserve and that it had made fuel available only for training; bomber, fighter, and

ground attack; and some transport flights. The Allied bombing also had an effect on land operations in Normandy. During the interrogation of a captured German battalion commander on 16 June 1944, he complained about the complete lack of fuel for motor transport for the infantry in France, which could move only by rail or by foot.[38] All of the refined-oil output continued to drop, with only 438,000 tons produced in July 1944.[39] On 10 July 1944, the Luftwaffe stopped all training of bomber crews except to replace losses and began the process of ending operations in less vital areas due to the lack of fuel. To replace losses and protect oil-production facilities, the Luftwaffe recalled all of its fighter units from France despite the need to help stem the Allied advance. Overall, at this point in the war, Germany was consuming more than twice as much gasoline and diesel fuel as it produced.[40]

Seeing the drop in production and realizing that the Allied air forces were engaged for the first time in a sustained effort to wreck the oil industry, Speer appointed Edmund Geilenberg as a special commissioner to lead a repair force for oil-production facilities.[41] One of Speer's most able subordinates in the Ministry of Armaments, Geilenberg had directed German munitions production.[42] As part of his new duties, he personally inspected all affected plants after an attack and directed their repair, requisitioning skilled workers from locomotive and tank factories in addition to other construction workers to man the repair workforce. Further, Geilenberg began construction of underground facilities for oil production; in fact, he used parts from equipment intended for those facilities to repair the unceasing damage to above-ground plants.[43] The special commissioner engaged in a back-and-forth battle with the bombers, restoring plants to full production in no more than six to eight weeks only to see them reattacked and out of production within two or three weeks.[44] In this attempt to keep industry operating, by 1 September 1944, Geilenberg was directing 150,000 workers in the repair of oil plants—a number that increased to 350,000 by late fall.[45]

By the end of August 1944, beleaguered by persistent Allied air attacks that negated defensive and restorative efforts, Germany had a

finished oil production of 345,000 tons—just 42.6 percent of April's production figures. This reduction in the oil industry's output was solely the result of Allied air attacks.[46] By 11 August 1944, Luftflotte Three, responsible for defending the German border with France, had restricted all flying operations to fighter air defense sorties.[47] In other theaters, the Luftwaffe severely restricted flying operations, directing fighters in Greece, for example, to fly only if a prospect of combat existed.[48] Lack of fuel caused cuts in German night-fighter operations from August 1944 until the end of the war.[49] Land operations were curtailed or delayed. Speer's August report to Hitler noted the absence of fuel for offensive moves planned for October 1944.[50]

After General Eisenhower returned control of Allied strategic air forces to the CCS on 15 September 1944, the latter directed control of the USSTAF and Bomber Command to their respective national chains of command. General Spaatz at USSTAF and Air Marshal Norman Bottomley at the RAF Air Staff, who shared joint executive responsibility for operations, maintained a close, cooperative working relationship.[51] After collaborating, the USSTAF and the RAF Air Staff issued Strategic Bombing Directive Number One on 25 September 1944, which prioritized oil as the most important target, followed by military equipment.[52] In September, Germany's totals for all finished oil products fell to 281,000 tons.[53] To ensure that the Luftwaffe would not recover its strength, Spaatz focused the USSTAF's September attacks on the four synthetic plants that produced aviation fuel. Intelligence continued to report that the German military faced a debilitating lack of fuel, even to the point of collapse. Shortages of pilots and gasoline rather than aircraft became limiting factors for the Luftwaffe because Speer managed to increase German fighter production during the summer of 1944.[54]

The German oil industry was on the road to complete collapse in October 1944, but four months of bad weather allowed it to begin recovering. In fact, all production of refined fuels did temporarily cease from 11 to 19 September 1944.[55] Despite the inclement weather, the

USSTAF and Bomber Command continued to attack the oil industry. Bombing results for the USSTAF were poor as bombers had to aim using radar; consequently, more often than not, most bombs missed their targets.[56] Given a respite by the weather and buoyed by heroic repair measures, the industry continued to function, though just barely. Refined oil production for October, November, and December totaled 316,000; 337,000; and 303,000 tons, respectively.[57] One can attribute the increases in production during October and November to the weather and the decrease in December either to the RAF's expanded efforts or to the attacks on transportation.

