The U.S. Army Air Forces in World War II

Preemptive Defense

Allied Air Power Versus Hitler's V-Weapons, 1943–1945

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In 1943, the Allies knew that Germany was developing *Vergeltungswaffe* (vengeance) or "V" weapons that threatened to reverse the course of World War II. But the Allies did not know exactly what the weapons were or how to defend against them. Eventually, Allied intelligence and aerial reconnaissance identified two separate programs—a pilotless aircraft bomb (V–1) and a ballistic missile bomb (V–2)—that endangered London and other sites in southern England. The Allies decided that the best defense was preemptive strikes against any targets identified with the V-weapons programs, including launch sites and supply depots. Allied leaders disagreed on how much and what kind of air power should be diverted to the strikes, and on how long such strikes should continue. Germany withheld launching V–1s until after D-Day and did not launch V–2s until September 1944. With Allied ground forces having returned to Western Europe in strength, the German bombardment of London and other European cities proved to be too little and too late to affect the outcome of the war.

INTRODUCTION

The Allied invasion of France on June 6, 1944, signaled the certain end to Adolf Hitler's Third Reich. Six days later, a German pilotless aircraft bomb—designated as the V–1—flew across the English Channel and dropped on central London. That these two events happened in *that* order within the same week was no coincidence: starting in December 1943, the Allies had diverted a substantial portion of their total war effort to ensure that whatever threat Hitler's V-weapons posed to the Allies would be delayed until *after* the invasion.

Allied intelligence had revealed in late 1942 the existence of two new German weapons. One was a flying torpedo, a jet-powered aircraft launched from a ground-based catapult or from another aircraft. It flew at roughly 360 mph with a range of about 150 miles. The torpedo could deliver 1,870 pounds of high explosive. Today we call this weapon a "cruise missile," ground-, air-, or sea-launched.

The second weapon was a long-range artillery shell. Launched on land from a fixed or mobile platform, this rocket-powered ballistic missile could reach supersonic speeds (3,355 mph) nine times faster than the flying torpedo, at altitudes as high as 50 miles, and then travel ballistically with a range of 150 miles to strike with 1,650 pounds of high explosive at a preprogrammed target area. Fired from northern France or from the Low Countries, these missiles could hit large targets like London.

Together, these devices were called V-weapons. Less precise than manned bombers, they were not accurate enough to threaten military targets. What made them a threat was their potential against civilian targets—the terror bombing of cities. Unlike the jet-powered V–1, which was vulnerable to tactical defense, the supersonic V–2 struck swiftly and without warning. Allied leaders did not know what kinds of warheads the V-weapons might carry and had to prepare for the worst possibilities, including unusually powerful explosives, poison gas, or perhaps even biological or nuclear weapons.

In late 1943, the best defense against the V–2 seemed to be a good offense: capture the V–2s with ground troops, push enemy launchers out of range as Allied troops advanced, or destroy the weapons before they were launched. The first two methods depended on the success of the D-Day invasion, and in the interim the Allies determined to strike often and hard at whatever V-targets appeared.

The decision to divert air power resources to finding and destroying V-weapon assembly facilities and storage and launching sites, and for poststrike assessment, was controversial. Some believed the V-weapon threat an elaborate hoax to draw Allied air power away from bombing Germany. Others thought the aerial response, Operation CROSSBOW, was a waste of time, planes, and men that could be better spent in strategic bombing of enemy territory. Those who favored V-weapon targeting had a

more subtle argument. In the air war over Europe, morale and politics played a major role along with the strategy of destroying the enemy's industry. British leaders were appalled to realize that London could still be a target of German bombardment when the Allies had all but achieved air superiority. Thus, the aerial campaign against the V-weapons was made a top priority and continued so until Allied troops pushed the enemy out of range.

V-WEAPONS

Nothing advances weapons technology more than a war in progress, especially when a nation's leaders act out of desperation because they know they cannot win by attrition or by conventional means. In 1917, both the Allies and Germany, enmeshed in trench warfare on the Western Front, looked hopefully toward the introduction of new weapons and techniques to break the military deadlock and win the war. These innovations—tanks, infiltration tactics, and strategic bombing—all eventually became staples of warfare.

The same thing happened in World War II. In 1937–1939, and again in 1942 when Hitler realized that the Axis would lose a two-front war of attrition, he directed German engineers and scientists to produce an array of *versuchmuster* (experimental) weapons in the hope that one or more of them might reverse the course of the war. Two of the most threatening V-weapons to come off the drawing board into actual production were the pilotless aircraft bomb (V–1) and the liquid-propellant rocket (V–2). Although it was deployed later, the V–2 was the first to receive significant research and development funding. The V-designation came from the German word *Vergeltungswaffe* or "vengeance."

Solid-propellant barrage-and-bombardment rockets had entered European military arsenals in the nineteenth century, but the introduction of rifling and developments in metallurgy after 1840 improved the accuracy and range of artillery and forestalled further work on solid-propellant rockets. By the start of the twentieth century, however, new technology made it possible to produce and store liquid oxygen and prompted research in liquid-propellant rockets.

The military potential of such rockets did not escape the German army, which was proscribed from developing conventional armaments after World War I. In 1929, Col. Karl Emil Becker of the Reichswehr's *Heeres Waffenampt* (Army weapons board) at the *Ballistiche und Munitionsabteilung* (ballistic and munitions department) directed a study of the military uses for rocket weapons. In 1930, he assigned staff officer Capt. Walter Dornberger to begin plans for two projects with vastly different objectives: solid-propellant rockets with a range of 5 to 5.6 miles, and liquid-propellant rockets that could carry a payload heavier than any

existing artillery shell and fire further than any existing long rifle. Dornberger studied what private rocket enthusiasts were doing, and, in 1931, took notice of a young engineer, Wernher von Braun. Dornberger offered the eager von Braun employment at the Army's *Versuchsstelle* (experimental station) at Kummersdorf-West, about seventeen miles south of Berlin.

From 1933 to 1937, the German rocket research program grew slowly but steadily. Under the careful management of Dornberger and von Braun, the liquid-propellant engine program proceeded by *Aggregat* (weapons series). In the "A" series, each new engine was larger than the preceding one, each step built on the experience gained before it. The A–4 rocket became what is now known as the V–2. Eventually plans called for rocket engines and staged rocket vehicles with sufficient range to hit New York City. Supported by Dornberger's superiors on the general staff, the V–2 program had military specifications on size, weight, and range by 1936 (see "The V–2 Rocket" on page 4), together with a timetable for development, testing, and production. Dornberger marshaled the personnel and funding needed to support von Braun's design team. To maintain secrecy, operations moved out of the Berlin suburbs in 1937, when the Wehrmacht Ordnance Division and the Luftwaffe began joint construction of the world's first "rocket city"—an experimental research and development station at Peenemünde, Germany, on the Baltic coast.

After 1937, the pace of the Wehrmacht's V–2 program quickened or slowed according to Hitler's sense of desperation, which varied with the fortunes of war. The program received high priority in the years when Germany appeared likely to be trapped again in a two-front war of attrition. However, the Nazi-Soviet Pact of 1939 and the rapid success of blitzkrieg against Poland, Norway, the Low Countries, and France brought a reversal, as it appeared that Germany would gain victory before a rocket engine could be developed. Even the country's failure in the Battle of Britain in 1940 did not help Dornberger's rocket development effort, and funding continued to decrease until late 1941 when the Nazi invasion of Russia stalled before Moscow and the United States entered the war.

With a shrewd sense of timing, Dornberger laid before Hitler plans and operational requirements for firing as many as 5,000 V–2s per year against the United Kingdom from the French coast. Plans called for an initial bombardment of London in 1943. Once again facing the specter of a war of attrition, Hitler restored top priority to the V-weapons programs in April 1942. He issued orders for full production and approved plans to manufacture rocket components in other parts of Germany and to construct rocket assembly and storage silos on the French coast. By October 1942, the V–2 development had achieved a range of 120 miles, sufficient to hit London from firing sites in the Pas de Calais.

At the same time that Hitler pushed the Wehrmacht's V–2 program, he also supported the Luftwaffe's development of another V-weapon, which

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THE V–2 ROCKET

The V–2 rocket was the world's first long-range ballistic missile, and it comprised five major subassemblies: warhead, control compartment, midsection, propulsion unit, and tail unit.

The 2,200-pound warhead consisted of 550 pounds of warhead casing and 1,650 pounds of explosive. The warhead used an impact-detonating two-fuse system that withstood the six-*g* acceleration and vibration of powered flight. The powerful explosive had to be insensitive to the heat and shock of flight.

The V–2 developers also knew that the weapon's power would mean little if it did not strike accurately. The trajectory of the single-stage rocket had two phases: powered flight and ballistic flight. Only during the powered ascent could the rocket be controlled. After its engine cut off, the V–2 followed a trajectory like any other artillery shell. Immediately after launch, the V–2 would begin its preprogrammed pitch, or elevation angle. On the proper azimuth, or heading, this elevation angle would be maintained until the rocket attained the speed to reach its intended target. Then the V–2 engine would be cut off, either by an on-board device or by radio control. During ballistic flight, the V–2 reached an altitude of fifty miles and had a velocity of 1,800 mph on impact.

The rocket motor, fueled from tanks of alcohol and liquid oxygen located in the midsection, produced 56,000 pounds of thrust, enabling the weapon to achieve speeds of 3,355 mph. The V–2 engine had three sections: the steam generator, the turbopump, and the combustion chamber. The steam generator supplied the steam to drive the turbopump. The turbopump forced the alcohol and oxygen into the combustion chamber, the bulk of the powerplant, where they were ignited to generate thrust. The exhaust from the engine could be directed by vanes located in the V–2 tail assembly, which also included four fins to direct the V–2 during atmospheric flight. In concert, the vanes and fins, each with a servo and an electric motor, could control the rocket around the three axes of yaw, pitch, and roll.

Configured for launch, the V–2 measured 46 feet in length, 5.4 feet in diameter, and had a fin span of 11.7 feet.

the Allies designated the V–1. Although the Luftwaffe was committed to high-technology research and development projects on new kinds of aircraft, such as jet fighters and bombers and rocket fighters, it decided in 1942 to revive an old, "low-tech" concept: the pilotless aircraft bomb. Propelled by an air-breathing turbojet engine, the V–1 was the ancestor of the remarkable robotic devices known today as "cruise missiles" (see "The V–1 'Buzz Bomb'" on page 6).

The concept of pilotless aircraft bombs first arose in World War I. In 1917, American engineers envisioned a simple and homely device, cheap to produce, theoretically easy to deliver by air or from the ground beyond the reach of enemy interdiction, with greater range than an artillery shell. They called it the "bug." For a simple mission, such as flying in a straight line at the same altitude for a predetermined distance and then dropping on its target, an aircraft did not need a pilot. It needed only an engine, wings, stabilizers, and a fuel tank. The propeller rotated a fixed number of times and then shut off; the weapon yielded to momentum and gravity. Because missions were one-way, most of the craft could be devoted to *being*, rather than *bearing*, a payload or, in other words, a bomb. But the bug concept had several serious defects: a pilotless aircraft had little target accuracy, could not evade antiaircraft fire or enemy fighter patrols, and could be brought down by something as simple as a balloon or a net.

If Allied success in 1919 left no reason to continue developing the bug beyond the conceptual stage, the Germans' desperation in World War II changed that. Within two years, 1942 to 1944, the Luftwaffe pushed the technology from drawing board to finished weapon system. Designed with a range of about 150 miles, a V–1 could hit a large target such as London if launched from France and pointed in the correct direction.

