

DOOLITTLE, BLACK MONDAY, AND INNOVATION

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Introduction

On March 6, 1944 America launched 814 bombers and 944 fighters from bases in southern England in the first maximum-effort daylight raid on Berlin, then the world's largest metropolitan city. Symbolically, it was also the 250th combat mission for the vaunted U.S. 8th Air Force, operating out of a hundred-odd bases leased from our British allies in an area of southeastern England known as East Anglia. It was the largest aerial armada ever assembled up to that time and more American aircraft and airmen were lost that day than any other during the Second World War. Few would have forecast that such grievous losses actually constituted a victory, but the activities of that afternoon spelled the beginning of the end of the German Luftwaffe.

Why 1,758 combat aircraft on a single mission? In those days, the big stick in America's military inventory was the long-range 4-engine bomber. By today's standards, these craft were crude: unpressurized and without insulation or heat; equipped with a dozen hand-guided machine guns; and devoid of any reasonable means of escape once the plane began to free-fall out-of-control (thousands were carried to their deaths, unable to extract themselves from plummeting aircraft). The big planes could bomb targets up to 1,000 miles distant and return to their bases. They cost about a quarter-million dollars apiece and required a crew of 10 men. There were two principal types: the Boeing B-17 *Flying Fortress* and the Consolidated B-24 *Liberator*, both built under license by a host of other manufacturers, such as Douglas, Ford, Vega and Lockheed. As Franklin Roosevelt's *arsenal of democracy*, the nation produced about 12,700 B-17s and 18,700 B-24's; as well as nearly 100,000 single engine fighters.

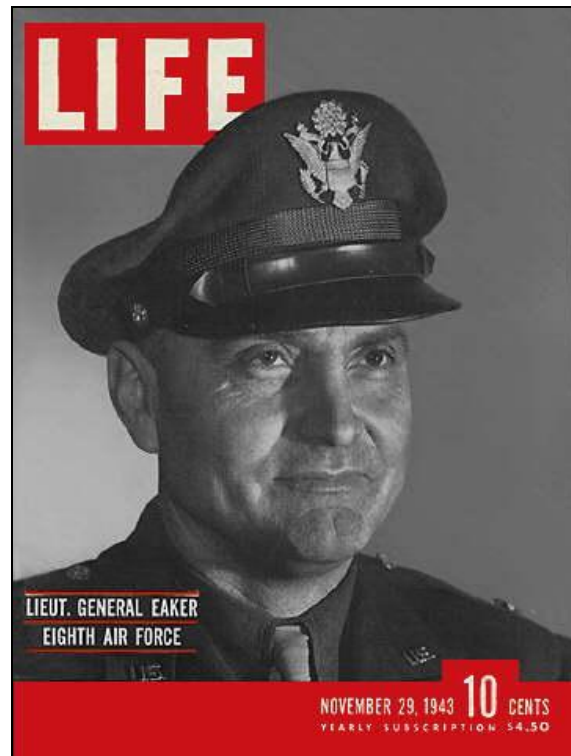
When the Second World War concluded in the fall of 1945, American manufacturing capacity yielded a Gross National Product (GNP) that exceeded the sum output of all other nations – combined. This simple fact is difficult to imagine in the present climate of spiraling national debt and devaluation of American currency. During World War II, thousands of young men died each day, just to put a few bombs on their targets. The average bombing accuracy on the briefed primary target was something between 2% and 12%.

My theme today is this: Regardless of any pre-war preparations, we should expect our enemies to innovate effective counter-tactics, which invariably, lead to an escalation of the envisioned conflicts.

Strategic daylight bombardment

So why did we send almost a thousand bombers to Berlin in early March 1944? A new commander, Jimmy Doolittle, had just taken over command of the 8th Air Force in January. A graduate of U.C. Berkeley in 1922, he was the first Army officer to earn a doctorate degree in engineering, receiving

his Ph.D. in aeronautical engineering from MIT in 1925. He was also the first reserve officer to attain the three stars of a Lieutenant General. Already well known as a Medal of Honor recipient for having led the first Tokyo Raid in April 1942, Doolittle took over the 8th Air Force when it was the largest enclave of aircraft ever assembled, based wholly in England.

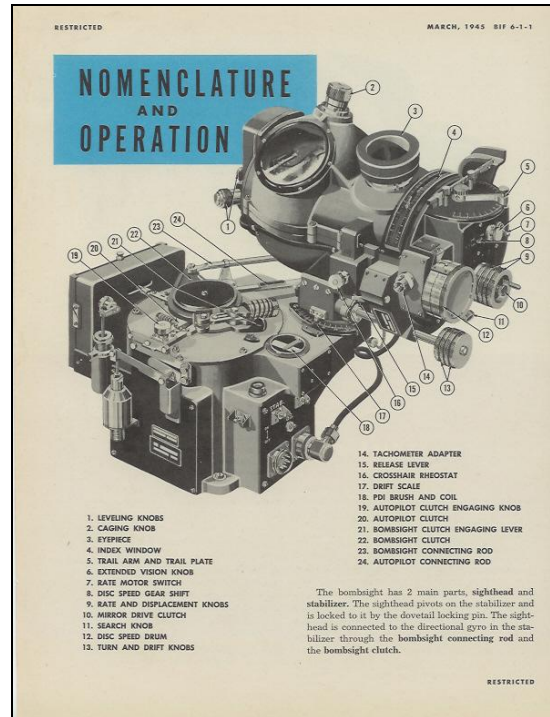
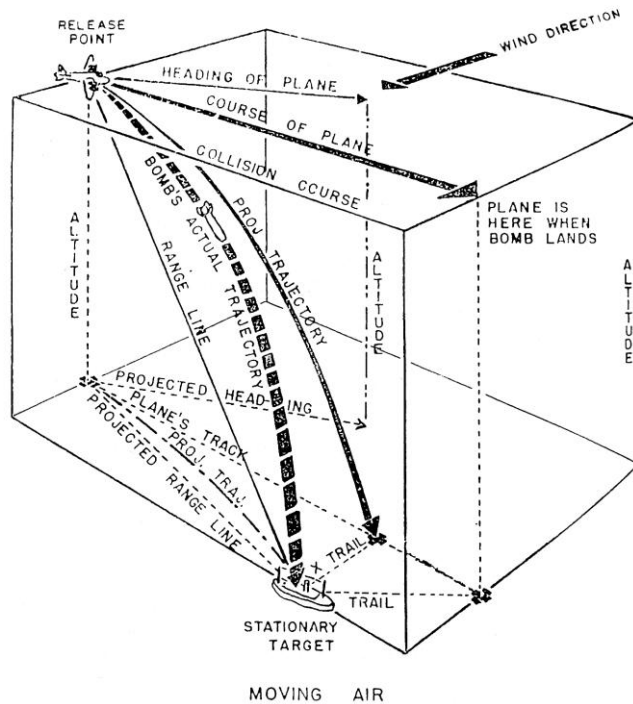


Ira Eaker (at left) was a career Army Air Corps officer who believed our 4-engine bombers could interdict critical enemy industries from high altitude using the Norden bombsight. This required daylight missions with bombers capable of defending themselves.

