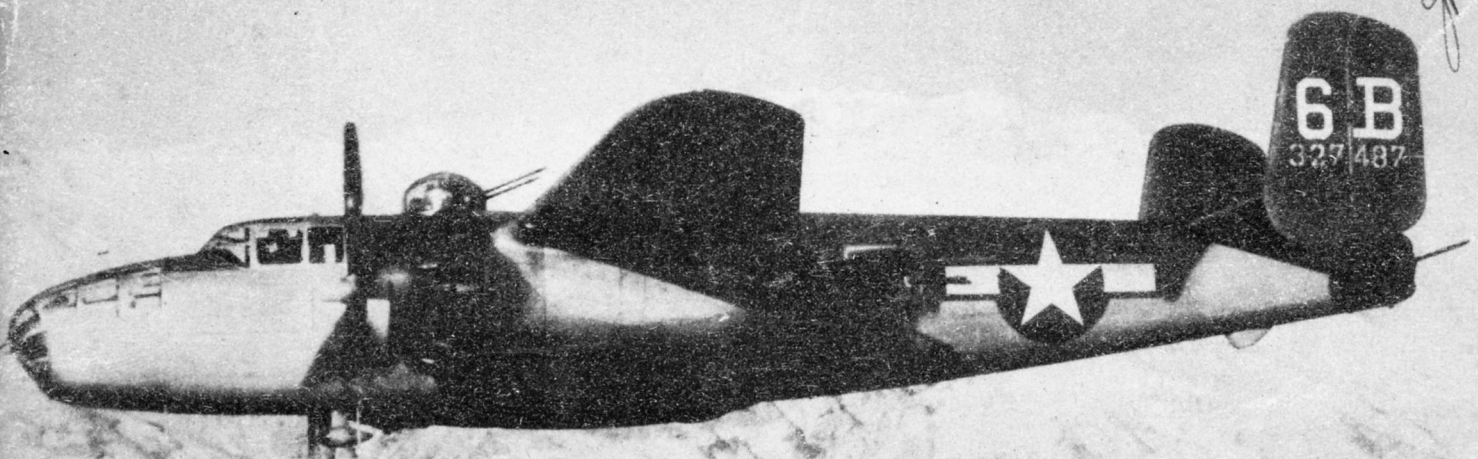


Battle of the Brenner

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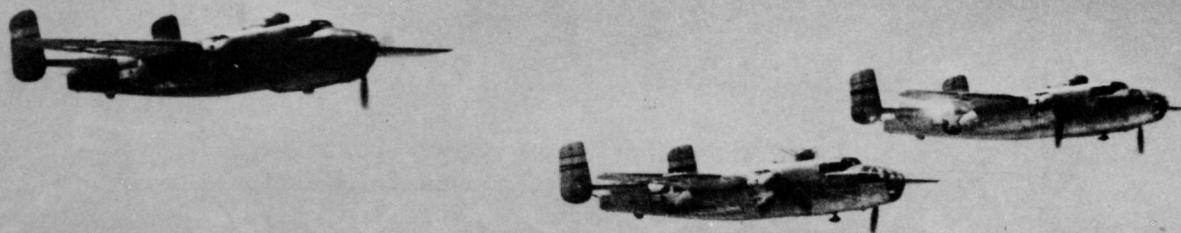


P R E F A C E

In the six-month period preceding the cessation of hostilities on 2 May 1945, the Air Forces carried out a powerful attack on the enemy's lines of communication. This co-ordinated attack centered on the Verona-Innsbruck or Brenner pass rail line and was carried out by 57 Bomb Wing and 22 Tactical Air Command of the 12 Air Force and the 15 Air Force. This is the history of the part played by medium bombardment aircraft, B-25s of the 57 Bomb Wing, in the Battle of the Brenner.

The information contained in this report is for the most part based on Intelligence information dating from prior to the German collapse in Italy. In many cases later information derived from German documents and interrogation may add to or amend the material available at the time this report was written.

57 BOMBARDMENT WING (M) -TWELFTH AIR FORCE-



...tical air effort remained available for the application of...
...and the close support of the ground forces. The level...
...as medium bombardment effort was assigned to the tank...
...battlefield. To better weaken and disorganize the...