The Nazis had great hopes for the V–1 aircraft and V–2 missiles. They were intended to postpone an Allied invasion of continental Europe by destroying supply depots, debarkation ports, and troop concentrations in southern England. Failing that, three purposes remained: (1) to disrupt an invasion at the beachhead where troops and supplies would be concentrated; (2) to pose enough of a counterthreat from France to divert Allied bomber resources from the offensive against Nazi industry in Germany and central Europe; and (3) to demoralize the British civilian population by terror bombing and thereby weaken Britain's prime minister, Winston Churchill.

Time was a critical factor and Germany could not afford delay. The V-weapons had to be operational and available in quantity to foil an Allied invasion by the summer of 1944. But bureaucratic and technical delays occurred. The first problem was that Hitler did not give V–1 and V–2 production the highest support until April 1942. Second, the designers of the V-weapons competed not only against each other for scarce resources, but also against German engineers and designers who wanted to produce new kinds of tanks, submarines, and aircraft. Third, all advocates of new

technologies had to contend with those who favored conventional warfare. Each service—Wehrmacht, Luftwaffe, Kriegsmarine, and Waffen SS—struggled for a share of Germany's resources, and within the various ministries of the Nazi government there was persistent factional infighting to

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THE V–1 "BUZZ BOMB"

Built as a stopgap measure before the deployment of the V–2 rocket and using existing technology, the V–1 was a pilotless, guided cruise missile for long-range bombardment. The V–1 was originally designated the Fi 103 and then the FZG 76.

The V–1 was powered by an Argus pulse jet made of a tube with a valve assembly at the front. The fuel, a low-grade fuel oil, was introduced into the combustion chamber behind the valve assembly and ignited. Pressures from the ignition closed the valves, forcing the gases to escape through the open aft end of the tube. This created a momentary vacuum in the combustion chamber and caused the valves to reopen and fuel to be drawn into the chamber. Again, the fuel-air mixture fired and the process repeated. The consecutive ignitions, occurring forty-seven times per second and generating 700 pounds of thrust, produced the distinct sound later described as a "buzz," and that led to the name "buzz bomb."

Because V–1s required forward momentum before the engine started, the weapons were originally launched from a 150-foot, steam-driven catapult. These early, often elaborate installations of several buildings and concrete ramps made obvious targets. Later, the Germans modified their launch sites with camouflage, wooden ramps, and fewer buildings.

Crossing the English Channel at 360 mph, a V–1 carried 1,870 pounds of explosives. With a length of 25.4 feet and a wingspan of 17.4 feet, the V–1 could strike 150 miles from its launch site. En route to its target, the V–1 stayed on course by means by a gyro-compass. A propeller, spinning freely on the nose of the aircraft, logged the distance traveled. When the propeller had spun a preset number of times, engine ignition ceased and the elevator locked in the down position. The weapon then dove to the ground and exploded. The sound of the buzz bomb provided up to ten seconds of warning before impact.

command funding. Finally, Hitler interfered with the various research efforts on intuitive whim. Dornberger's V–2 funding priority ground to a halt for two months in March 1943 because Hitler dreamed that the rocket would never reach England. It took two months of careful maneuvering to get Hitler to reverse his decision and restore top priority to the V–2. Hitler later admitted his mistake, but valuable time was lost. Although he gave an order in May 1943 to triple the scale of V–1 site construction in France and laid plans to fire over one hundred V–2 rockets (about one hundred tons of high explosives) daily against London, the first firing date for both programs had to be pushed back six months to January 15, 1944.

Following the bureaucratic delays were technical problems and slowdowns resulting from occasional shortages of components and materials. The Allied strategic bombing of German industry and transportation systems was taking its toll. The V–1s, ready in limited quantities by April 1944, came too late to disrupt the buildup of troops and supplies in England. Anticipating the D-Day invasion of June 1944, Hitler held back the V–1s he had available in France for a massed retaliation strike against London. Meanwhile, the technical complexity of the V–2s caused unexpected malfunctions, and they were not ready for firing until September 1944, months after the Allies went ashore in France.

RECOGNIZING THE THREAT

In the absence of hard knowledge, the Allies did not begin to respond to the threat of the V–1 and V–2 programs until the summer of 1943. By November 1939, British intelligence knew of the existence of Peenemünde as an experimental station, but they did not know its real purpose. The British Air Ministry's Scientific Intelligence Office and the

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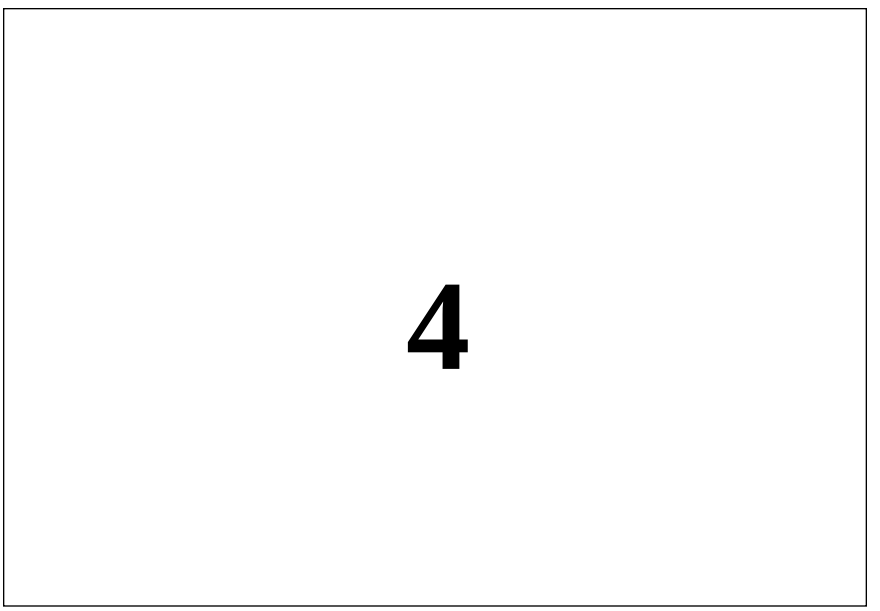
A piloted V–1 rocket was designed but never used in combat.

British Secret Intelligence Service (SIS) both knew that the Germans were developing some kind of pilotless aircraft and rocket-based artillery. The first information about the nature and extent of the V-weapons appeared in late 1942 and early 1943 from three important sources: disaffected German nationals; foreign nationals who worked with the Germans but maintained contact with members of the Czech, Danish, French, and Polish underground movements; and prisoners of war captured in North Africa. But with each piece of good information on the size, shape, range, and other characteristics of the V-weapons came several pieces of nonsense or exaggeration. By sifting and sorting, the SIS understood that at least one long-range bombardment program was under way, with launching sites probably planned for the Pas de Calais.

In January 1943, the British War Office's Military Intelligence (MI) branch warned the Central Interpretation Unit (CIU) to watch the French coast for any unusual construction. Meanwhile, SIS asked Britain's Photographic Reconnaissance Unit (PRU) to look further at Peenemünde. The last available photos of the Baltic station had been taken from a PRU Spitfire in May 1942. New photographic overflights on January 19 and March 1, 1943, revealed that the Germans had constructed many large buildings and a power plant. A conversation overheard on March 22 between two German generals captured in North Africa prompted genuine concern. One of the generals, respected for his technical knowledge, said that he



Rockets were tested in the elliptical earthwork at Peenemünde, Germany. Shown above are one V–2 rocket (A), cranes (B), and the assembly shop (C).

had seen A-series test flights at Kummersdorf. Unaware of the SIS electronic eavesdroppers, he described the rockets, their ballistic flight path, and his doubts that any substantial progress had been made. In light of these comments, MI decided to take evidence of growth at Peenemünde more seriously and alerted operational staffs that the rocket threat might well be real.

On April 11, 1943, after consulting with the scientific adviser to the Army Council and the controller of projectile development in the Ministry of Supply, the British vice-chief to the Imperial General Staff decided to circulate among the vice-chiefs a paper titled "German Long-range Rocket Development." The paper contained many inaccuracies; for example, it guessed that the enemy was developing a multistage rocket weighing 9.5 tons, capable of delivering 1,600 pounds of explosive over a range of 130 miles. But the bottom line was that the authors believed that a rocket weapon capable of bombarding London was technologically possible—and was probably in development.

On April 15, the vice-chiefs of staff reported the findings to Prime Minister Churchill, suggesting that he appoint Duncan Sandys to a fact-finding task. Sandys, respected for his general technical knowledge and his influence as joint parliamentary secretary to the Ministry of Supply, was also Churchill's son-in-law. The prime minister, delighted with the suggestion, made the appointment quickly and charged Sandys to find out whether the available intelligence was reliable and, if so, to describe the weapon and its delivery system and to recommend appropriate countermeasures.

Sandys immediately asked both the Secret Intelligence Service and the Combined Services Detailed Interrogation Centre to conduct a general investigation, codenamed BODYLINE. He requested that the Photographic Reconnaissance Unit continue to photograph Peenemünde. The CIU gave highest priority to a search for clues about the new weapons; by the end of April, the CIU had prepared a detailed interpretation of photos of Peenemünde taken over four sorties. The area contained many structures common in factory production of explosives, but there were also towers, cranes, and elliptical and circular emplacements that could not be explained. Photos taken over time also revealed movement of very large objects. Overall, the evidence confirmed the expected: Peenemünde was a research and testing facility.

On May 17, 1943, Sandys issued an interim report to the chiefs of staff in which he concluded that the Germans had been busy developing a long-range rocket and that it probably was far advanced. If so, he added, then the British must start studying possible countermeasures and civil defense preparations. Meanwhile, he wrote, the PRU should supply the CIU with more photographs. Overflights on May 14 and May 20 captured disturbing new evidence of cylindrical objects being carried by road and railway. On June 12, photos revealed a tower about forty feet tall and on it a cylinder

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The German V–2 rocket, ready for firing, is cleared away from obstacles.

about thirty-five feet long, blunt at one end and tapered at the other. Finally, on June 28, photographs showed two identical "torpedo-like" items thirty-eight feet long, about six feet in diameter, and each with a tail and three fins. By this time Sandys had no doubt that he was looking at long-range rockets.

The BODYLINE investigation moved into its second phase, namely trying to determine some of the specifics of the German rocket program. Working on the assumption that the range of the weapon might be 130 miles, the PRU had photographed the entire area of northern France within 130 air miles of London. The experts looked for "projectors"—tubes or guide rails from which rocket shells would be launched. British scientists and engineers, more familiar with solid-propellant rockets than with liquid-propellant technology, presumed that the German rocket was a two-stage, solid-propellant device. Judging from the size of the rockets in the reconnaissance pictures, each one would have to weigh between sixty and one hundred tons, with a warhead weighing two to eight tons. Something that heavy, the experts reasoned, had to be launched from a projection apparatus.

The British experts did not know that the Germans had designed the V–2 to be launched from either fixed or mobile platforms hauled by truck or by railcar. Furthermore, the V–1, which did use a steam-driven catapult as a projection facility, had not yet been deployed. As a result, aerial reconnaissance of France revealed no unusual construction that could be connected to rockets. The lack of evidence was puzzling and cast doubt on how far the enemy rocket program had advanced. And there were other mysteries as well. What evidence was there that the rockets were two-staged? If the rockets used projection launchers, why did they need such

large tail fins, components that suggested there were stability problems at launch?

Lord Cherwell, a member of the U.K. Defence Committee and Churchill's scientific adviser, thought that the rumors of a seventy-ton rocket were nonsense—and he was absolutely correct. However, never imagining that the Germans were using liquid instead of solid propellant, Cherwell concluded that the entire enterprise was a hoax designed to cover some other development project such as a pilotless, jet-propelled aircraft bomb.