Doolittle' predecessor as commander of the 8th had been Ira C. Eaker, a career officer known in the halls of Congress as the Air Corps' point man in promoting strategic daylight bombardment; a theory of aerial warfare hatched during 1940-41, upon development of the secretive Norden bombsight. The Norden was high technology for its day: a sophisticated optical device which controlled a bomber's path, making the necessary corrections for wind, drift, air speed and altitude to place bombs in an area 200 feet square from an altitude of 20,000 feet. At least that was the theory. Better yet, we had the Norden bombsight and nobody else did.

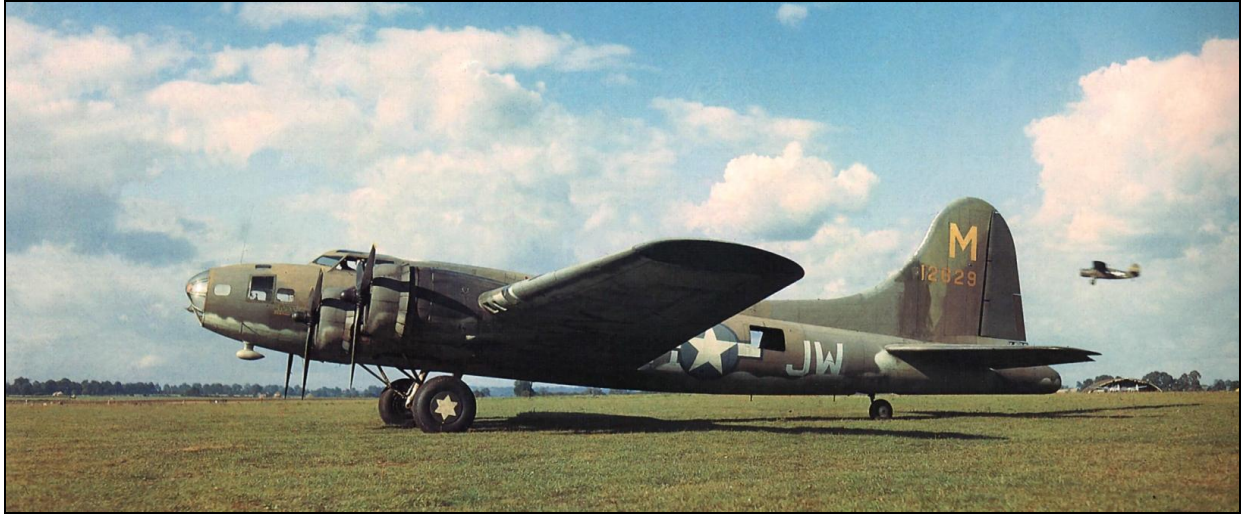
Zealous Air Corps officers felt that long-range high-altitude bombers equipped with Norden bombsights would systematically destroy an enemy's critical war industries from altitudes above effective anti-aircraft fire, and prosecute the conflict from air bases 500 miles away. These "strategic targets" included: aircraft production centers, factories producing war material, key parts (such as ball bearings), petroleum, oil and lubricant (POL) facilities, and key transportation facilities, such as bridges and railway marshalling yards. The nuts-and-bolts military targets were termed "tactical

targets". These were to be interdicted by lighter medium-ranged bomber and fighter aircraft, positioned closer to the fighting fronts.



The Norden Bombsight was a super secret device that allowed American aircraft to drop bombs "in a pickle barrel from 20,000 feet". It provided corrections for altitude, airspeed and cross wind, controlling the aircraft during the bomb run. Before the Second World War 20,000 feet altitude was assumed beyond the effective range of defensive anti-aircraft canon.

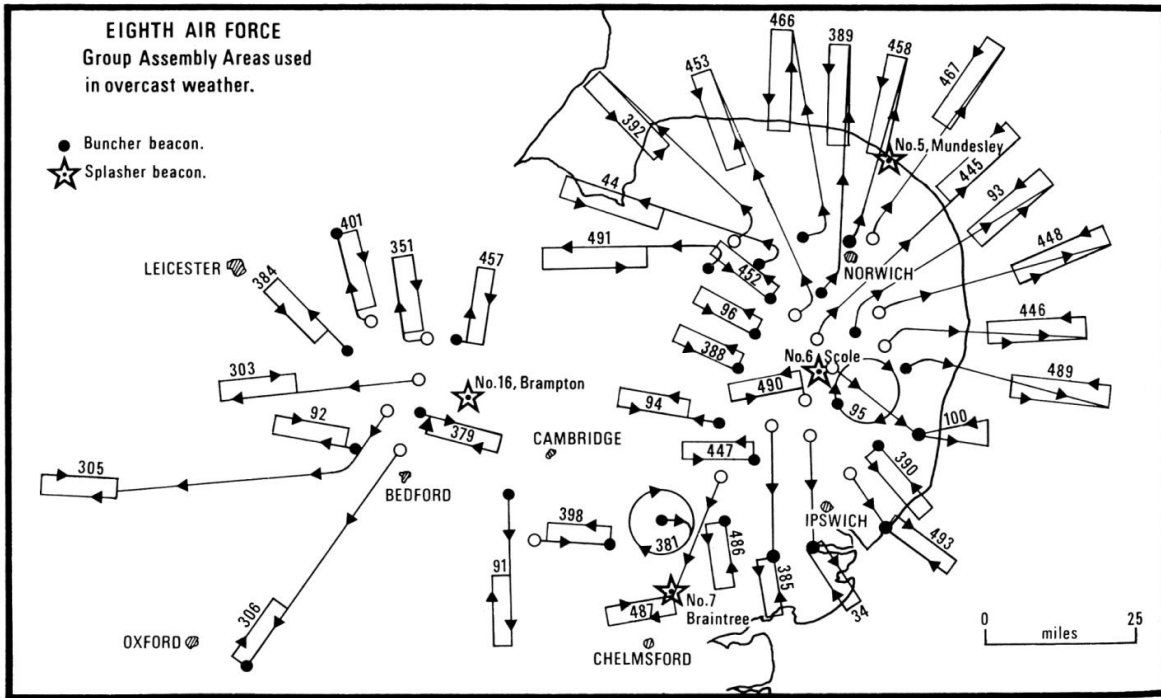
The long range strategic bombers were fitted with defensive machine guns; the theory being that they could fly deep into enemy territory without fighter escort and defend themselves by flying in tight formations with overlapping defensive fire. This limitation was essential to the pre-war plan, because fighters of that era had limited range. The bombers were originally fitted with five 50-caliber guns, but by war's end, this number had increased to 13; armor plate added, and self-sealing fuel tanks in the wings. With all these additions, the bombers became slower, but our air force brass was confident that these aerial armadas would hold their own over enemy territory in broad daylight, and they sought to prove it at the earliest opportunity.



The early cadres of B-17s were E models like the one shown here, which began arriving in England during the summer and fall of 1942. Crews had to fly 25 combat missions over Europe before rotating stateside. 89% of the crews engaged in combat during the first year of operations were lost. Combat wings of two and three adjacent groups began to be formed in June 1943, followed by three air divisions, formed in August-September 1943. The First and Third Air Divisions of the 8th Air Force were comprised of B-17 Flying Fortresses.



The Second Division was made up exclusively of Consolidated B-24 Liberator bombers, like those shown here. The Liberator had slightly greater range and bomb load than the B-17 because of its aerodynamic Davis Wing, but was more difficult to fly and unable to absorb as much battle damage as the B-17. First Division aircraft carried triangles on their tails, Second Division Liberators employed circles and Third Division planes used squares, all with identifying letters.