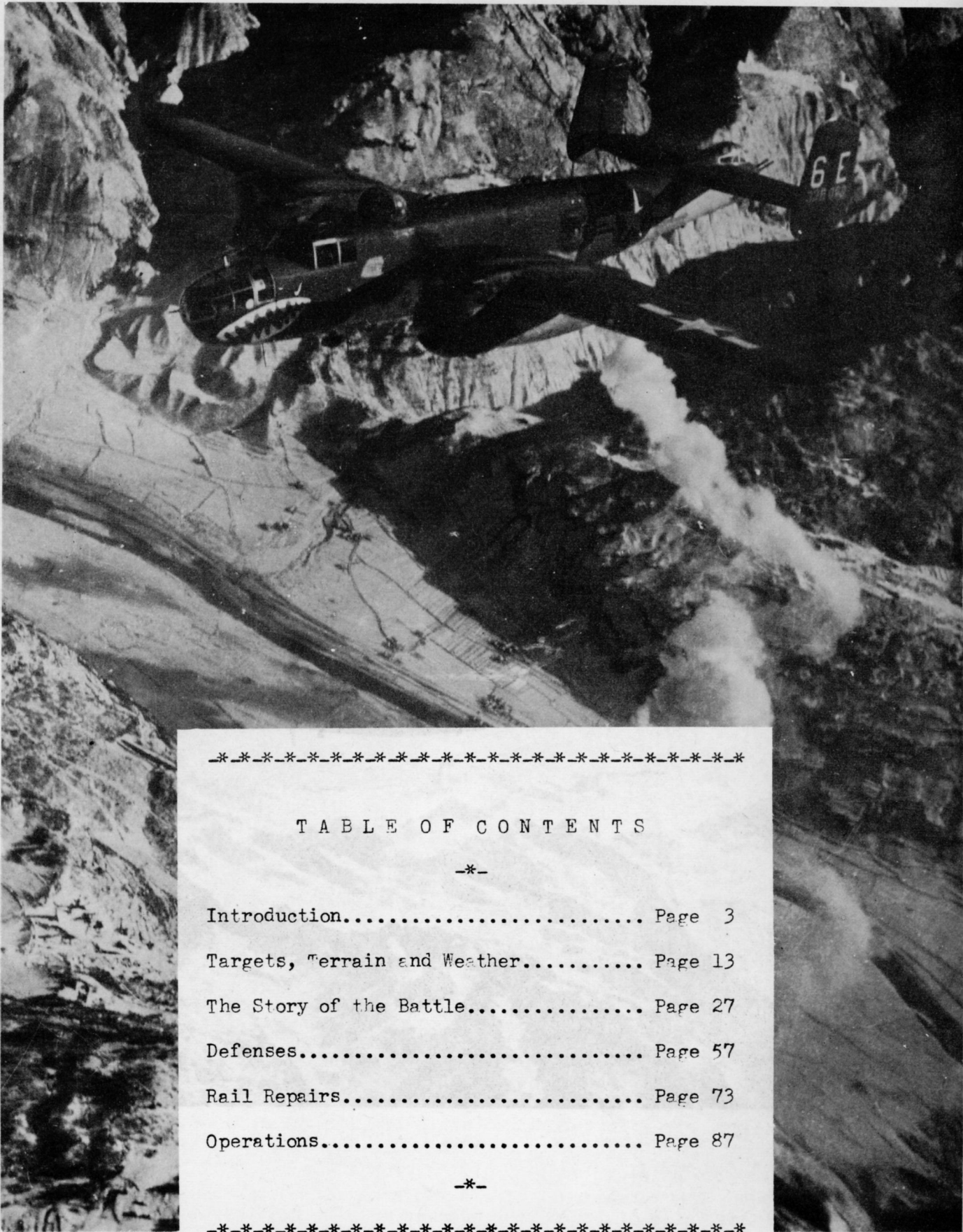