Concurrent with the onset of unfavorable weather in October 1944, Air Chief Marshal Tedder attempted to aid the bogged-down ground campaign near the Franco-German border by requesting that Bomber Command and the USSTAF attack the German transportation system. According to the agreement, on cloudy days the American forces would bomb railroad marshalling yards using radar and on the infrequent clear-weather days would attack the oil industry.[58] With this agreement backed by intelligence indicating the effectiveness of both the oil and transportation attacks, on 28 October 1944, the USSTAF and the RAF Air Staff issued Strategic Bombing Directive Number Two, which dropped all target objectives other than oil and transportation.[59] However, RAF Bomber Command was slow to increase its attacks on oil targets. For example, in October 1944 the command dropped only 6 percent of its bomb tonnage on oil targets in response to Strategic Bombing Directive Number One and then, under pressure, increased its tonnage on oil and transportation targets to 38 percent by January 1945.[60] The RAF's contributions were most needed and valuable because at this time in the war, that air force's bombing accuracy, combined with its larger bombs, inflicted greater damage on oil facilities than did the USSTAF.

Devastating attacks on Germany's transportation network occurred simultaneously with the accelerated effort against the oil plants.[61] These strikes proved so severe in the Ruhr area that on 11 November

1944, Speer reported to Hitler that the Ruhr was effectively cut off from the rest of Germany.[62] This fact raises the question, Did the lack of the basic raw material—coal—cause the synthetic oil industries to stop production? Eighty percent of all German coal was mined in the Ruhr and sent to other industries by rail and barge transport.[63] However, because the coal and chemical industries initially developed the synthetic oil industry, they quite naturally built the new plants adjacent to developed coal fields for ease of production and cost reduction.[64] Transportation of coal to the plant should not have presented a problem.

Nevertheless, the transportation crisis might have affected production at the Fischer-Tropsch synthesis and Bergius hydrogenation plants. Tedder thought that by December 1944, some oil plants in western Germany were out of action due to bomb damage, and some because they could not obtain coal to make synthetic oil.[65] Interestingly, all Fischer-Tropsch synthesis plants in the Ruhr area stopped production simultaneously with the attack on transportation. Production at the Bergius hydrogenation plants is less consistent: of the five western plants, two ceased operations prior to initiation of the transportation attacks, and one of the other three remained in production until January 1945. Neither the USSBS or other records offer data referring to production stoppages due to loss of coal. Logically, the correlation between the transportation attacks and the decline in production suggests that the western synthetic oil plants may have stopped because they could no longer obtain coal, store fuel on site, or transport fuel to the end user.[66] But no data exists that can definitively prove causation. Regardless of whether shortages stemmed from bombing or the disruption of transportation, air attacks caused the western synthetic oil plants to fail.

Thus, by the end of January 1945, the air attacks had neutralized the Ruhr's synthetic oil industry and had crippled the synthetic oil plants in central Germany.[67] Specifically, in March 1944, Germany produced 181,000 tons of aviation gasoline; 134,000 tons of motor gasoline; and 100,000 tons of diesel fuel.[68] By January 1945, those figures had de-

clined to 11,000 tons of aviation gasoline; 50,000 tons of motor gasoline; and 64,000 tons of diesel fuel. The numbers for January may seem to indicate a good deal of fuel, but the following description reflects the practical effect for Germany by the end of the war: "Pilots sent into combat with only 40 to 45 hours flying time. . . . Tanks and armored vehicles moved to the front by oxen. Every motor trip exceeding 60 miles had to be approved by a General Officer."[69] Without these facts, one could look at the ground situation in January 1945 and easily conclude that Allied armies advancing on Germany from the east and west caused the oil industry's collapse.