The American 8th Air Force was dispersed across East Anglia and the Midlands of England. This map shows the bomb groups' respective assembly areas. Four squadrons made up each bomb group and three adjacent groups usually comprised a combat wing, which always flew together.



Despite the best weather predictions, thick cloud cover often obscured primary targets over western Europe, especially during the colder months. This necessitated shifts to secondary targets or dropping bombs into the North Sea.

German counter tactics

When Doolittle took over from Eaker in January 1944 the strategic bombing campaign was taking heavy losses and bombing accuracy was sporadic, as the cloudy skies of northern Europe seldom favored the clear sky conditions necessary for the Norden to work as advertised. Meanwhile, the Germans demonstrated remarkable innovation in developing effective counter tactics. They began by establishing reliable radar detection arrays to track incoming bombers, allowing them to accurately vector their defensive fighters to the bomber's projected tracks. German fighters could fly at least two defensive sorties to each of our missions: one when the bombers flew inbound, and another on the bomber's return leg to England. For targets deep inside Germany, some Luftwaffe pilots flew as many as five sorties.

For those bombers who were forced to drop from formation, their return was largely a matter of chance, happened by cloud cover. Once they dropped out of formation, stragglers were extremely vulnerable because they were bereft of the covering fire from sister aircraft. Most seasoned pilots turned their aircraft for the ocean, realizing that, without their own at-sea search-and-rescue capability, German fighter pilots seldom strayed more than 15 miles offshore. One of the first decisions Doolittle made was to slow down the bomber streams, so that damaged bombers could limp home in formation. It was not until 1944 that American fighters could escort bombers over Germany proper, due to the longer range of the latest P-47 and P-51 fighters equipped with disposable drop tanks.

Luftwaffe fighter chiefs repaired damaged Flying Fortress bombers and flew these in mock air battles to evaluate the bomber's vulnerability to aerial attack from various directions. They soon discovered the plane was vulnerable from head-on and tail-low attack angles.



The Messerschmitt Me-109 was a potent and nimble fighter interceptor used by the German Luftwaffe. 35,000 examples were manufactured during World War II by Axis forces, more than any other aircraft in history. It came equipped with two 7.9 or 13 mm machine guns in the nose and two 20 mm under the wings or a single canon which fired through the propeller hub. These canons were potent weapons because they had greater range than the defensive armament on the American bombers and could inflict serious damage when using explosive shells.



The Focke Wulf FW-190D was another potent German fighter, with 20,000 being produced during World War II. It was initially fitted with four 7.9 mm machine guns, but later models were equipped with just two machine guns in the nose and a pair of 20 mm canon in each wing with 200 rounds each.

German munitions experts also developed highly effective anti-aircraft canon, installing 11,000 batteries by war's end. Using height-finding radar, these so-called "flak batteries" employed proximity fused projectiles, which exploded whenever they sensed a mass of metal, like an airplane, within a preset altitude "window". By surrounding their most vulnerable targets with such batteries, substantive losses were incurred without having to launch large numbers of defensive fighter aircraft.

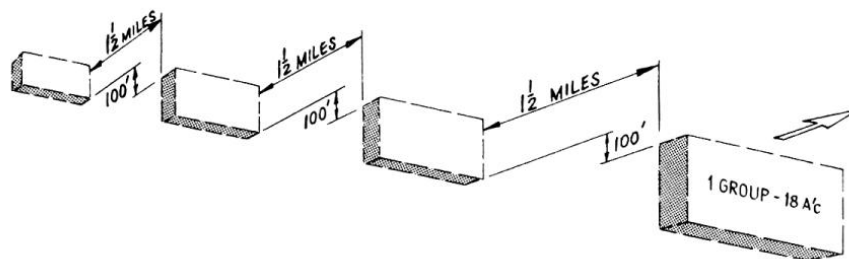


Close up view of canon damage to an American B-17. The Luftwaffe employed explosive canon shells which could devastate the American bombers. Badly damaged craft only made it home if they did not have to leave formation. A high percentage of these stragglers were finished off by marauding German fighters.

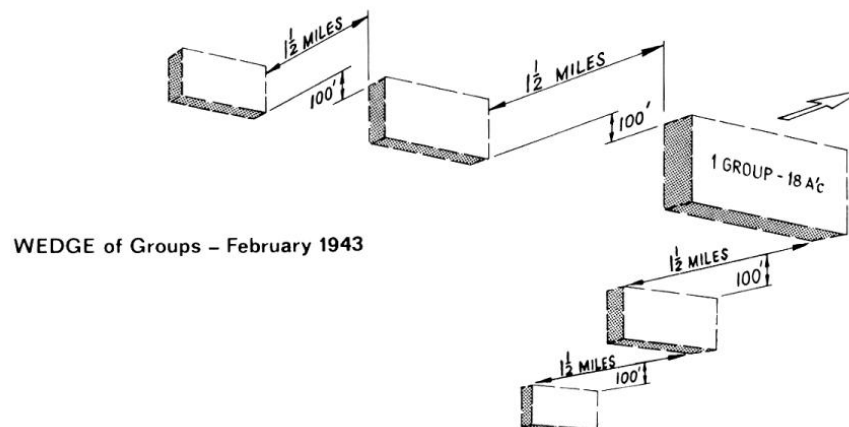
American counter-counter tactics

The Americans, losing more and more aircraft, made adjustments of their own. A young career aviator named Curtis LeMay had entered the Air Corps upon graduation from ROTC at Ohio State in 1929. A First Lieutenant when the European war broke out, by mid-1942 he was a full Colonel, commanding the 305th Bomb Group in England. The early missions specified zig-zagging over target areas to avoid anti-aircraft cannon fire, but this resulted in a loss of formation integrity, with sporadic bombing. LeMay witnessed so much carnage he felt obliged to change the American tactics. He suggested flying straight and true over targets in order to reduce the time of exposure over flak batteries, and thereby maintain superior formation integrity. He also concocted a scheme by which every bomber in the formation stream would fly at a different altitude, spread out over 3000 vertical feet. This tactic reduced the number of aircraft that could be targeted by pre-set altimeter detonators, which the Germans had been employing with their anti-aircraft batteries. This new formation was called the “combat box.”

DEVELOPMENTS in the DEPLOYMENT of GROUP FORMATIONS.