The British Air Ministry disagreed with Cherwell. There was too much activity and there were too many related bits of evidence to believe that the rocket program was all a ruse. Rocket experts even retrieved pieces of a V–2 that accidentally fell into Swedish territory during an errant test flight. On June 29, 1943, the Defence Committee decided to strike Peenemünde with a massive Bomber Command night raid as soon as possible. Even Lord Cherwell agreed. Other equally important recommendations made to the Defence Committee included continuing to fly reconnaissance missions along the northern French coast, and preparing to attack any projection installations found there.

The Nazis intended to fire V-weapons against London and cities in southwestern England, including Aldershot, Bristol, Plymouth, Southampton, and Winchester. For the assault on London the Germans needed launching sites for the V–1s and silos or staging depots for the V–2s in the Pas de Calais. For the other targets, facilities would be more to the west,

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The German V–2 rocket, shown on its mobile trailer, carried a one-ton warhead that could destroy several city blocks.

mainly in Normandy. The original plan was to build forty-five V–2 and sixty-four V–1 sites in an arc curving from Cherbourg to St. Omer. The engineers and scientists working in the V–2 program wanted to build concrete bunkers as launch sites, but experienced German officers who knew these bunkers would make obvious targets insisted on the development of mobile launch platforms. As a result, two kinds of V–2 sites were constructed, fixed and mobile. The fixed ones, known as "large sites," were massive underground structures, possibly intended as launch facilities but definitely used to store liquid oxygen and other supplies. The mobile V–2 launchers, smaller and relatively inconspicuous, could be hauled to a site comprising nothing more than a few sheds. Because the Germans did not start to build V–1 ramps until August 1943, Allied reconnaissance spotted nothing unusual in May or June of that year.

The large sites could not be missed, however. Soon after the Defence Committee's decision in June 1943 to keep a wary eye on the French coast, PRU sorties began to note strange activity in France at Watten, near St. Omer. Throughout July, as the Royal Air Force (RAF) planned its nighttime raid on Peenemünde, photographic overflights showed that a number of rail lines and huge underground bunkers were being constructed at Watten. Intelligence sources reported that as many as 6,000 construction workers toiled at Watten. Other sources hinted ominously that Watten held an artillery gun capable of firing a shell at a range of 230 miles, that the site held supplies and stockpiles of V-weapons, and that overall headquarters and communications would be located there. British intelligence had heard so many contradictory rumors about the long-range "retaliation" weapons and possible deployment timetables that in late July it turned in desperation to its U.S. and Russian counterparts. The Russians revealed nothing, perhaps because they knew nothing, and U.S. intelligence suggested that Germany intended to use poison gas in its secret weapon program.

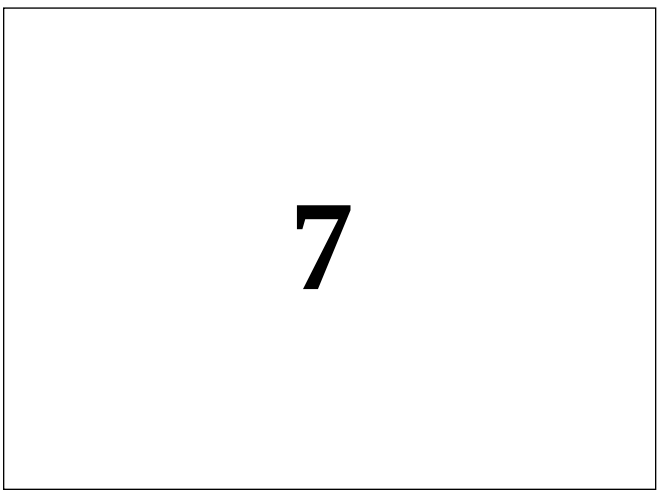
Watten was the first of seven large sites. In a July 6, 1943, report to the British Chiefs of Staff, Sandys concluded that the RAF should bomb Watten but that a delay was permissible. The chief of Air Staff, aware that the U.S. Army Air Forces (USAAF) was considering a daylight raid on Watten and Wissant, agreed with the delay. Raids were planned and executed against both sites in mid- to late August. Meanwhile, the CIU noticed that mammoth construction projects had begun at Löttinghen and Wizernes, in September at Mimoyecques and Siracourt, and shortly thereafter at Söttevast and Martinvast on the Cherbourg peninsula. These bunkers had steel-reinforced concrete walls up to thirty feet thick and were large enough to house whole divisions.

Then the Allies detected another kind of site: an elaborate launching platform consisting of two inclined rails, almost 300 feet long, resting on a metal latticework anchored with a concrete emplacement. Intelligence agents in France suggested the British should closely photograph this

strange concrete structure near Yvrench-Bois-Carre in the Pas de Calais. Aerial reconnaissance near the end of October 1943 revealed for the first time what came to be know as the "prototype ski site"—a launching platform for a pilotless aircraft bomb. Once the PRU and the CIU knew exactly what to look for, they detected ski sites all around the Pas de Calais. By mid-November, twenty-one such sites had been identified. The Germans eventually completed twenty-two of them and worked on seventy-four more. All of the skis were pointed menacingly at London. Cherwell, who had fought the notion that the Germans had developed a working ballistic missile, was willing to accept the possibility that the enemy had created pilotless aircraft. An Allied aerial offensive against the V-weapons was soon to begin.

ROUND ONE: THE AIR OFFENSIVE

The RAF's nighttime raid against Peenemünde on August 17–18, 1943, and the USAAF's daylight raid against Watten ten days later marked the start of an aerial offensive against the V-weapons that did not cease until May 1945. Operation CV, as the effort came to be called, was the strangest bombing offensive conducted during World War II. With their southern cities threatened, the British diverted Allied heavy bombers from strategic bombardment in Operation POINTBLANK, the destruction of German industry, and from interdiction bombing in Operation OVERLORD, support for the invasion of France. The use of heavy bombers contradicted U.S. studies demonstrating that fighter-bombers operating at low altitude were more strategically effective and cost effective in destroying V-site



This aerial view of Peenemünde shows the bomb craters left by the RAF's nighttime raid in August 1943. The raid was the first in a long aerial offensive against German V–1 rocket production and launching.

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The Handley-Page Halifax was one of several types of bombers that the RAF sent to destroy Peenemünde.

targets. The British and the Americans argued over what priority CROSSBOW missions should have relative to other offensive aerial missions, and in the end the Allies undertook an ill-conceived campaign against an ill-defined threat. Allied air commanders remained uncertain what results, if any, they were producing—a terrible burden in light of the real cost in lives and aircraft. At times, Operation CROSSBOW appeared to be much more a political than a military solution to the problem of the V-weapons, a demonstration that any German terror bombardment of London would be met by a counteroffensive of some kind. D-Day came and passed with no Nazi vengeance strikes, so the Allies relaxed. When the Germans finally did launch V–1s in June through August of 1944, the Allied response was immediate and drastic—but probably ineffective.

The RAF Bomber Command raid against Peenemünde on August 17–18, 1943, used the most sophisticated bombing techniques available at the tactical and operational levels. Five hundred ninety-six bombers of mixed type—including Short Stirlings, Avro Lancasters, Handley-Page Halifaxes, and de Havilland Mosquitoes—used pathfinders, aiming points, time-and-distance bombing, and a master bomber for coordination. The raid was executed in waves, accompanied by a feint against Berlin to draw off fighter opposition. Nonetheless, the RAF lost forty bombers and 290 men, most of those in the latter waves after German interceptor defense forces realized what was the true target.

The August 27, 1943, USAAF daylight raid against Watten, on the other hand, was more typical of the sledgehammer approach. The Eighth Air Force dispatched 187 B–17F (Flying Fortress) heavy bombers, flying at high altitude. Their mission was to destroy that large, fixed target. For good measure, smaller raids of Eighth Air Force medium and heavy bombers attacked Watten again on August 30 and September 7.

Both Peenemünde and Watten were Allied tactical successes but strategic failures. The Peenemünde raid did heavy damage to installations and killed some key personnel, but it alerted the Germans to the fact that the Allies considered the V-weapon program a serious threat. German commanders promptly relocated production facilities elsewhere. The Watten raids proved premature. British intelligence estimated that the American raids would delay construction of the Watten large site about three months, but that delay was ultimately overshadowed by scheduling problems in the V–2 program itself. Meanwhile, using Mosquito fighter-bombers, the RAF's Second Tactical Air Force bombed the large site at Mimoyecques twice in early November and in late November and early December struck the large site at Martinvast with 450 tons of explosives.

Duncan Sandys' BODYLINE committee transferred its responsibility for investigating the extent of the V-weapons systems to Britain's Air Ministry. The task of finding, photographing, and assessing targets had grown so large that it had to be handled by regular intelligence departments and operational staffs instead of a committee. On November 15, 1943, the code-name BODYLINE was replaced by the new name, CROSSBOW. The Joint Intelligence Subcommittee of the British Chiefs of Staff wrote its first CROSSBOW report nine days later and presented its findings before the British War Cabinet on November 29. The War Cabinet ordered another

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Heavy bombers—187 B–17Fs from the Eighth Air Force—made a high-altitude daylight raid against Watten, France, the first large site targeted.

Annotations on this aerial photo show Allied bomb damage to the large site at Watten. Road and rail lines, conveyor ramps, and storage areas were destroyed.

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massive reconnaissance and steadfast bombing of the chain of ski sites in northern France.

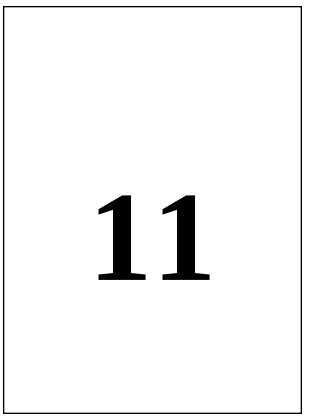
The CROSSBOW aerial reconnaissance mandated by the War Cabinet began on December 4 and covered a swath of territory 150 miles wide southeast of London and Portsmouth. PRU Spitfires and other aircraft identified sixty-four ski sites—two dozen more than had been seen a week earlier. By the third week of December, the identified total had risen to seventy-five. Allied generals decided to begin bombing the sites as soon as possible, using tactical air forces then being marshaled for Operation OVERLORD. U.S. Lt. Gen. Ira Eaker, commanding the USAAF in Britain, agreed with a suggestion by Air Chief Marshal Sir Trafford Leigh-Mallory, Allied Expeditionary Air Force (AEAF) commander, to attack any of the ski sites that seemed to be more than 50 percent finished. Eaker told Lt. Gen. Lewis Brereton, commanding the U.S. Ninth Air Force, to prepare for strikes using Martin B–26 Marauder and Douglas A–20 medium bombers, joined by Mosquitoes, Marauders, and Havocs of the RAF Second Tactical Air Force. On December 3, the British War Cabinet approved this AEAF and Air Ministry plan, and a few hours later Eaker directed Brereton to begin Ninth Air Force CROSSBOW operations with the highest priority. Although hampered by poor weather, the operations began two days later.

The air leaders' problem was not only to determine what to strike and how to strike it, but also how often to strike—a problem the Allies never

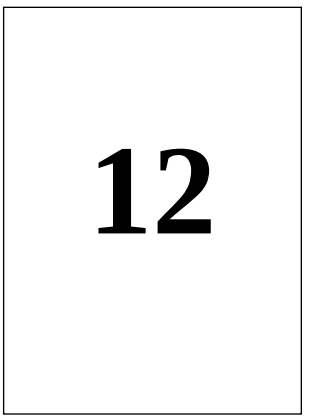
really solved because it was impossible to know whether specific raids were effective. One well-placed 2,000-pound delayed-action bomb could do more damage than twenty-five 500-pound bombs scattered indiscriminately from a high altitude. On the other hand, the more bombs dropped on a given area, the higher the probability that at least one would find its mark. Analysts in the Air Ministry's CROSSBOW agency and personnel in several Allied air forces tried to estimate the number of attacks and the tonnage of bombs needed to do serious damage to a ski site.