An in-depth examination of the situation readily reveals that air attacks crippled Germany's refined-fuels industry rather than ground forces' capture of resources. The Soviets did indeed seize the Romanian oil fields in August 1944, but, as previously noted, air attacks had already brought a halt to the production and shipment of refined fuels. The Soviets captured the Hungarian oil fields and their refineries in early April 1945.[70] Germany's surrender only a month later, on 7 May 1945, makes it difficult to accept any assertion that the loss of the Hungarian oil fields disabled the German oil industry. The same can be said for the Austrian oil fields in the Vienna basin. The Soviets took control of this area even later in the war than the capture of the Hungarian fields. This is not to say that Germany did not lose some crude-oil resources prior to the final collapse of the oil industry in January 1945. Germany exploited crude oil from Estonia, Albania, and Poland (occupied territories) during the war. These minor crude-oil resources provided only 5 percent of all German finished oil products, but one must acknowledge that Germany experienced losses due to captured territory rather than bombing. However, such loss hardly dealt a crippling blow to the German war machine.

One might also ask whether the drop in refined oil products stemmed from the capture of synthetic oil plants on the German borders. Again this was not the case. In 1944, as the British, American, and Soviet armies moved closer to the German border, several syn-

thetic oil plants became vulnerable to seizure or production stoppages. Four such plants located in Silesia became vulnerable near the end of 1944: Blechhammer, Heydebreck, Auschwitz, and Schaffgotsch. The Heydebreck and Auschwitz plants never produced any fuel as a result of air attacks during their construction, and the Schaffgotsch plant ceased production in October 1944.[71] This left Blechhammer as the only operating synthetic fuels plant that the Soviet army could take out of production. When the Germans evacuated Silesia in January 1945, the Soviets captured Blechhammer, but by then air attack had reduced its production from an all-time high of 16,500 tons in November to 3,000 tons in December 1944.[72]

On Germany's western border, all the Fischer-Tropsch synthesis plants were located in the Ruhr (with the exception of the Schwarzheide plant south of Berlin) or on the Rhine River. All of the plants except for Schwarzheide ceased production by November 1944, with some doing so in September 1944.[73] The British and American armies reached the Rhine near the Ruhr in late February 1944 and physically cut off the Ruhr from the rest of Germany only in April 1945.[74]

The Bergius hydrogenation plants located on the western border included Scholven, Gelsenberg, Welheim, Wesseling, and Ludwigshaven. Gelsenberg ended production in September 1944; Welheim in October 1944; and Scholven in November 1944, along with Wesseling and Ludwigshaven.[75] Neither the British nor the American armies forced the Fischer-Tropsch synthesis or the Bergius hydrogenation plants to stop operating—air attacks did.

By March 1944, after almost five years of war, Germany had performed a minor miracle in supplying its forces with adequate fuel for operations. Unfortunately for Germany, Britain and America had also performed a minor miracle during the same time period, creating two strategic air forces that denied Germany adequate amounts of refined fuels. The collapse of the German refined-fuels industry during World War Two was the result—or effect—of the CBO's air attacks and certainly not the result of ground forces seizing crude oil needed for re-

fined fuel products. However, Airmen also need to remember that air attacks on German industries in 1944, with the exception of the oil industry, only slowed down the production of essential war supplies until all industries in Germany felt the catastrophic effects of Allied attacks on transportation.

In just five months of measured and persistent attacks, the CBO put the German oil industry on life support. Despite heroic efforts to repair the bomb damage, German land and air forces increasingly had to restrict their operations due to the lack of fuel. The persistent attacks prevented the oil industry from recovering and continued its decline. If winter weather had not come early and restricted visual bombing, the oil industry's collapse very possibly would have occurred in October or November 1944 rather than January 1945. Aerial attacks on this industry, combined with attacks on the German transportation system, had a crippling effect on the oil industry, which, in turn, incapacitated the mechanized portions of the German military. This situation enabled the military end state of the land forces' successful occupation of Germany. While taking pride in their heritage, Airmen should remember that the collapse of the German oil industry did not win the war in and of itself; rather, it resulted from successful execution of the mission assigned by the Casablanca Directive in what we should now view as a joint fight to defeat Germany. ✪

Notes

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