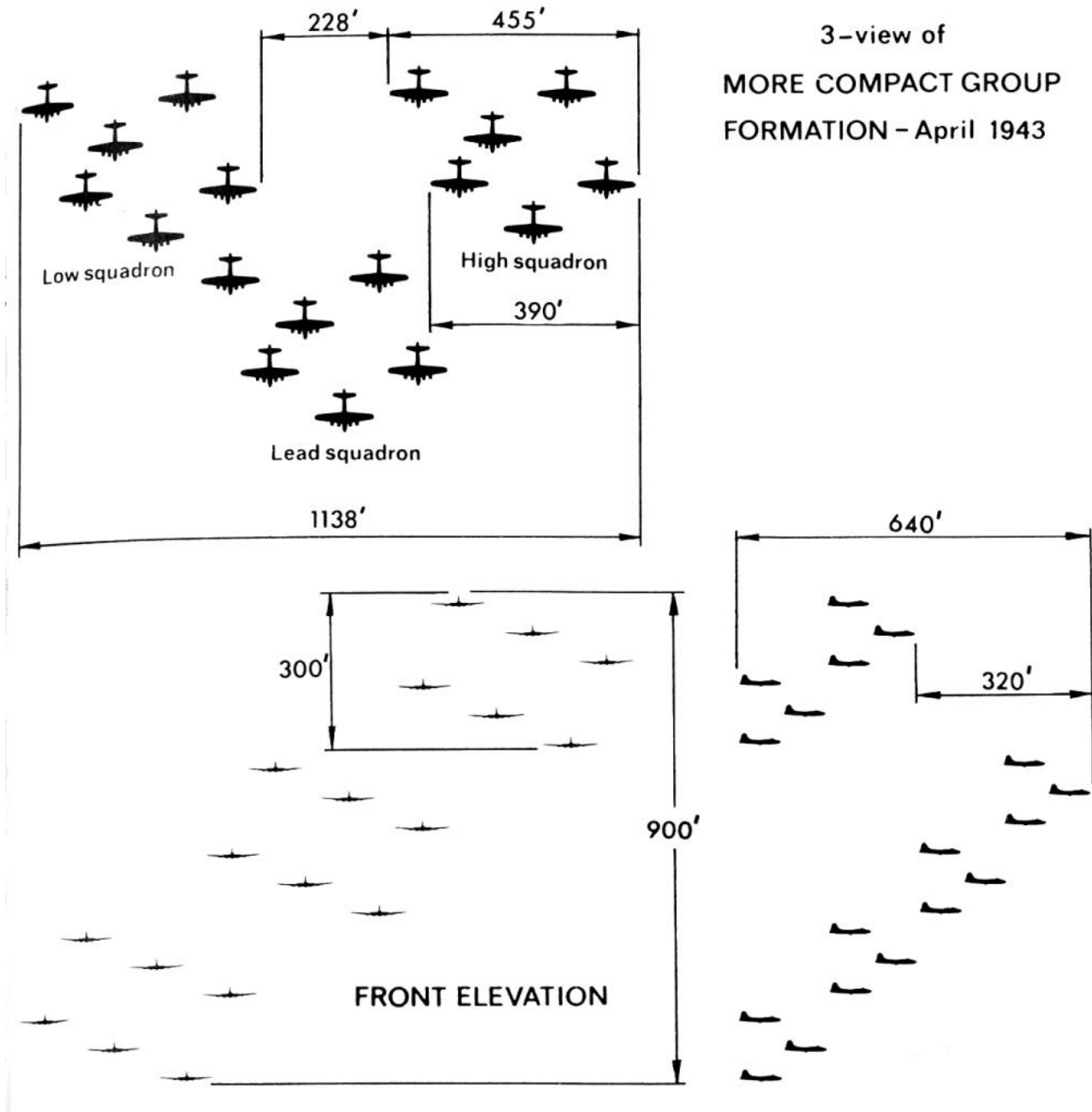


JAVELIN of Groups – December 1942



WEDGE of Groups – February 1943

The 8th Air Force initially employed Javelin formations (upper) that flew zig-zag paths to their targets. By February 1943 the formation style switched to defensive wedges (lower), which evolved into the combat box formation, used the remainder of the war. Both of these formations encountered severe problems while attempting to turn back towards England after bombing their targets.



Curtis LeMay was one of the innovative American commanders who pioneered the employment of the Combat Box formation in early 1943, shown here. Unlike the wedge formation, it placed every bomber at a different altitude, with a maximum spread of 900 feet between the lowest and highest aircraft. The box formation retained the close spacing needed for bombing accuracy and overlap of defensive machine gun fields of fire. The most vulnerable position was the rear of the low squadron, where there was no overlapping cover fire. LeMay began the war as a first lieutenant in January 1940. By August 1944 he was the youngest major general in the Air Force when he was posted to the Pacific Theater to oversee the 20th Bomber Command flying B-29s.

While LeMay was developing formation counter-tactics, other changes were employed to make the bombers less vulnerable. A new hydraulically-operated chin turret was added beneath the nose of B-17s to ward off head-on attacks; and armor plating was added to protect the pilots. These changes made the airplane more survivable, but the cruising speed decreased 11 miles per hour from the earlier models. The standard transit speed in formation was 155 mph, and this was reduced to 150 mph over the target so aircraft losing a single engine could remain in formation and release their bombs in unison. They would then be left on their own to get home if they could not maintain the 155 mph speed on the return leg.

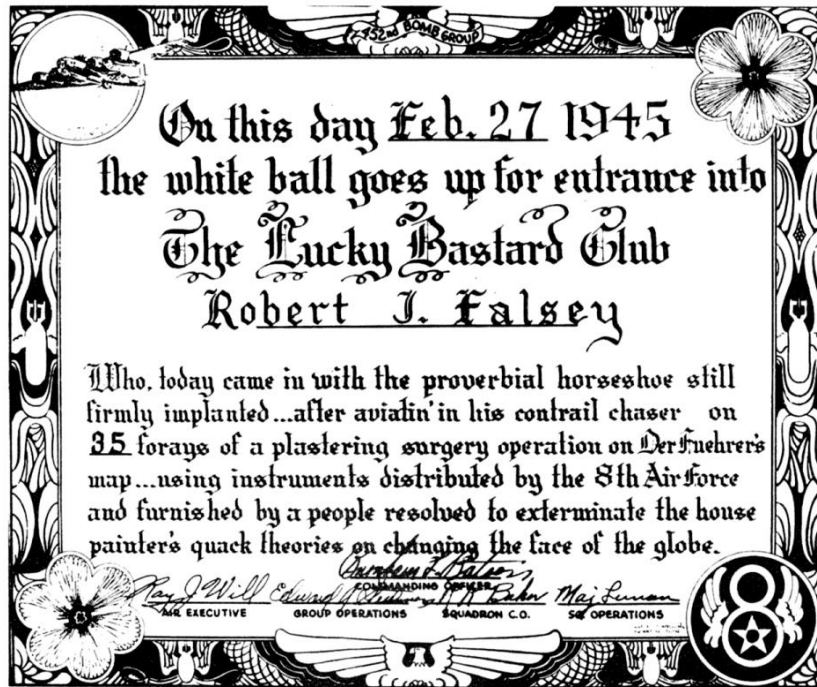
Contrastingly, German fighters became faster with each passing month. They began the war with top speeds close to 300 knots, and by war's end, had developed piston engines and jets capable of propelling fighters at speeds between 400 and 500 knots through the American bomber streams. And, their firepower became increasingly deadly, using 20 and 30 mm cannons with explosive projectiles. The favorite German approach was from head-on. German fighters aimed for the cockpits of the lead American bombers, whose pilots were forbidden to take the slightest manner of evasive action in order to hold their tight defensive formations. With a closure speed in excess of 500 miles per hour, the bomber cockpits were in a critical trajectory window that lasted just half a second. And, the Luftwaffe pilots developed a deadly aim.