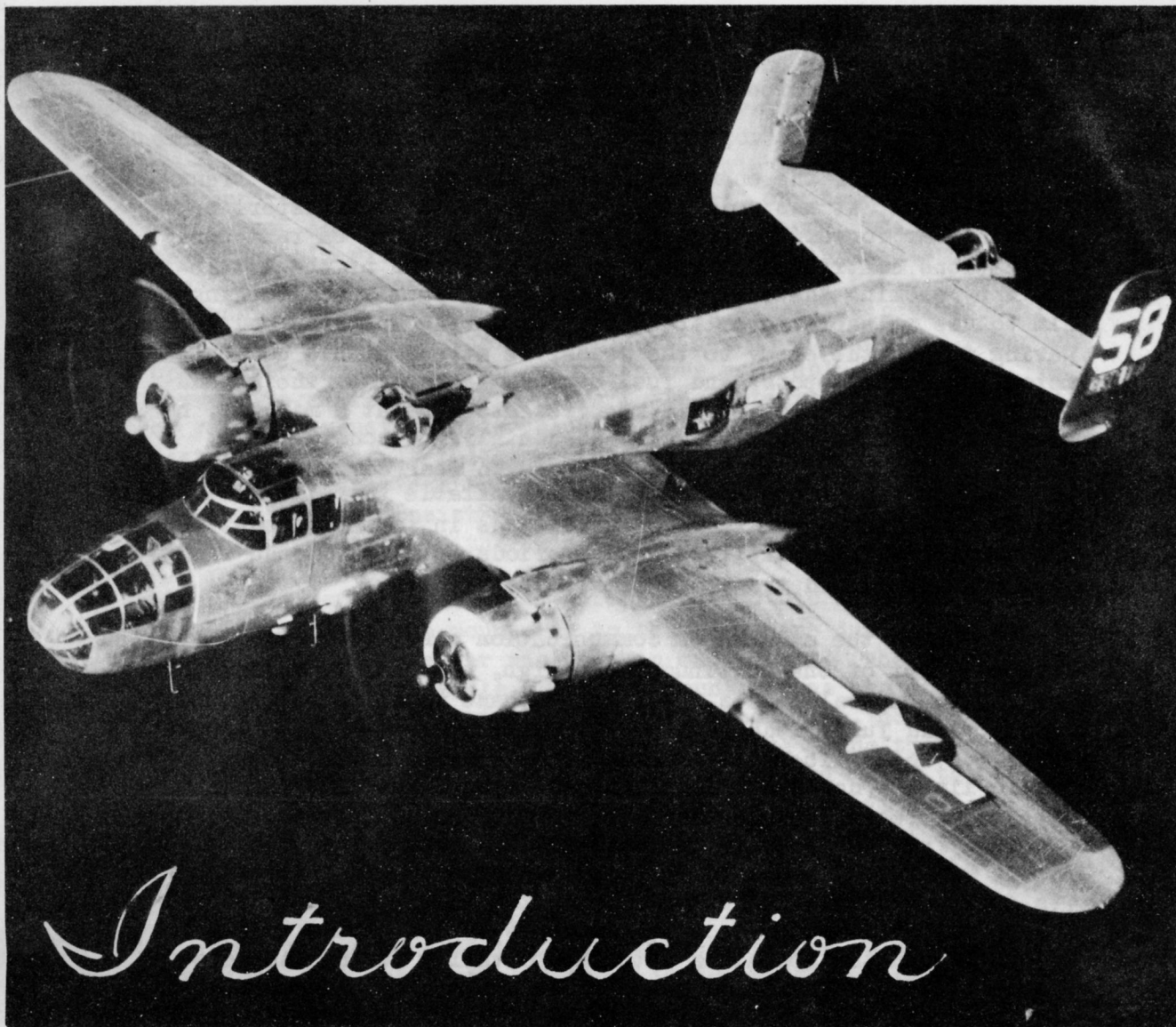