With Allied combat air patrols having swept the skies almost clean of German fighter interference, heavy bombers on short-run, high-altitude missions could drop more bombs with relative impunity. Less fuel was needed for the short sortie from England to France, so more bombs could be carried. For example, a Mosquito had a maximum bomb load of one 4,000-pound "blockbuster" bomb. To deliver its explosive with any accuracy the Mosquito had to make a mid-to-low-level attack run through vicious ground-based antiaircraft fire. But with just enough fuel for a 300-mile round-trip, a Lancaster could carry a bomb load of almost 18,000 pounds. That bomber did not have to be so precise, could remain at high altitudes, and consequently could fulfill the mission at less risk to aircraft and crew.

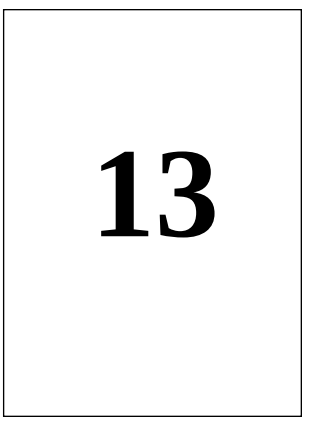
At least that was the theory: high efficiency, low risk. But was the risk of using heavy bombers any lower than using other bombers? Losses happened about 1 percent of the time; during the nearly 37,000 sorties ultimately flown by the RAF Bomber Command and the USAAF Eighth Air Force against CROSSBOW targets, about 400 heavy bombers were lost. Under poor operating conditions, the USAAF Ninth Air Force and RAF Second Tactical Air Force lost about 1 percent of medium bombers. Later studies



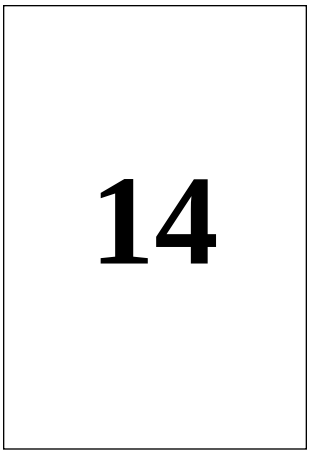
Lt. Gen. Ira Eaker

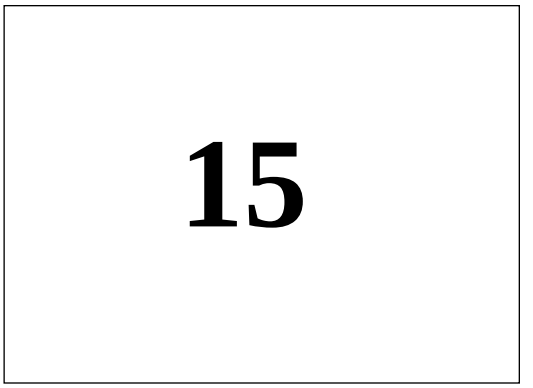


Air Chief Marshal Sir Trafford Leigh-Mallory



Maj. Gen. Lewis Brereton



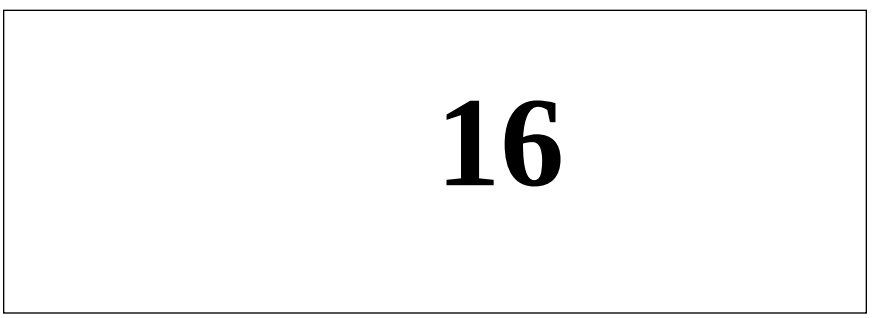


Through the window installed in the plastic nose of a B–26, the bombardier sighted his objective.

showed that Mosquito missions actually were *safer* than any other type of aircraft used in CROSSBOW.

On the basis of early results, the British concluded that medium bombers operating at lower altitudes were ineffective against V-sites. On December 15, 1943, the British Chiefs of Staff decided to ask the Americans to use the Eighth Air Force's heavy bombers in the CROSSBOW offensive. At that point, Eaker did not see those missions as diversions from Operation POINTBLANK's bombing of Germany; the vagaries of winter weather sometimes made it impossible to strike primary targets in Germany but possible to attack targets in France. As it happened, however, bad weather hampered activities on both fronts and it was not until Christmas Eve that the Eighth Air Force made its first CROSSBOW attack.

More than 1,300 aircraft participated in mission number 164, the largest Eighth Air Force operation to that point—even larger than the raid on Schweinfurt-Regensburg. Six hundred seventy B–17s and Consolidated B–24 Liberators, escorted by Republic P–47 Thunderbolts, North American P–51 Mustangs, and Lockheed P–38 Lightnings, dropped 1,700 tons of explosives on twenty-three ski sites. The size of the mission



The de Havilland Mosquito bomber.

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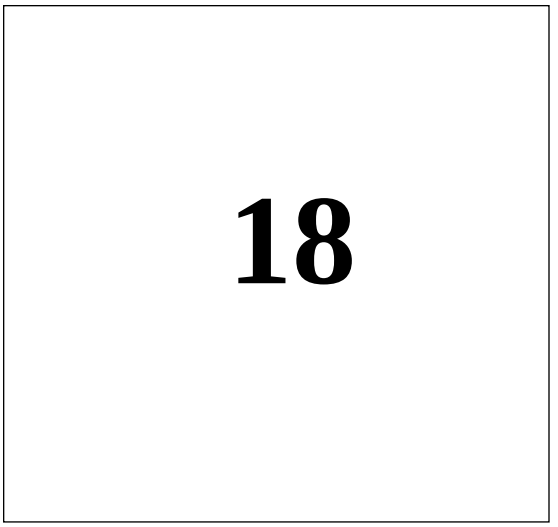
The U.S. Eighth Air Force made its first Operation CROSSBOW attack using B–17 Flying Fortresses over German soil on December 24, 1943.

demanded some explanation, and through various sources war reporters learned more than even the U.S. aircrews knew—namely, that the Allies were pounding installations connected with the long-anticipated German vengeance weapons.

USAAF aircrews might not have questioned the bombing, but U.S. military leaders harbored grave doubts about it. They wanted to cooperate with the British, who were supplying intelligence for CROSSBOW, but they had questions about the extent of the German V-weapon program, how far it had progressed, and the threat it actually posed. The Watten raids had been directed against a large site, not the compact ski sites, and it had never been clear that Watten was a V-site. On December 22, U.S. Army Chief of Staff Gen. George Marshall asked Lt. Gen. Jacob L. Devers to get answers to the questions. Devers arranged for a courier to fly from England that night to bring sketches of a ski site to the United States.

Marshall realized that the British were not sharing information immediately, partly because of their own internal disagreements over what the photographic evidence revealed, and he recommended to U.S. Secretary of War Henry L. Stimson that he appoint a U.S. committee to assay the V-weapon threat independently and to suggest a course of action. On December 29, Stimson assigned the director of the War Department's New Developments Division, Gen. Stephen G. Henry, to chair that committee. Henry was to make sure that *everyone*—the War Department, the U.S. Navy, and especially the British—coordinated closely on fact-finding and problem-solving. If the V-weapon threat was so acute (and that must be the case if the Air Ministry and British Chiefs of Staff were requesting massive help from the Eighth Air Force), why hadn't British intelligence told their U.S. counterparts about it sooner? And why were heavy bombers supposedly more effective in attacking V-sites than were medium bombers? Did the British have other information that they were not sharing? Marshall sent a curt memorandum to the highest-ranking British officer in the United



Pictured, *from left,* are Lt. Gen. Jacob Devers, U.S. Secretary of War Henry Stimson, and Maj. Gen. Ira Eaker as they review bombing photos.

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States, declaring that the USAAF could offer no help until U.S. leaders understood why CROSSBOW should claim aerial resources from either Operation POINTBLANK or Operation OVERLORD.

The British Chiefs of Staff had already discussed this issue with Lt. Gen. Sir Frederick E. Morgan, chief of staff to Supreme Allied Commander Gen. Dwight D. Eisenhower. Morgan was responsible for presenting information and options to Eisenhower and he served as a useful liaison between the British and the Americans. The British Chiefs of Staff had asked if the V-weapon threat had advanced sufficiently to jeopardize the Operation OVERLORD invasion of France planned for the spring of 1944. Yes, Morgan replied, but not enough to prompt a change of plans or a postponement of the invasion. The V-weapons had to be considered a reintroduction of German air power, limited and cumbersome to wield and likely to cause the Allies grief, but unlikely to ruin the invasion. He said that the threat of V-weapon bombardments of London and Portsmouth would prove a greater political problem than a military one. British military leaders did not want to exaggerate the V-weapon strategy's ultimate effect on the outcome of the war, but neither did they want to lose U.S. support for an aerial counteroffensive that might prevent or reduce bombardment of the British Isles. The U.S. leaders might decide to continue with Operation POINTBLANK and leave Operation CROSSBOW to RAF Bomber Command, and what if Bomber Command alone could not stop the V-threat?

It suited British purposes that General Henry's U.S. CROSSBOW committee initially assumed the worst. Committee members went through precisely the same reasoning process as had the BODYLINE investigation committee six months earlier: massed V–1 attacks could overwhelm antiaircraft defenses, and if the rumors of the supersonic V–2 were correct, there was no defense against it. The Germans were capable of using biological or chemical weapons against military and civilian targets. Until more information on the V-weapons' production, transportation, and assembly methods could be obtained, the only targets to attack were the

launch sites, assumed to be the large sites and the ski sites, but ground or airborne assault was impractical.

By early 1944, the U.S. CROSSBOW committee concluded that the best defense would be a good offense—hit the V-sites before the vengeance weapons hit London, but committee members doubted that diverting heavy bombers from POINTBLANK strategic bombing missions was the best strategy. In January and February 1944, thirteen of twenty-nine missions flown by Eighth Air Force bombers had been directed at CROSSBOW targets, but plenty of U.S. fighters and medium bombers were staged in England awaiting Operation OVERLORD. Could these be used more effectively against ski sites and underground bunkers than the Eighth Air Force's high-altitude Flying Fortresses?

Henry's committee asked the USAAF to determine the best method of attacking CROSSBOW targets. Because the strategic Eighth and tactical Ninth Air Forces based in England would be providing actual firepower, it seemed reasonable and pragmatic to fly the missions and then study the results. Army Chief of Staff Marshall approved that suggestion on January 12, 1944. The commander of the Army Air Forces, Henry H. "Hap" Arnold, wanted to study further the best method for destroying V-sites, particularly the ski sites, and he argued successfully that every type of aircraft the USAAF had in operation—fighters, medium bombers, and heavy bombers—should be flown with different bomb payloads in test attacks against mock-up sites. The attacks would take place under war game conditions against real antiaircraft units.

The responsibility for marshaling the aircraft, bombs, antiaircraft guns, and, most importantly, construction workers and materials to create simulated V-1 sites from scratch fell to the USAAF Proving Ground Command at Eglin Field in the Florida panhandle, commanded by Brig. Gen. Grandison Gardner. On January 25, Arnold telephoned Gardner and told him to do the impossible: reproduce simulated V-sites within days. "It will take a hell of a lot of concrete," Arnold said bluntly. It did, and a few civilian toes were stepped on in the process. Gardner sent purchasing agents hundreds of miles in every direction to buy all the available brick, lumber, concrete, cement, and steel from any supply source they could find.