The Combat Tour

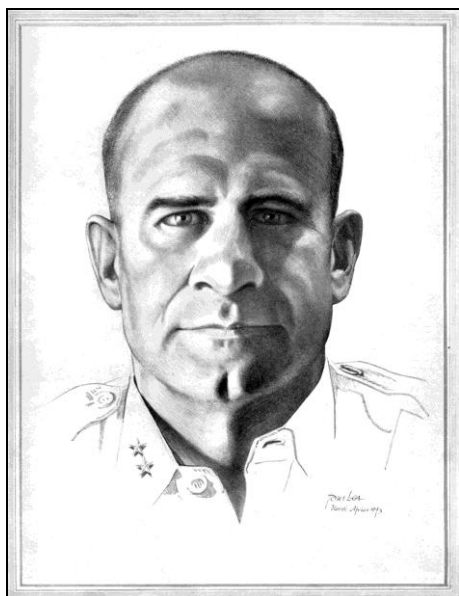
During the first year of operations (August '42 to August '43) over occupied Europe only 11% to 17% of the bomber crews completed the specified 25 mission "combat tour"; the rest were either killed or captured. There was lots of bravado, there was good press coverage, and thousands upon thousands lined up to become Army Air Corps cadets, including my father. The Army Air Corps was the elite cadre of the armed forces, only accepting volunteers between the ages of 18 and 27. Applicants needed their parent's written permission (regardless of age), and were allowed just two chances to pass difficult entrance exams. Once selected, two years of intense training followed. Severe attrition created unparalleled promotion opportunities. Pilots commissioned more than six months before Pearl Harbor (mid-1941) could become full colonels at the tender age of 25 or so, if they survived combat. Army aviators became the most decorated group of servicemen, but with the highest casualty rate of any of the services. More than one in four (26%) of Air Corps personnel in the 8th Air Force were killed, wounded or captured during the Second World War. Everyone thought they would be one of the lucky ones; they had to.

Jimmy Doolittle: born innovator

Doolittle's selection for the 8th Air Force command was no accident; he and General Eisenhower had worked together previously in North Africa and Italy, where Doolittle commanded the air forces in those theaters.



Crewmen that completed the specified number of combat missions were rotated back to the United States, where they were obliged to instruct the next generation of fliers in the Air Corps Training Command. This elite fraternity was known as the Lucky Bastard Club, which issued unofficial certificates like that shown here. In 1942-43 the prescribed number of missions was 25, increasing to 30 in mid-1944 and 35 missions by late 1944, because Luftwaffe opposition became increasingly impotent.



In January 1944 Jimmy Doolittle (at left) was given the charge of dispatching the German Luftwaffe in five months, prior to the scheduled Normandy invasion. He was known as one of the greatest pilots in the world and became a national hero after bombing Tokyo just four months after the Pearl Harbor attack and receiving the Medal of Honor from President Roosevelt (right).

Doolittle's charge from Air Corps chief Hap Arnold was simple: use the tremendous forces at his disposal to eliminate German control of the skies over occupied Europe before the Allied land invasion of the Continent, then scheduled for early May 1944. He had just five months.

Jimmy Doolittle was a born innovator. Having owned just about every American aviation record imaginable at one time or another, he commanded the flier's respect with an aura hard to imagine today. He'd been in combat, he had led some of the war's toughest missions, including the first sorties over Tokyo and Rome, and even survived a difficult bail out over Japanese occupied China. But his talents were not limited to courage; he was also a keen strategist. It was Jimmy Doolittle who had conceived the art of instrument flying, who had tinkered with gasoline, discovering that lead additives increased performance.

The tactics Doolittle chose to employ during the early stages of his 8th Air Force tour bore striking resemblance to those used by Ulysses Grant when he took over the Army of the Potomac in mid 1864: attack, attack, and then, attack again. Grant had the men, the weapons, and the logistical tether to sustain him, while his enemy did not. Doolittle found himself in a similar situation; American logistical support was increasing each month of the war, and he was accumulating a vast armada of aircraft, the likes of which had never been imagined.



The Republic P-47D Thunderbolt was the rugged mainstay of American fighter strength in the ETO in mid-1943. It was powered by a massive 2,430 horsepower radial engine and carried eight 50-caliber machine guns in its wings. It was called a "Jug" by the Americans and "Jabo" by the Germans, who feared the terrible damage wrought by its ground strafing.



The North American P-51 Mustang became the elite fighter of the American inventory because of its long range. Its standard range of 1070 miles could be increased to 2600 miles when equipped with two 165 gallon drop tanks. It was powered by a Packard Merlin inline engine, which used about half the gasoline per hour that the P-47 required. It carried six 50-caliber machine guns in its wings. Late model Mustangs were able to out-climb lighter Me-109s. 15,500 Mustangs were manufactured.



Drop tanks allowed American fighters to escort the heavy bombers deeper and deeper into Germany. In mid-1943 bomber command was screaming for drop tanks, but there were few to be found in England. The first tanks were of 75 gallon capacity, increasing to 165 gallons by March 1944. The fighters used this fuel first so they could eject the tanks if they went into combat.

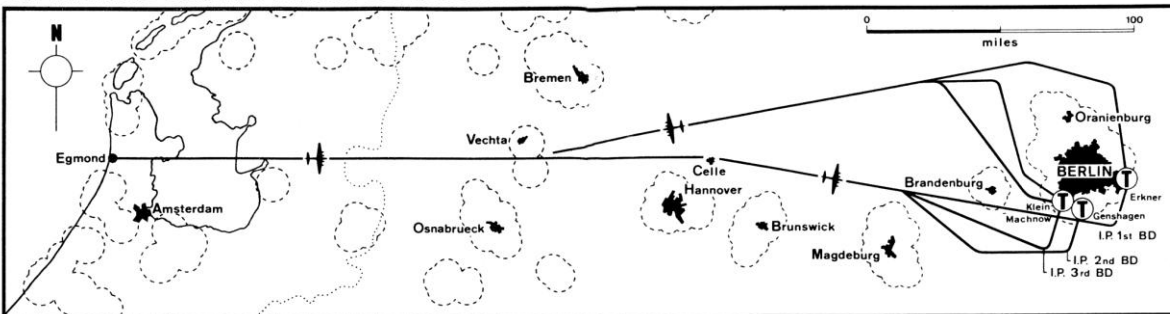
Black Monday

Is attacking, attacking, and coming back and attacking again, in the face of great losses, a wise tactic in wartime? The 8th Air Force onslaught began in earnest on “Black Monday,” March 6, 1944, when 814 bombers and 943 fighters sortied for Berlin. Known as the first daylight raid on Berlin by the Americans, it was technically-speaking, actually the second, as 300-odd bombers had made an attempt to bomb Berlin two days earlier. Up till that time, the March 6th mission constituted the largest combined effort of the war by American forces, and 69 of the 702 bombers that stayed the course that day were shot down, equaling the worst single day losses of the war (the other disastrous

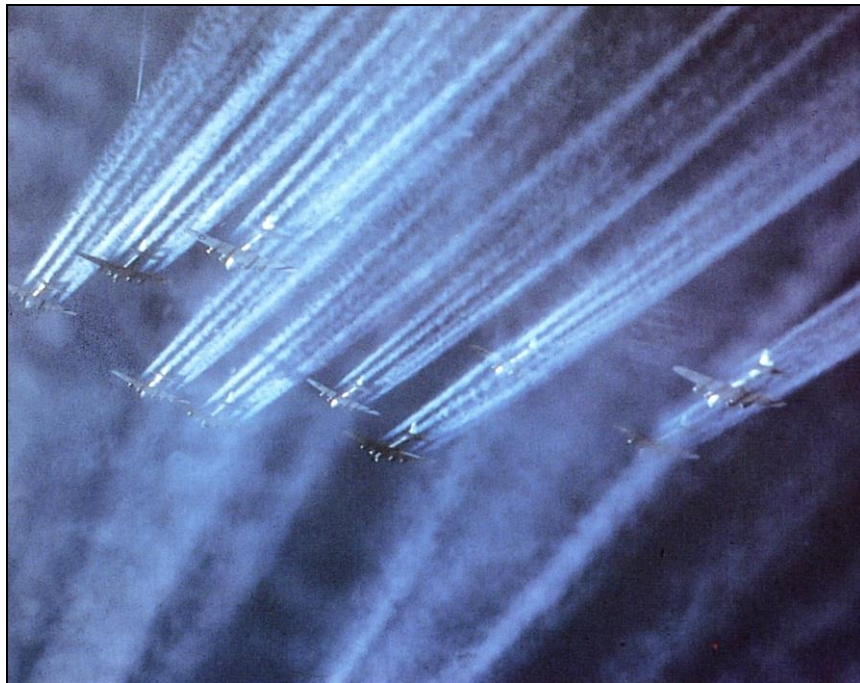
day had been the September 1943 mission to the ball bearing factories near Schweinfurt, Germany). Doolittle put up what came to be known as a maximum effort: every aircraft that was deemed combat ready was asked to fly. The bomber train, comprised of three aerial divisions, stretched out over 93 miles. It took about 45 minutes for the planes to fly over any given point!

As with most of the big missions, a great many things went wrong. The bomber van was divided into three separate armadas, flying in trail of one another. The leading echelon was the First Air

THE PLANNED ROUTE, 6 MARCH 1944, SHOWING THE FLAK ZONES



Map showing the planned route of the March 6, 1944 maximum effort raid against Berlin by the American 8th Air Force. The bomber van was 93 miles long and took 45 minutes to fly over any given locale. The path led due east and sought to avoid heavy concentrations of German flak as much as possible. Unfortunately, the First and Third Air Divisions became separated over the English Channel.



The van of 702 heavy bombers threw an impressive wake of condensation contrails across the skies of western Europe on the March 6th mission, typical of cold wintry days. The contrails were a beacon for marauding Luftwaffe fighters, some of whom flew as many as five defensive sorties that day.

Division, followed by the Third Air Division. The First and Third Divisions were grouped together because they both flew B-17s. They were followed by the entire Second Air Division flying B-24s. The lead navigator in the van of the First Air Division forgot to make the proper correction for crossing head winds, so the entire First Air Division drove deep into Germany on an uncorrected compass heading, gradually drifting south of their intended track.

German radar pickets correctly deduced the *intended flight path of the bombers, heading for Berlin*. They vectored their fighters to intercept the lead elements of the bomber train, but when the fighters rallied at the intercept point, they found empty blue sky. They could not see the wayward bomber van, which by now had drifted 29 miles off course, to the south. They instinctively peered westward, and off in the distance they could barely discern a large formation of incoming bombers, heading east, on the correct heading. The First and Third Air Divisions of B-17s had become detached from one another while flying through clouds over the English Channel. Losing sight of the First Air Division, the lead navigator of the Third Air Division was forced to do his own navigating. He made the necessary corrections for cross wind, so there he was, right where they were supposed to be, but without defensive fighter cover. Mission planners had massed all the defensive fighters over the lead elements of the bomber stream (the First Air Division) assuming that would be where the Germans would concentrate their fighter opposition.

The results of this navigational error were disastrous for the lead echelon of the Second Division, the 100th Bomb Group. That afternoon they became known as the “bloody 100th” Bomb Group, losing 15 of their 16 aircraft. They were ever-after convinced they had been singled out for elimination by



The Square D's of the 100th Bomb Group led the Third Air Division on Mission 250 to Berlin. They were caught without any fighter cover and lost 15 or 16 aircraft, known ever after as “The Bloody 100th”. No 8th Air Force group suffered as dearly during the war.

the Luftwaffe. The impact on the 100th Group's morale was staggering. Hours passed as ground personnel stood by their respective hardstands back in England, waiting for aircraft and crews that never returned. The veteran bomb group from Thorpe Abbots had been eliminated.



Berlin had the largest land area of any city in the world when it was attacked in March 1944. The Luftwaffe deployed every available defensive aircraft in their inventory on the March 6th raid, including night fighters never previously deployed against daylight bombers.



On Black Monday the 8th Air Force was led by the 94th Combat Wing, shown here. They were comprised of the 351st, 401st and 457th Bomb Groups, stationed in the Midlands of Northamptonshire, about 100 miles north of London. None of the primary targets in Berlin were actually bombed that fateful day.

The German fighter attacks and poor weather wreaked chaos on the mission plans; hardly any aircraft dropped bombs on primary targets around Berlin that day. But, the Luftwaffe launched everything imaginable to defend the honor of their capital city. They had 1,024 fighters available for interception, and most of these flew 2 to 5 sorties, making it the biggest defensive effort of the war.

Attrition, by its very nature, seldom seems ominous at first take. The Luftwaffe lost over 160 aircraft, most outgunned by swarms of pursuing American fighters. Late in the day, one of their top fighter commanders was lost over the Dutch border. He was killed by the return fire from the chin turret of a doomed B-17, which exploded shortly after hitting him. Though it was the Luftwaffe ace's 4th bomber kill of the afternoon, it was also his last.

Unrelenting pressure is an effective tactic

Incredulously, when Doolittle faced correspondents that evening he gave it straight: telling everyone we had lost 69 heavy bombers, equaling our greatest single day losses. It was a forthright appraisal, meaning another 700 American airmen were lost. His German counterparts, obliged to propaganda, claimed 118 American bombers and 22 fighters downed. For the men who flew it, it quickly became known as Black Monday, the beginning of what history would term the Big Week in the aerial war over Europe, a campaign of attrition that would cost nearly a quarter million airman casualties over Europe, 26,000 of those being Americans who paid the supreme price.



The Americans lost 400 bomber and fighter aircraft during the Big Week in early March 1944. This view shows the aircraft of Lt. John C. Morgan, who had been awarded the Medal of Honor for valor in a previous mission in July 1943, going down over Berlin on March 6th, when the Americans lost 69 heavy bombers. Morgan bailed out and was the first Medal of Honor recipient to be captured by the Germans. He survived the war in a POW camp.

To his airmen's horror, Doolittle ordered the entire 8th Air Force back to Berlin two days later, on the 8th, then, incredibly, again on the 9th. Yet another mission to Berlin followed on the 22nd. On these second, third and fourth trips to Berlin clouds did not obscure the city, and most of the intended ground targets were at least damaged. During the month of March 1944 the U.S. 8th and 15th Air Forces mounted 18 such combined attacks deep into the German heartland. Although we lost just over 400 bombers and fighters, these losses were replaceable because of the war material and training pipeline coming in from a fully-mobilized United States. American manufacturing capacity was outstripping our adversaries in ever-enlarging numbers.