During February and March, the Americans began building V–1 sites in Florida much faster than the Germans were building them in France.

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Brig. Gen. Grandison Gardner

Army Ground Forces sent camouflage units and a full antiaircraft battalion by truck and train. Most of the construction materials for the Eglin Field mock-ups arrived by aircraft, trains, and trucks, and thus showed that the French-Belgian-German rail and road transportation system would be a legitimate CROSSBOW target.

In February 1944, Eglin Field boasted the largest construction/destruction project on the Eastern seaboard. No sooner would a target building and site stand complete than airplanes would flatten it. Experts rated the destructive force of different kinds of bombs, how effectively different aircraft delivered them, and the success rate and risk of different attack techniques. Studying the reports, Gardner learned that lightning-quick, low-altitude attacks maximized damage and minimized aircraft risk. The key points were to (1) give antiaircraft defenses as little warning as possible, (2) hit the site with a delayed-action 1,000- or 2,000-pound bomb from a very low altitude, and (3) get out fast. The damage was substantial, but not necessarily a knockout blow; repeated raids would deliver that. The quick raid well suited fighters such as the P–38 or fast bombers such as the Mosquito. On February 19, Gardner invited Arnold and British Air Marshals Norman H. Bottomley and Frank Inglis to watch a demonstration at Eglin Field. The British were impressed; Arnold was convinced.

On March 1, Gardner prepared a final report outlining the tests' conclusive findings that treetop-level attacks by fighter-bombers were just as effective against ski sites as were attacks by medium- or high-altitude

Simulated V–1 sites were built and bombed repeatedly by U.S. forces at Eglin Field in the Florida panhandle, in an effort to identify the most effective means of knocking out the V–1 threat.

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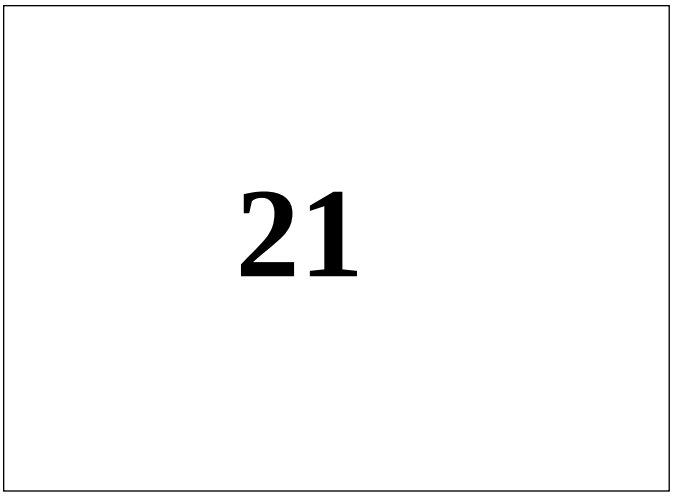

The Lockheed P–38 Lightning fighter was well suited to quick low-altitude raids.

bombers, and at less cost and with less risk. It was not necessary to divert Eighth or Ninth Air Force heavy bombers from POINTBLANK strategic missions. Gardner went to England in mid-March with a special mission of U.S. officers to discuss the Eglin Field tests with Eisenhower at Supreme Headquarters Allied Expeditionary Force (SHAEF) and with British and U.S. air commanders at air headquarters and air bases.

USAAF Generals Arnold, Brereton, and Hoyt S. Vandenberg, and U.S. Strategic Air Force in Europe (USSTAF) Commander Gen. Carl Spaatz were eager to introduce the minimum-altitude bombing technique. To their surprise, British Air Chief Marshal Leigh-Mallory insisted on continuing to use heavy bombers at high altitude. He believed the Eglin Field tests had been conducted under ideal rather than real-world conditions, and that enhanced antiaircraft defenses around the V-sites posed even greater risks to low-flying aircraft. Leigh-Mallory had other information that he did not immediately share with the U.S. commanders: British intelligence had learned in early February that the Germans had seen the vulnerability of the ski sites and were constructing less elaborate, modified sites that were more easily camouflaged. Leigh-Mallory believed that the smaller, harder-to-find targets would be more easily and safely hit by high-altitude scattered-area bombing.

Arnold was angered at what he perceived to be British obstinacy and an apparent penchant for theoretical analysis over hard evidence. He considered the Eglin Field studies more real-world than Britain's guesswork. Neither he nor Spaatz wanted Operation CROSSBOW missions to interfere with the strategic bombing of Operation POINTBLANK. How, he wondered, could the British justify diverting heavy bombers from POINTBLANK without solid evidence to contradict the findings of the Eglin Field tests? Arnold was even angrier on February 13 when, at British insistence, the

Pictured here is Commander of the Army Air Forces Henry H. "Hap" Arnold. Standing directly behind him are U.S. Strategic Air Force in Europe Commander Gen. Carl Spaatz and Gen. Hoyt S. Vandenberg.

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Combined Chiefs of Staff gave CROSSBOW priority over all Allied bombing missions except the destruction of the German interceptor airframe industry. That would remain Allied policy unless and until Eisenhower changed it. As a result, the Allies dropped 4,250 tons of bombs in 2,800 CROSSBOW sorties during March, most of them against ski sites.

British anxiety over the V-weapon threat mounted in April 1944. Photographic reconnaissance of the large, ski, and modified sites showed German and forced-labor construction battalions continuing to rebuild shattered venues and to complete new ones. Intelligence received reports of many V–1s being dispersed throughout northern France. All of this implied that the V–1 offensive might begin in mid- to late April. Although Allied bombers had inflicted "Category A" damage (an estimate that it would take the Germans two months to rebuild) on many ski sites, it appeared that CROSSBOW was failing.

On April 18, the secretary of the British War Cabinet, Sir Hastings Ismay, urged Eisenhower to step up attacks against all suspected V-sites. The British conceded that the campaign to that point had been a failure, but now they demanded more resources for the struggle. Eisenhower deliberated and the next day granted CROSSBOW missions priority over all Allied air operations. By the end of the month, the CROSSBOW campaign had increased in volume by about 50 percent; Allied aircraft, mostly heavy bombers, dropped a total of 7,500 tons of bombs in 4,150 sorties. Although they believed that Operation POINTBLANK was the key to defeating

Germany, Arnold, Spaatz, and other U.S. air commanders had to defer temporarily to CROSSBOW. Spaatz concluded that if things kept up this way, he would not have enough aircraft to support Operation OVERLORD, much less Operation POINTBLANK.

Arnold was unwilling to concede the POINTBLANK strategic bombing campaign in favor of CROSSBOW. In early May, he sought fresh evidence that the Allies should switch from high-altitude, heavy bomber strikes to minimum-altitude, fighter-bomber strikes. If results from the Eglin Field Proving Grounds did not convince the British, perhaps results from theater operations would. Spaatz reported that four P–47s, each armed with two 1,000-pound delayed-action bombs, used the Eglin Field minimum-altitude technique to attack four ski sites. Three of the four fighter pilots scored Category A damage despite heavy antiaircraft fire. Eighth Air Force commander Maj. Gen. James Doolittle reviewed statistics from Eighth Air Force missions and showed that Mosquito fighter-bombers had achieved the best results with the fewest losses.

As D-Day neared without any sign of a V–1 offensive and U.S. military strategists increased their pressure, the British lessened their insistence that CROSSBOW take higher priority than POINTBLANK and OVERLORD. The Allies had pummeled ski sites with Category A damage 107 times, and most of the sites were ruined. By early May, ski sites were no longer listed as primary targets. Heavy bombers, mostly Eighth Air Force B–17s, and medium bombers each accounted for about one-third of these strikes; fighters and Mosquitoes had accomplished the remaining one-third. Those statistics, more than any others, supported the U.S. contention that the use of heavy and medium bombers was wasteful. And it did not help the British position that RAF Bomber Command had flown nearly one-sixth of all CROSSBOW sorties without once scoring Category A damage. Between December 1943 and June 1944, the Allies flew more

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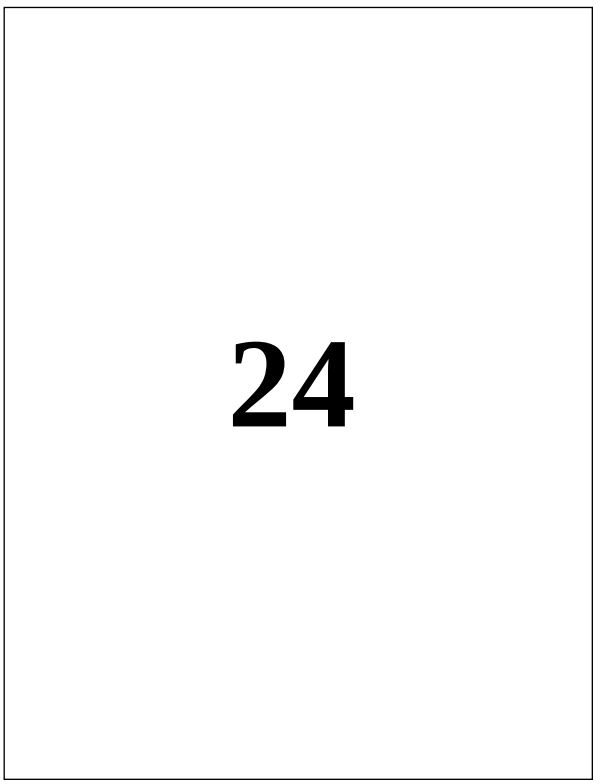
This Republic P–47 carries a 1,000-pound bomb under each wing. P–47s were more effective than heavy bombers in assaults on V-weapon ski sites.

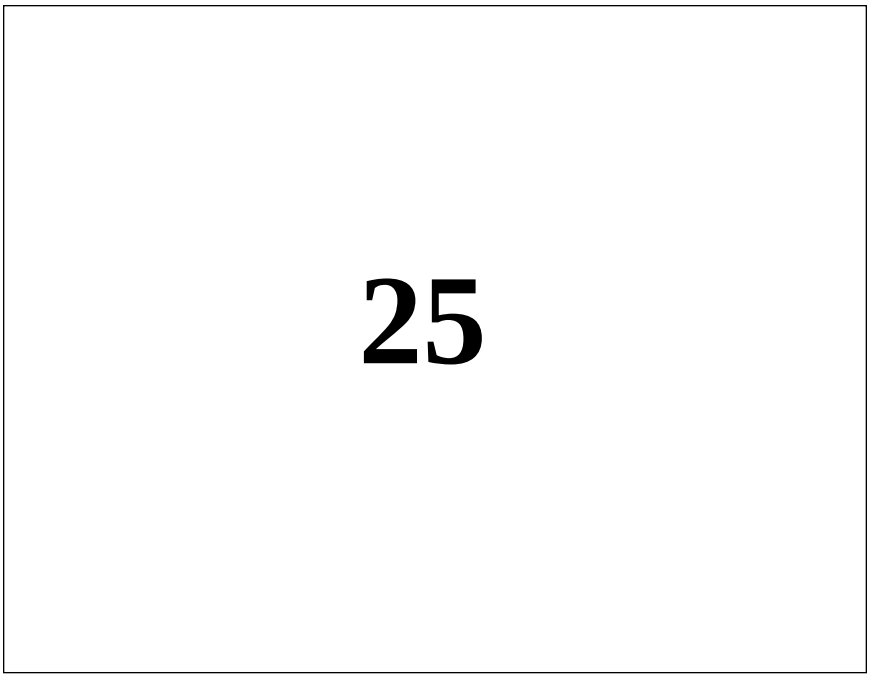
than 25,000 sorties and dropped over 36,000 tons of bombs on CROSSBOW missions. In that effort, the Eighth Air Force lost 462 men and forty-nine heavy bombers; the Ninth Air Force lost 148 men and thirty medium bombers; and other USAAF and RAF units lost 161 men and seventy-five aircraft of mixed type.