Luftwaffe defeated by pilot attrition

For the Germans, it was a similar story, but they could not sustain the losses. In March 1944 they lost 357 fighters with another 163 damaged. More importantly, they lost over 300 skilled pilots, all killed in action. These combat-experienced pilots could not be replaced, especially in terms of their valuable experience, which served to erode combat leadership in the air. Between January and June 1944, when the allies landed at Normandy, the German Day Fighter Arm was to lose over 1,000 experienced



The 8th Air Force targeted Axis petroleum, oil and lubricant (POL) facilities with uncanny efficiency between May and September 1944, destroying 96% of production. The Germans couldn't relocate their refineries or power plants below ground because of ventilation requirements.

pilots. The Luftwaffe never recovered from this staggering loss. Unlike our training pipeline, the German training syllabus was hampered by lack of combat-experienced instructors, too little fuel and, therefore, insufficient flight time to train up anything but easy targets for the more well-trained Allied airmen.

Strategic bombardment finally succeeds

After a brief hiatus supporting the Normandy invasion in early June 1944, the thrust of the allied strategic bombing offensive switched to German-controlled petroleum-oil-lubricants industries, focusing in particular on Germany's synthetic oil production plants. With Luftwaffe fighter cover withered away by the costly air battles over the homeland, the results were devastating. In April 1944 the Germans had been able to produce 175,000 tons of aviation fuel. By June this had dropped to 55,000 tons, 35,000 tons in July, 16,000 tons in August, and only 7,000 tons by September. The strategic bombing campaign had finally succeeded, because Luftwaffe opposition had been crushed. This lesson was not lost on anyone who studied the war: defeat enemy air defenses first, then go for strategic war industry essentials, like fuel. But, the converse could be argued as well.

Why the original bombing plan failed

We can learn much from studying the aerial war in Europe. It was a maximum-effort conflict, lasting about three years. Our original plans failed for several reasons: 1) Both sides sought to develop effective counter measures to the other, and if the Germans had not developed so many fronts (Russia, Italy and the Balkans), it is doubtful the American campaign could have succeeded during mid-1944. 2) The successful bombing of the Focke Wulf plant near Marienburg in October 1943 signaled the end of above-ground aircraft production. The Germans smartly moved their critical manufacturing facilities underground, out of lethal range of the American bombers. German fighter production actually *increased* every month of the war, right up to VE Day. 35,000 Messerschmitt 109 and 20,000 Focke Wulf 190 fighters were produced during the war, more than any other aircraft in history. 3) The American introduction of the P-51 Mustang fighter with drop tanks in mid-1944 enabled escort of the long range bombers deep into Germany. Because of their increasing numbers and quality of training, American fighters dominated most situations during the last year of the war, with the exception of German jet interceptors, which were too few to make a difference.

So, how did we win the war over occupied Europe? Instead of bombing aircraft factories to establish air superiority, we accomplished our goals by provoking Luftwaffe fighters to come up and shoot it out with our aircraft, like a duel. The Luftwaffe lost the air war through gun-to-gun air combat. Nobody, on either side, had foreseen such an occurrence. Visit a German classroom today and the message of history they are taught is: *The Americans could sustain losses, which the Germans could not, because Germany was spread over too many fronts.* This is probably a more accurate picture than our students are told. Though not as spectacular as a cavalry charge, attrition works like cancer, slowly draining resources. Wars are won and lost on the basis of several factors: 1) motivation of the

individual participants; 2) quality of training; 3) ability to sustain losses with skilled replacements; 4) production capacity for critical war material; 5) logistic support; and 6) intelligence.

The post war focus of the Germans and the Soviets was on industrial capacity and how to safeguard such critical facilities from nuclear attack, through burial, dispersion and concealment. Small wonder, as they learned these lessons first-hand during the Second World War.



Most American fighters saw little air-to-air combat after September 1944 because the Luftwaffe ran out of pilots and fuel. American fighters were freed up to strafe targets of opportunity on the return legs of escort missions, wreaking havoc with German daylight mobility.

The most crucial aspect of Doolittle's plan was finding a way to draw the Luftwaffe into the sky, so they could be eliminated in air-to-air combat. He was able to accomplish this goal during the first half of 1944 by abandoning the keystone principle of strategic bombardment: bombing political versus strategic targets. By attempting to bomb a prize political target like Berlin, every fighter in the Luftwaffe was ordered into the air to defend the honor of Germany. Men's pride usually plays a larger role than logic, and Germany's leaders felt obliged to defend their capitol. In doing so, they suffered irreplaceable losses.

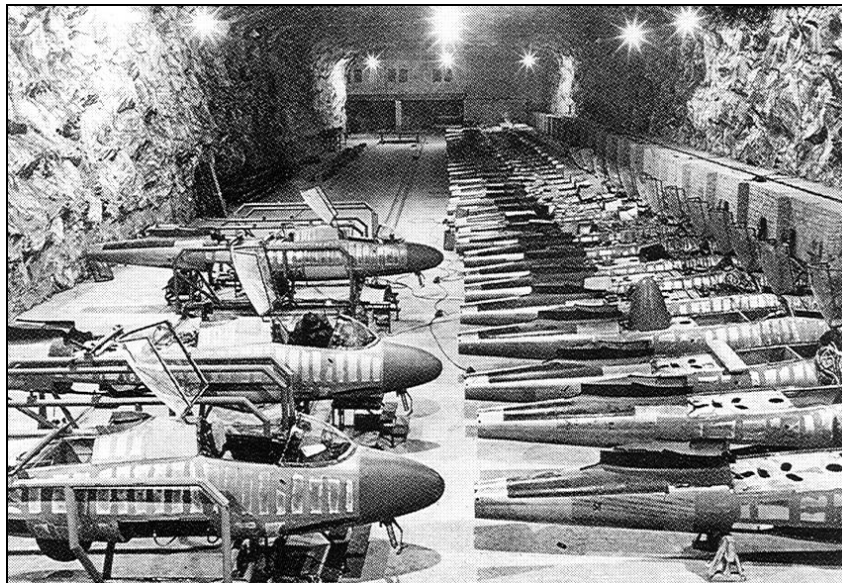
Impact on post-war operations analysis

Operations analysts are taught to neutralize the enemy's defensive air capability before air power can be effectively projected against either tactical or strategic targets. The Americans initially sought to neutralize the enemy air force by bombing its manufacturing facilities (aircraft factories). During the first 250 missions this goal had not been realized. Strategic bombing did not destroy the Luftwaffe; 50-caliber machine guns in air-to-air combat did; something no one had foreseen. Once their defensive apron became less effective, the systematic destruction of vulnerable German fuel resources commenced, with devastating results. By war's end the Luftwaffe had the planes, but was critically short of fuel and experienced pilots. The severe fuel shortages fomented by American bombing between June-September 1944 sealed Germany's fate.

American training pipeline

Of great import to the American cause was the quality of our personnel. Despite all the respect we traditionally pay German militarists, we had better-trained warriors. Why? Because we were able to establish a unique training pipeline in the United States and within the European Theater of Operations (ETO), before our people ever saw their first taste of combat. It's that first taste of battle that is usually most lethal. By early 1945, the Americans were training about 50 times as many aviators as the Germans. The average American aviator had about two full years of training and between 400 and 900 hours of flight time before entering combat, while the average German flier was lucky to receive 50 hours.

The American innovations of Air Training Command, Air Logistics Command and the Combat Tour likely contributed more to our winning the war than any degree of individual heroics. In post-war conflicts the critical import of combat experienced instructors has shown itself, over and over again. In our system of combat tours, one was obliged to return to Training Command, unless they specifically requested a second combat tour. Few did so.