ROUND TWO: THE V–1 BOMBARDMENT

CROSSBOW operations from December 1943 through June 1944 had been carried out with a short-term military objective and a long-term political one. The immediate goal was to prevent the Germans from using V-weapon bombardment to disrupt or otherwise interfere with Operation OVERLORD, the invasion of Normandy. Politically, Allied leaders hoped to prevent any V-weapons from hitting London and demoralizing the civilian population. When Allied troops landed on the French coast on June 6, 1944, without an attack on London or the southern coast of England, the short-term objective was fulfilled.

The three stars of Lt. Gen. Lewis Brereton's Ninth Air Force were, *from top to bottom,* the twin-engined P–38 Lightning, the long-nosed P–51 Mustang, and the stocky P–47 Thunderbolt. Each of these aircraft began work in the European theater as bomber escorts before conversion to fighter-bomber status.





Making its final dive, this V–1 rocket and hundreds like it were aimed at the morale of the besieged London citizenry.

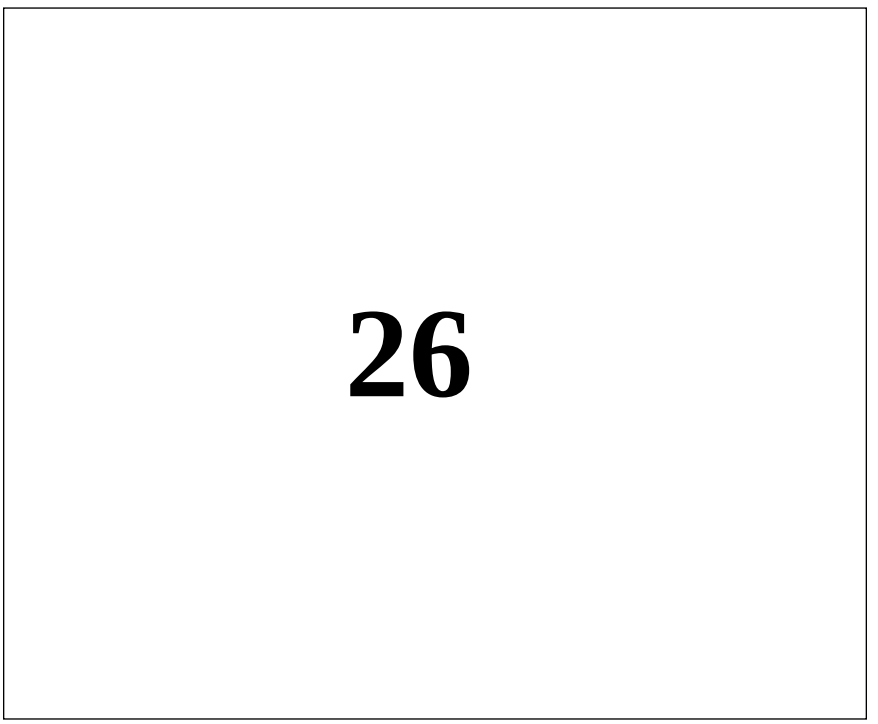
Ironically, this achievement may have been less a result of the Allied air campaign than of Hitler's preference for massed retaliation strikes. The "massed" strategy probably accounted for the decision to delay the V–1 bombardment past April when only limited quantities of the pilotless aircraft had been distributed to undisturbed modified sites. Massed attacks were useful possibly because of the tactical value of surprise or to overwhelm interceptor and antiaircraft defenses, but more probably because of their ability to stun a war-weary population with a sudden, devastating attack.

In retrospect, what was probably a political delay on Hitler's part proved a blunder, but he made his decision in part because he expected the Wehrmacht to contain an Allied invasion and eventually smash any beachhead. That was the chief danger confronting the Allies from mid-June through August. CROSSBOW would not be a military success until ground troops broke through the German Seventh Army and destroyed or captured V-sites in Cherbourg and Pas de Calais. The long-term political threat remained as long as V–1s and V–2s could reach London.

Germany's massed V-weapon offensive was set to begin on the night of June 15–16, ten days after American, Canadian, and British troops stormed ashore at Normandy. Instead, it began sporadically on the night

of June 12–13. Even V–1s were mistakenly fired toward London, and four of them hit the target. The Allies knew that this signaled a second Battle of Britain. On June 15–16, the Germans fired roughly 300 V–1s. Some of the buzz bombs ran out of fuel or veered off course, some were shot down by antiaircraft fire, and some were downed by interceptors; seventy-three fell randomly on London.

The Allies were not sure how best to respond. The need to maintain overwhelming air support for the Operation OVERLORD beachheads and to interdict German reinforcements to Normandy precluded using much air power in a continuing counteroffensive against V–1 modified launching sites. On June 13, Allied air leaders settled on a strategy of destroying V–1 supply depots, but sent only thirty-six sorties against them in three days. After the June 15–16 bombardment, Churchill and other British war leaders, relieved that the enemy was using conventional explosives instead of poison gas or biological weapons, asked Eisenhower to direct whatever aircraft he could spare to lessening the V–1 threat. Meanwhile, Britain's Air Defence did the best it could to counter the pilotless bombs, using radar for early detection and fighter interceptors, antiaircraft fire, and even barrage balloons to destroy the missiles in flight.



London firemen kept the city from burning down during the relentless German rocket bombardments during the summer of 1944.

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Pictured, *from left to right,* are Gen. Dwight D. Eisenhower, Lt. Gen. Carl Spaatz, and Eighth Air Force Commander Maj. Gen. James Doolittle.

Eisenhower recognized the V–1 as a political threat best countered by political means (Allied strategists evaluating a counteroffensive seriously considered a massive air raid against Berlin). The V–1s posed no great military threat: they were aimed against London, not against Allied troops or the artificial ports that had been towed to the Normandy beaches to supply and reinforce the invasion. But it was necessary to convince the British populace that the Allies were *trying* to stop the V–1 attacks. If the people of London kept faith in the war effort and in their leaders, the V–1 attacks would fail strategically no matter how much structural damage they did.

On June 17, Eisenhower directed the Eighth and Ninth Air Forces to attack V-sites and V–1 supply points. He gave first priority to the immediate tactical needs of OVERLORD, with CROSSBOW missions second, much to the annoyance of U.S. air commanders who still hoped to cripple Germany's industrial production with POINTBLANK missions. U.S. heavy bombers from the Eighth Air Force began attacking V-sites on June 19; the Ninth Air Force medium bombers began on the 23d. RAF Bomber Command, which until June 16 had played a supporting role in Operation OVERLORD, switched immediately to flying as many CROSSBOW missions as possible. On June 16–17, the night after the massive V–1 strike against London, British heavy bombers flew 315 sorties and dropped almost 1,500 tons of bombs on large sites and suspected supply depots in France. The RAF kept up this pace through the end of June, flying nearly 30 percent of all its sorties against V-targets and dropping more than 15,900 tons of bombs. Thus, in the last two weeks of June, Allied bombers delivered almost 23,500 tons of bombs against CROSSBOW targets.

The British Air Ministry had identified the following targets, in order of priority: large sites, whose purpose was still unknown; supply depots

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In the days after the Normandy invasion, RAF Bomber Command Air Chief Marshal Sir Arthur Harris, pictured here sitting to Gen. Ira Eaker's left, sought British permission to attack more targets in support of Operation OVERLORD instead of Operation CROSSBOW.

where V–1s were being stored and distributed; ski sites; and modified sites. Most V–1 launchings were coming from modified sites, but these were small, well-hidden targets. In bad weather, Allied bombers had to use radar bombing techniques, which were inefficient against the modified sites. In general, of the four kinds of targets, only the supply depots made sense to the bomber commanders.

The main concern of Allied air commanders who argued against the renewed CROSSBOW counteroffensive was the inconclusiveness of its results. No one knew if the Allied strikes were succeeding. Every night the Germans launched one hundred V–1s against London. Air commanders could not dismiss civilian morale as irrelevant, but it seemed to them that they jeopardized men and aircraft in missions with dubious outcomes. Other missions promised more to speed the invasion's success, and once Allied troops occupied the French and Belgian coasts, the V–1 attacks would end.

In the days after the Normandy invasion, Air Chief Marshal Sir Arthur Harris of RAF Bomber Command and Eighth Air Force Commander Doolittle both complained to SHAEF Deputy Supreme Commander Air Chief Marshal Sir Arthur Tedder about the shift in priorities and requested permission to attack more targets in support of Operation OVERLORD. The

commander of the British Second Tactical Air Force, Air Marshal Sir Arthur Coningham, also sought Tedder's approval to switch from CROSSBOW operations to missions in the Normandy theater. As it stood, only immediate support for the frontline troops could supersede the ongoing CROSSBOW missions. Tedder refused.

General Spaatz of U.S. Strategic Forces introduced some other novel ideas into the CROSSBOW debate: because the large sites—whatever their purpose—could not function without electricity, why not knock out Pas de Calais power generators and transformers? Or, against large sites that apparently had their own generators, why not load old bombers slated for the spare-parts junk hangars with 20,000 pounds of explosives and fly them by radar right into the target? (That idea would later come to fruition as Project AP.)

Spaatz also argued in favor of different targets. Heavy bomber raids against the modified sites were not producing the desired results. He suggested bombing the source of V–1 production and assembly, rather than concentrating on the launch sites. The Allies had identified the factories that made the guidance components (gyrostabilizers)—attack *them*, Spaatz urged. In effect, he concluded that the Allies needed to return to the objective of the Combined Bomber Offensive: destruction of the German air force and German industry in Operation POINTBLANK.

At the end of June, Eisenhower once again considered the advice and recommendations of his generals to change operational priorities and he

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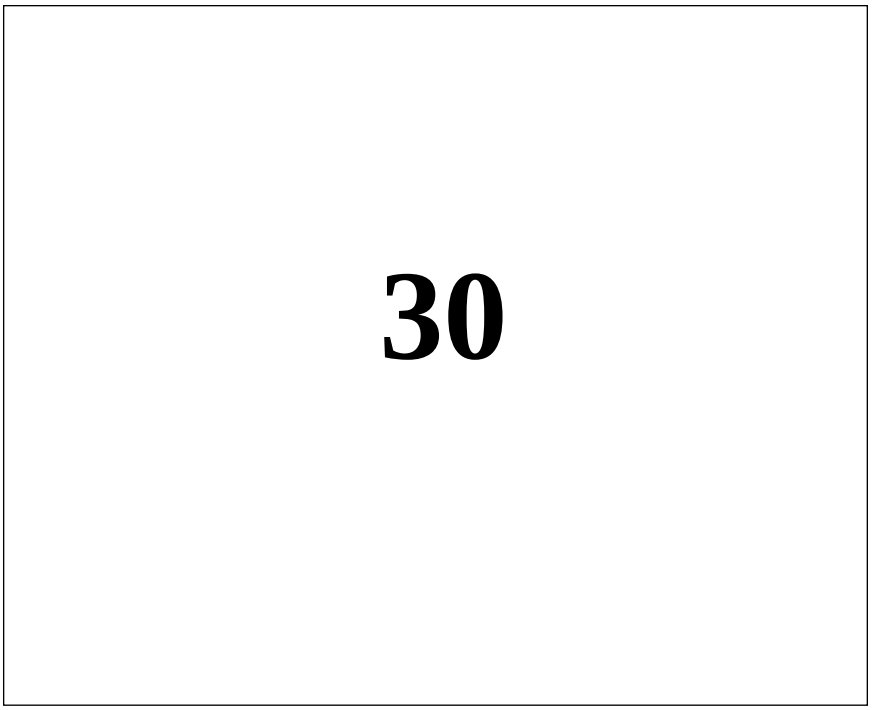
Despite repeated requests to direct some air resources away from Operation CROSSBOW, both SHAEF Deputy Supreme Commander Air Chief Marshal Sir Arthur Tedder and Supreme Allied Commander General Eisenhower, pictured above, *far left and right, respectively,* kept offensive missions against V-weapons a top priority.



The U.S. Eighth Air Force's bombing attacks put this V–1 buzz bomb production plant out of business. The facility was the Fallersleben Volkswagen factory, which had a brief period of peacetime automobile production before the German authorities converted it to wartime military use.

made his decision: except for immediate support of the troops in Normandy, CROSSBOW would "continue to receive top priority."

In July and early August 1944, as ground troops and armored vehicles slowly fought through the Normandy peninsula and prepared to make a devastating break past the German Seventh Army and into central France, the Germans fired a continual barrage of V–1s against London at a rate of roughly one hundred every twenty-four hours. RAF Bomber Command continued to fly about 30 percent of its bomber sorties against CROSSBOW targets: some 5,800 sorties dropped nearly 24,300 tons of explosives in July and 5,700 sorties dropped more than 25,300 tons in August. Other Allied air forces pitched in. The Eighth dropped almost 10,900 tons of bombs in CROSSBOW missions; the Ninth flew 400 sorties; even the Fifteenth Air Force based in Italy attacked the V-weapon manufacturing plant at Ober Raderach in southern Germany with more than 750 tons of bombs. In those two months, the Allies used about 20 percent of their total heavy bomber strength against V-sites and V-weapons targets, but as far as anyone could tell, the aerial campaign had no effect. By mid-August, the

V–1 launch rate was no lower than it had been when the Germans began bombing London two months earlier.

The Allies could do little more. They rejected proposals for using poison gas against the V-sites; once started, that kind of warfare might escalate and give the enemy an excuse to do the same thing against London. Another proposal called for saturation bombing of German cities in retaliation for the London bombardment, but air leaders dismissed this as a further diversion of air power from the strategic POINTBLANK missions.

In mid-July 1944, Allied air commanders tried to tie CROSSBOW more closely to the general objectives of the Combined Bomber Offensive, or at least to organize the attacks in a more economical and efficient way. Spaatz, in particular, pushed Air Chief Marshal Tedder to establish a joint Anglo-American CROSSBOW committee comprising an equal number of British and U.S. air staffs. Tedder set up a Joint CROSSBOW Target Priorities Committee, but he was not about to relinquish real authority to make the final decision; the committee was an advisory group only and Tedder was not obligated to follow their recommendations. When the Joint Committee recommended abandoning heavy bomber sorties against launching sites in favor of attacks against V–1 storage depots in France and V-weapons production factories in Germany, Tedder ignored them.

In return, some Allied air commanders began to ignore Tedder. Air Marshal Harris agreed with the objectives of the Allied air commanders and he protested as much as he dared, but he could not easily ignore the wishes of the British War Cabinet or the chiefs of staff. He recommended as a CROSSBOW target the V-weapons production plant at Ruesselheim,

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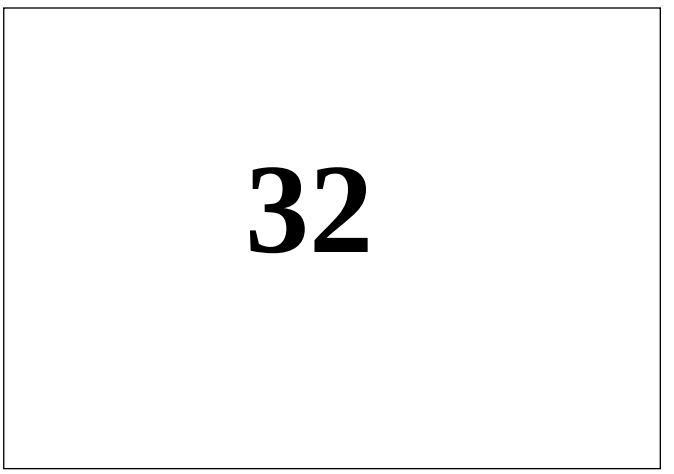
A German crew tows a V–1 rocket to its launching ramp. More than 9,000 of these rockets were deployed against Great Britain in the summer of 1944.

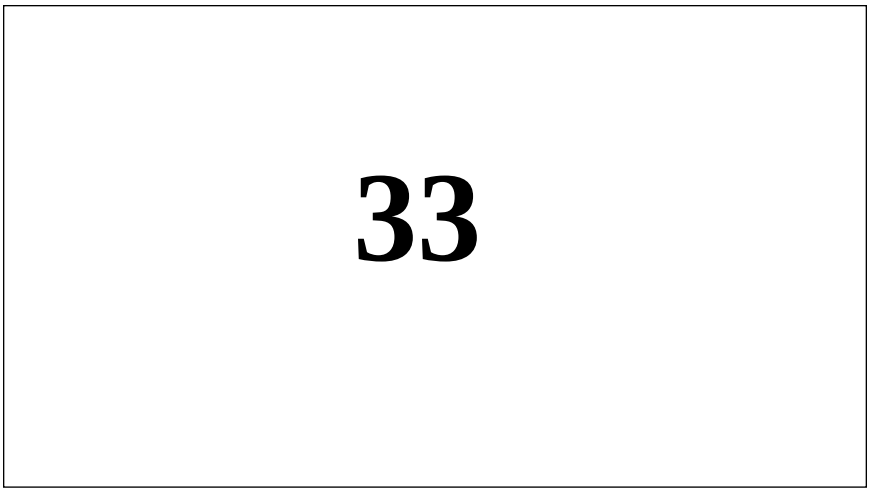
which RAF Bomber Command attacked with almost 700 sorties and more than 2,500 tons of bombs in two night raids. Eighth Air Force Commander James Doolittle, on the other hand, expressed his displeasure with Tedder's decisions by increasingly reserving Eighth Air Force aircraft for OVERLORD or POINTBLANK missions first. By mid-August, with the Allied breakout well under way, Doolittle decided that the best way to defeat the V–1s was for Allied ground forces to overrun launch sites and his highest air priority went to supporting the breakout. When Tedder insisted on direct CROSSBOW attacks, Doolittle complied but kept the attacks relatively light. Tedder was annoyed, but he could not give Doolittle direct orders and he had little institutional leverage against the USAAF general. It was a bureaucratic stalemate.

Events on the ground ultimately changed the nature of the CROSSBOW campaign. In mid-August 1944, in the path of advancing Allied forces, German units responsible for firing V–1s began to pull back from the northern coast of France to avoid capture. The V–1 firing rate against Britain decreased to roughly eighty per day—still more than 1,100 launches every two weeks. The Allied advance was so swift, however, that by September 1 the Germans had been pushed out of range and forced to air-launch V–1s from the underbellies of Heinkel He–111s, an inferior method that caused inaccurate missile flight. For a short time, the V–1 offensive was over, although the Germans planned to introduce an improved, longer-range version of the V–1 from new launch sites in Holland. Between June 12–13 and September 1, the Germans fired more than 6,700 cruise missiles against England.

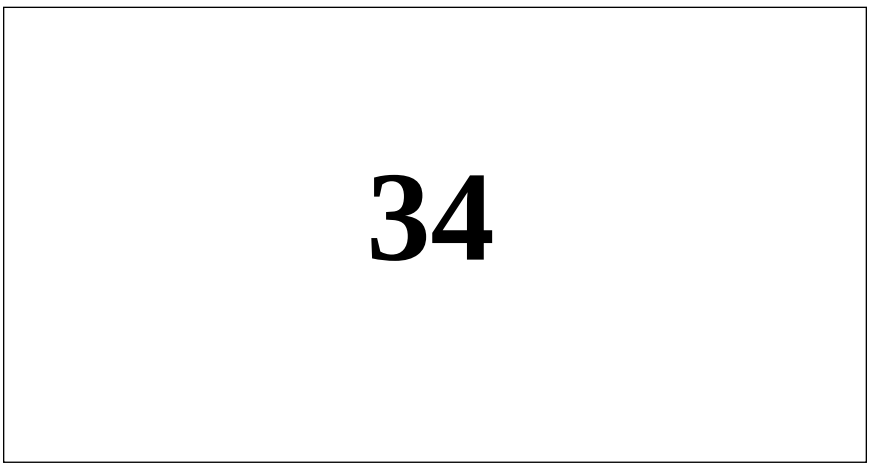
Believing the worst to be over, British Air Defence officials breathed a collective sigh of relief. On September 3, 1944, many air commanders were even happier to hear that all CROSSBOW offensive countermeasures,

When German V–1 launch crews were pushed inward from the coast of France, they could no longer target Great Britain from the ground. Instead, the Luftwaffe had to launch V–1 missiles from the air.





Heinkel He–111s carried and launched the buzz bombs at London in the late summer of 1944.



This Heinkel He–111 was shot down in flames.

especially the detested heavy bombing raids against modified sites, were suspended. Three days later, the British Chiefs of Staff agreed to halt the diversion of air power from more crucial operations in favor of CROSSBOW targets, except for raids against the airfields used by the Heinkels that were still launching the V–1s from the air. The next day Duncan Sandys, the War Cabinet spokesman on the V-threat, felt confident enough to announce publicly the end of the V–1 bombardment.

Within twenty-four hours, falling without warning out of the stratosphere, a V–2 ballistic missile exploded in London.

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Once launched, the V–2 ballistic missile could not be defended against. Nonetheless, the Allies did not consider the V–2 weapons as great a threat in late 1944 as they had expected earlier in the war.

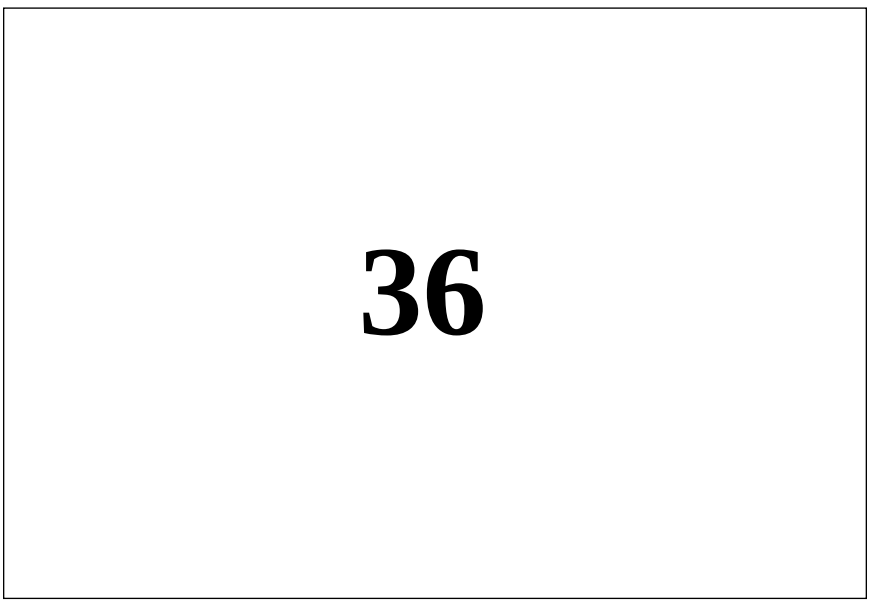
ROUND THREE: THE V–2s

The subsonic V–1 could be shot down by interceptors and antiaircraft guns, but there was no defense against a ballistic missile in flight. The best defense seemed to be air attacks against every aspect of its production, transportation, and launching. Accurate intelligence on the V–2 had been difficult to acquire. The British were unaware that V–2s could be launched from mobile platforms and had insisted on pounding the seven large sites in France in the mistaken belief that they were launching silos. During July and August 1944, RAF bombers dropped 12,000-pound bombs, called "Tallboys," in an effort to destroy those large sites. Later investigation revealed little about their true purpose; some sites apparently were used as liquid-oxygen manufacturing centers, others as storage bunkers for a variety of weapons and as command and control centers for the Wehrmacht units firing V–1s and V–2s. If the Germans had ever

intended to use those sites as missile silos, such plans had been abandoned shortly after the CROSSBOW campaign began in December 1943.