The Germans moved as many war critical industries underground as they could to escape the pounding of Allied around-the-clock bombardment. This shows the He-162 Volksjager (People's Fighter) jet fighters under construction in an old salt mine shortly after the war ended.

Emotions overrule logic

There is much we can still learn from studying the successful employment of the American 8th Air Force. When you get right down to it, people are imperfect. People are especially prone to making poor decisions when they allow emotions to overrule logic. The Germans should not have

committed their entire Air Force to defending a militarily insignificant target such as urban Berlin. But, what warriors among us could sit on the ground while our enemy bombs our capitol? None of us could, we would have done the same thing; we would have tried our hardest to defeat the enemy armada.

The more I've studied the air war over Europe, the greater my admiration for those thousands of young men. My father was part of it, a B-17 navigator in the 401st Bomb Group of the 94th Combat Wing, the echelon that led the 8th Air Force that fateful Monday in March 1944. There was no denying it was the galvanizing experience of his life. He never encouraged any of his sons to choose military careers, though we all volunteered to do so. Looking back, I cannot imagine how those young men mustered the courage to get into those planes each day, knowing the odds were against their survival. You had to be an optimist. My Dad said everyone prayed, and he kept on praying the rest of his life, always cognizant of his mortality in a way that my fun-loving generation seldom pondered. I didn't understand or fully appreciate what he had experienced until I went to war and saw the faces of brave men who God called home. Now I am the one who prays and is cognizant of my mortality.



Some of the key American generals responsible for the European air offensive, as seen on April 11, 1944 at Debden, England. From left: BGES Jesse Auton (CO 65th Fighter Wing), GEN Dwight D. Eisenhower (Supreme Allied Commander), LGEN Carl Spaatz (CO of AAF Strategic Air Forces), LGEN James H. Doolittle (CO of 8th Air Force), MGEN William Kepner (CO of 8th Fighter Command) and COL Don Blakeslee (CO 4th Fighter Group). Doolittle had just been awarded his third star on March 13th.

Sustainable losses

It is interesting to note that history has been kind to General Eaker, even though his daylight strategic bombing doctrine was unable to accomplish its goals until the last year of the war, after he left to take command of Allied Air Forces in the Mediterranean. In a most unusual post-script to history, Eaker and Doolittle were both awarded the 4th stars of Air Force generalship in 1985, 40 years later.

It was a belated recognition of their contributions and influence upon their service, as compared with other 4-star generals during that interim. Just how many losses are “too many” depends on the available assets one has at their disposal, and political support from the home front. When Eaker was transferred in January 1944, the 8th had lost 882 heavy bombers over Europe. That was an average rate of 3.9 percent of those aircraft which sortied during the previous 18 months. During Doolittle’s first six months, we lost 1,935 bombers, but this figure only represented about 2.5% of those engaged. By war’s end Doolittle would lose another 2,528 bombers, but rate of loss dropped to less than 1% during the last five months of the war. By that time, the Luftwaffe was almost gone and the training and production pipelines streaming in from the States were overwhelming the Germans with enormous armadas of aircraft.

Role of air power in defeat of Germany

The 8th Air Force raided Berlin for the last time on 18 March 1945, using 1,327 heavy bombers. Although the Luftwaffe launched 50 Me-262 jets against them, American air superiority was absolute, and only eight bombers were lost in these attacks. Flak accounted for 16 more bombers, and damaged 16 others, which were forced to land in Russian-held territory. On April 16th the Air Corps’ high command decreed that there were no more strategic targets worth bombing, and the air war shifted to tactical support of the ground armies. The 8th Air Force performed its last raid of the war on April 15th, bombing the Skoda munitions plant in Pilsen, Czechoslovakia.

Did air power overwhelm Germany and bring about a quicker end to the war? The staggering loss of petroleum refining and power generating capacity confirms that American strategic bombardment succeeded in eliminating the Luftwaffe as a potent force and severely crippled Axis mobility. But, that wasn’t until the summer of 1944, after the Normandy invasion. The bombing failed to neutralize Axis material production because the Germans moved most of their essential manufacturing facilities underground or further east, where they could not be molested by Allied bombing.

We should always expect a shrewd and determined adversary will quickly develop effective countermeasures, negating the intended effectiveness of whatever plan of destruction is initially envisioned. The Maginot Line should tell us that. Radar-derived height finding, altimeter-set projectiles and proximity fuses on flak rounds were just a few of the technical innovations developed by the Germans that were never foreseen by American proponents of strategic bombardment in 1941.

Innovation essential to ever-shifting needs

It is the innovators, officers like Curtis LeMay and Jimmy Doolittle, who win wars. Their stars seldom shine in a peacetime environment. Neither was an imposing physical figure, yet genius is about the only word one could use to describe them. Like so many of their predecessors in wars long forgotten, these men tasted the sting of battle firsthand, and were motivated to develop effective tactics and counter-tactics. You have to throw out the manuals in wartime and find people with the guts to take risks. Innovation involves risk. My father always said that “*we were lucky to have a guy like Jimmy Doolittle on our side.*” It is doubtful we would allow a reserve officer similar latitude in command responsibility today.



J. David Rogers received his B.S. in geology and geophysics from the California State Polytechnic University in 1976 and master's (1979) and doctorate (1982) degrees in civil engineering from the University of California, Berkeley. He served on the faculty of the Department of Civil and Environmental Engineering at Berkeley between 1994-2001. He gave this lecture in May 1995 to the AFROTC cadets on the 50th anniversary of the American victory in Europe. Rogers is a former naval intelligence officer and operations analyst, who flew 4-engine patrol bombers during the Cold War, hunting submarines. Rogers enjoys interviewing veteran aviators of varied backgrounds and experience, including Jimmy Doolittle. He presently holds the Karl F. Hasselmann Chair in Geological Engineering at the University of Missouri-Rolla.



Jimmy Doolittle was a student in Berkeley's School of Mines when he enlisted in the Army Signal Corps to become a pilot in April 1917, when America entered the First World War. Doolittle returned to Berkeley after the war and completed his bachelor's degree in mining engineering in 1922. He went on to earn his doctorate in aeronautical engineering from MIT in 1925, becoming the Army's first general officer to hold a doctorate degree when promoted to brigadier general in June 1942 (skipping the rank of Colonel) . In 1943 he was recognized by Berkeley as their first Alumnus of the Year. In 1985, President Reagan awarded a fourth star to Doolittle and Ira C. Eaker at a special White House ceremony honoring the pioneering accomplishments of the two men that led the largest combat air corps ever assembled.



Rogers' father, LT Dallas K. Rogers II, was a B-17 navigator with the 401st Bomb Group in the 94th Combat Wing, which led Mission 250 to Berlin on March 6, 1944. Despite the horrific losses of the Black Monday mission, Rogers' father thought that “Jimmy Doolittle was the greatest pilot who ever flew an airplane.” A graduate of Ball State University (1942), he used the GI Bill to attend Case Western Reserve University during summers, receiving his master's degree in 1950. He taught art in the South Bend, IN public schools before moving to southern California in 1952. He then taught art in public schools and universities in the Los Angeles area until retiring in 1990. He passed away in August 1995.