On August 25, 1944, the Joint CROSSBOW Target Priorities Committee prepared a plan to acquire aerial reconnaissance of suspected V–2 launching points and forward and rearward storage depots, and then to bomb them, along with liquid-oxygen plants. Other missions would destroy rail bridges and V-weapons production plants in Germany and Austria. Previously the RAF Bomber Command and Eighth Air Force had expended most of their CROSSBOW energy against modified sites, some storage depots, a few airfields, and a handful of strategic targets such as liquid-oxygen plants. When the V–1 bombardment faltered on September 1, however, Allied war leaders began to wonder if the V–2 would ever be deployed and placed on hold the "Plan for Attack on the German Rocket Organization When Rocket Attacks Commence."

After the surprise V–2 attack on London on September 8, the Allies decided not to divert further bomber resources from POINTBLANK. First, they reasoned, the V–2 of 1944 was not nearly the threat that the British had anticipated in 1943. A physical examination of the first few V–2s to strike London revealed that their warheads were no greater than the explosive payload that a V–1 could deliver—less than one ton of high explosive. True, its unexpected arrival made the V–2 an effective terror weapon. Intelligence estimates, however, suggested that the Germans had pro-



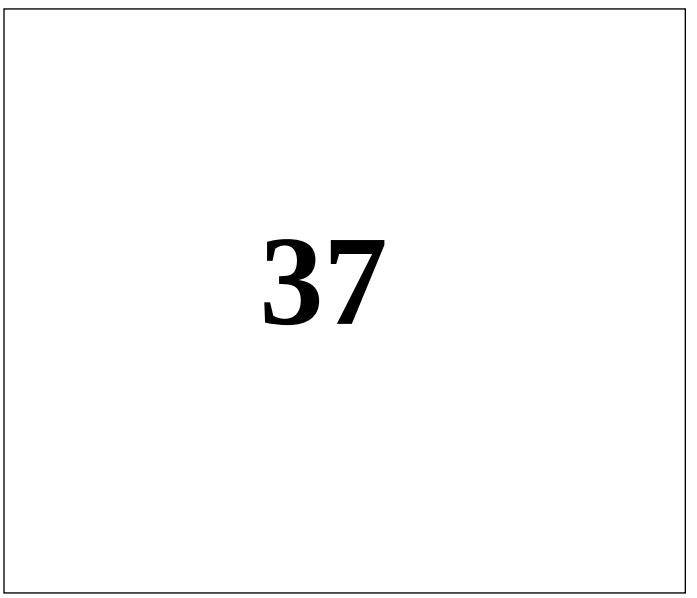
What had been a London fish market was changed to a gaping hole by a German V–2 in September 1944.

duced far fewer V–2s than V–1s, so the British judged the V–2s to be less a threat in September than the V–1s had been in June.

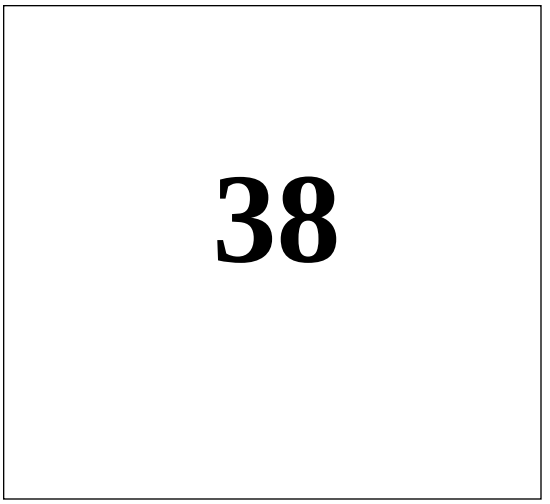
Second, the V-weapons were no longer being launched purely as retaliation against London, but were now sent against Paris as well. That expanded the purpose of the enemy campaign from undermining British morale to destroying *Allied* morale. Again, the British reasoned, this weakened the V-threat. How could French morale be lowered by terror bombing when most of the country had just been liberated after four years of brutal occupation? V-weapon attacks against the French would fail, as would later ones against the Belgians.

In a single massive raid on September 17, 1944, RAF Bomber Command flew about 700 sorties over Holland and dropped more than 3,800 tons of bombs against airfields suspected of basing the He–111s that air-launched V–1s against London. Except for a few Eighth Air Force raids in September and December, the airfields' bombardment marked the final use of heavy bombers against V-targets. In September and thereafter, the Allies flew less than 1,000 heavy bomber sorties and dropped about 48,000 tons of bombs on airfields and suspected V–2 production plants. By now they had learned that V–2s were being launched from mobile platforms, which were difficult targets for bombers to locate and destroy.

Much to the delight of USAAF commanders like Spaatz and Doolittle, the British finally acquiesced to U.S. insistence on using minimum-altitude fighter-bomber attacks against the small, well-hidden modified



Gen. Dwight Eisenhower inspects a German V–2 captured by the Allies.



Generals Spaatz and Doolittle, *second and third from left,* were delighted when the British finally agreed to use fighter-bombers in minimum-altitude assaults against the remaining V–2 launch platforms in Holland and Germany.

sites and V–2 launch platforms remaining in Holland and Germany. Aircraft from the Ninth Air Force and RAF Second Tactical Air Force strafed or bombed those targets relentlessly in more than 10,000 sorties, dropping about 2,000 tons of ordnance by war's end.

In October 1944, Allied leaders realized that the focus of the V-threat had shifted to the continent, specifically against Antwerp, a critical resupply port for Allied armies on the German border. On October 9, Eisenhower asked the Air Ministry to transfer intelligence operations on CROSSBOW activities to SHAEF, a move accomplished by October 24. By mid-December, SHAEF had created a continental CROSSBOW organization responsible for gathering intelligence and using it to strike at any V-targets not captured by Allied troops. Destructive, yet ineffective, German attacks failed to stop the Allied advance.

The Continental CROSSBOW organization received one last shock during the winter of 1944–1945. The German army unexpectedly counterattacked the Allies in what came to be known as the Battle of the Bulge. New Nazi weapons appeared in the skies over Germany, including turbojet and rocket-powered fighters, turbojet bombers, and other novel technologies. There were rumors that the enemy was about to unleash a V–3 long-range intercontinental ballistic missile that could hit cities on the Atlantic seaboard of the United States. It seemed possible; captured German technicians suggested that there once had been plans to use the large sites as silos for that type of missile. By February 1945, however, Allied leaders decided that such weapons, even if developed, could not be used before the collapse of Germany, which took place in late April and early May 1945.

MODERN ROCKETRY AND LESSONS LEARNED

The V–1s and V–2s fired against London and the European continent during the summer of 1944 survive today as cruise missiles and mobile-platform-launched ballistic missiles. Their range, maneuverability, accuracy, and destructive power have improved dramatically, but the offensive capabilities have been countered by improvements in defensive technology—surface-to-air missiles, electronic countermeasures, and antiballistic missile missiles.

More than five decades later, the key lessons of Operation CROSSBOW still apply. In the Gulf War of 1991, when Iraqi president Saddam Hussein ordered the launch of tactical ballistic (SCUD) missiles against Israeli cities, many people feared that the warheads might contain poison gas, biological, or perhaps even nuclear weapons. The SCUDS served a political purpose, not a military one: to draw Israel into the war and thus prompt Arab forces to withdraw, thereby undermining the United Nations coalition against the Iraqis. The vengeance weapons proved ineffective. The warheads contained conventional explosives and, to preserve the coalition, Israeli leaders chose to withhold retaliation. Like their predecessors in World War II, the allied leaders of Operation DESERT STORM suggested that the best defense against cruise and ballistic missiles was to knock them out, if possible, before they were fired. A preemptive strike against mobile targets, however, is not always possible. Even with overwhelming air superiority and top aerial priority given to the task, the World War II Allies made no significant dent in the German V–1 launch rate. The modified sites of the V–1 and the mobile launching platforms of the V–2s were too easily camouflaged and too difficult to destroy using heavy bombers or fighter-bombers. Fifty years later, SCUD mobile launching platforms proved no easier to find and destroy.

On the other hand, ground forces can overrun enemy missile sites or push the launch batteries out of range. In World War II, this strategy ultimately defeated the V-weapon threat. Seen in that light, the combination of Operations CROSSBOW and OVERLORD was grand-strategy thinking at its best. Allied leaders knew that the invasion of France could succeed only with air superiority secured, and that V-weapons could disrupt the invasion or the reinforcement of the beachheads; therefore, Operation CROSSBOW had to delay the threat of the V–1s and V–2s long enough to ensure victory on the ground.

The best defense, as it turned out, was not destruction but delay and the use of air power to achieve limited victories as part of a greater combined arms campaign. German use of V-weapons came too late to change the outcome of an overwhelming war of attrition. Although it is not clear that CROSSBOW actually delayed the Germans' use of the weapons, one can ponder what the outcome of the war might have been if the Allies had done nothing to impede the V-weapon systems. The British and Americans

diverted enough resources—about 20 percent of their total air power—from their combined strategic bombing campaign against Germany to reduce the V-weapon threat from something that could change the course of the war to something that could only delay the inevitable Allied victory.

SUGGESTED READING

Arnold, Henry Harley. *Global Mission*. Blue Ridge Summit, Pa.: Tab Books, Inc., 1989.

Collier, Basil. *The Battle of the V-Weapons, 1944–1945*. New York: William Morrow, 1965.

Cooksley, Peter G. *Flying Bomb*. New York: Charles Scribner's Sons, 1979.

Craven, Wesley Frank, and James Lea Cate, eds. *The Army Air Forces in World War II* (7 volumes). Chicago: University of Chicago Press, 1948–1958.

Cully, George W. "A Kind of Déjà Vu." *Airpower Journal* 4 (Spring 1990): 47–60.

Dornberger, Walter. *V–2*. New York: Viking Press, 1958.

Garlinski, Josef. *Hitler's Last Weapons*. New York: Times Books, 1978.

Hastings, Max. *Bomber Command*. New York: Simon and Schuster, 1989.

Henshall, Philip. *Hitler's Rocket Sites*. New York: St. Martin's Press, 1985.

Hinsley, F. H., with E. E. Thomas, C. F. G. Ransom, and R. C. Knight. *British Intelligence in the Second World War* (3 volumes). London: Her Majesty's Stationery Office, 1984.

Kennedy, Gregory P. *Vengeance Weapon 2*. Washington, D.C.: Smithsonian Institution Press, 1983.

McGovern, James. *CROSSBOW and OVERCAST*. New York: William Morrow, 1964.

Middlebrook, Martin. *The Peenemünde Raid*. New York: Penguin Books, 1988.

Morrison, Wilbur H. *Fortress Without a Roof*. New York: St. Martin's Press, 1982.

Williams, C. R. *United States Strategic Bombing Survey—Report on the "CROSSBOW" Campaign: The Air Offensive Against V-Weapons, EW #60 (24 September 1945)*. Washington, D.C.: U.S. Government Printing Office, 1945.