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THE GROUND AND AIR BACKGROUND TO THE
BATTLE OF THE BRENNER

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From early spring of 1944 until the capitulation of the German armies in Italy, and southern Austria, the Mediterranean Allied Tactical Air Force engaged in a continuous campaign against enemy lines of communication. The establishment of air supremacy, the first principle of tactical air doctrine, had been accomplished prior to this time; however fighter bombers and fighters of MATAF struck regularly at any German airfields which showed activity and swept the sky to prevent interference with our own air operations. Thus the overwhelming share of the tactical air effort remained available for the application of the second and third tactical air principles; namely, isolation of the battlefield and the close support of the ground forces. The largest part of the medium bombardment effort was assigned to the task of isolating the battlefield. To batter, weaken and disorganize the enemy

so that he would be unable to resist effectively the attack of the Allied ground forces was the long range policy of this grinding air war.

Because of the enemy's critical shortages of motor transport and fuel, it was well known that he hoped to transport supplies as far forward as possible by rail. Attacks on rail communications contributed largely to the isolation of the battlefield by choking the enemy's main artery of supply and forcing him to use valuable motor transport for moving supplies and troops. Having forced the enemy to the roads, we struck at his convoys, motor parks and depots, and fuel stores. As long as the ground front remained static and his requirements were at a minimum, he was capable of supplying himself adequately. A considerable amount of transport had to be committed to rear communications, but at the same time there was sufficient available to fulfill his requirements for supply and communications in forward areas. With his requirements multiplied during periods of heavy ground fighting, his supply and transport proved insufficient.

Though the attacks on communication since February, 1944, were all part of one continuous campaign, they may be divided into three general phases. The first phase took place between February and July, 1944, and was in support of the Allied ground offensive which liberated Rome and then carried north to the Gothic line. The area of rail interdiction first extended from Rome to Florence, but as the Allied armies moved forward, it was extended farther north to the main Rimini-Bologna-Piacenza railroad. The second phase began in July and continued into October. Its sphere of operation extended over the length and breadth of the Po valley in support of the attempts by the ground forces to break through the Apennines into the Po valley during the late summer of 1944. The third phase of this campaign, in preparation for the final offensive in the spring of 1945, began in the fall of 1944 and continued until the cessation of hostilities in Italy on 2 May, 1945. During the third phase the first priority area of interdiction was limited to northeast Italy, extending from Verona-Padua-Venice area north and east to the Italian frontier.

The air operation "Strangle", leading up to the Rome breakthrough, represented the first phase in the long Italian air war against communications. In this operation our attacks on rail communications multiplied the demands for motor transport in rear areas and resulted in an almost complete collapse of front line mobility and distribution. This phase was extremely successful and comparatively easy to carry out because between Rome and Florence there were only two major rail lines and a half dozen alternate lines to be cut in order to interdict rail traffic completely. In addition, at almost all bridge targets, valleys were steep-sided and rivers were deep, making repairs difficult and the construction of diversions nearly impossible. Lastly, considerable reductions had been made in equipment and personnel devoted to the

maintenance of rail lines.

After the Rome break-through in May-June, 1944, the Allied armies in Italy sped on to the north in pursuit of the weakened German formations. However, because of his shortening supply lines and our rapidly extending supply lines and our need for regrouping, the German commander could afford to give ground, which finally permitted him virtually to break contact. During mid-summer, when our ground forces again moved forward, they found the Germans reorganized and holding a series of good screening positions from south of Florence in the west to near Ancona in the east. Though opposition was sharp, our ground forces were able to push on forward to Florence and to drive to the Metauro river just south of Fano in August. These delaying battles by the Germans were designed to protect the approaches to their Gothic line and to permit the proper completion and manning of its prepared positions. The Gothic line consisted of elaborately prepared fortifications and took advantage of the spine of the Apennine mountains.

The decision to break through the Gothic line and to attempt to break through the mountains to the Po plains during the remaining months of summer weather was made in mid-August. The second phase of the air forces' battle against communications was in support of the Fifth and Eight Armies' efforts to accomplish these objectives. The Eight Army on the east flank was to drive along the narrow Adriatic coastal area, through the mountains and on to the west to reach Rimini and the plains. The operation was designed as a major blow, but simultaneously Fifth Army units were to clear the plains and foothills north of Florence. Then, if the Germans should draw off enough troops in trying to stop the British drive, the Fifth Army was to drive straight through the mountains to Bologna and the plains. The Germans controlled a force superior in number of divisions, but substantially equal in number of troops. Our advantages, pitted against the Germans' superior defensive positions, were air, artillery and armored superiority. The Eight Army attack along the Adriatic coast struck off on 26 August, when British, Canadian, Polish and Indian units crossed the Metauro river south of Fano. The strength of the drive surprised the Germans and our forces drove 15 miles against moderate but stiffening resistance. On 30 August, Polish troops entered Pesaro, but the town was not cleared for another week in some of the hardest fighting since Cassino. These operations, combined with advances further inland, had broken through a 20-mile stretch of the Gothic line from the Adriatic inland. Bitter fighting continued along the Adriatic coast as additional infantry and armor were brought in by the Germans. Our troops inched forward to take Riccione, just five miles south of Rimini, on 11 September. German reserves were brought up in increasingly greater strength, but after three weeks of intense fighting in the hills south of the city, Rimini was taken 21 September.

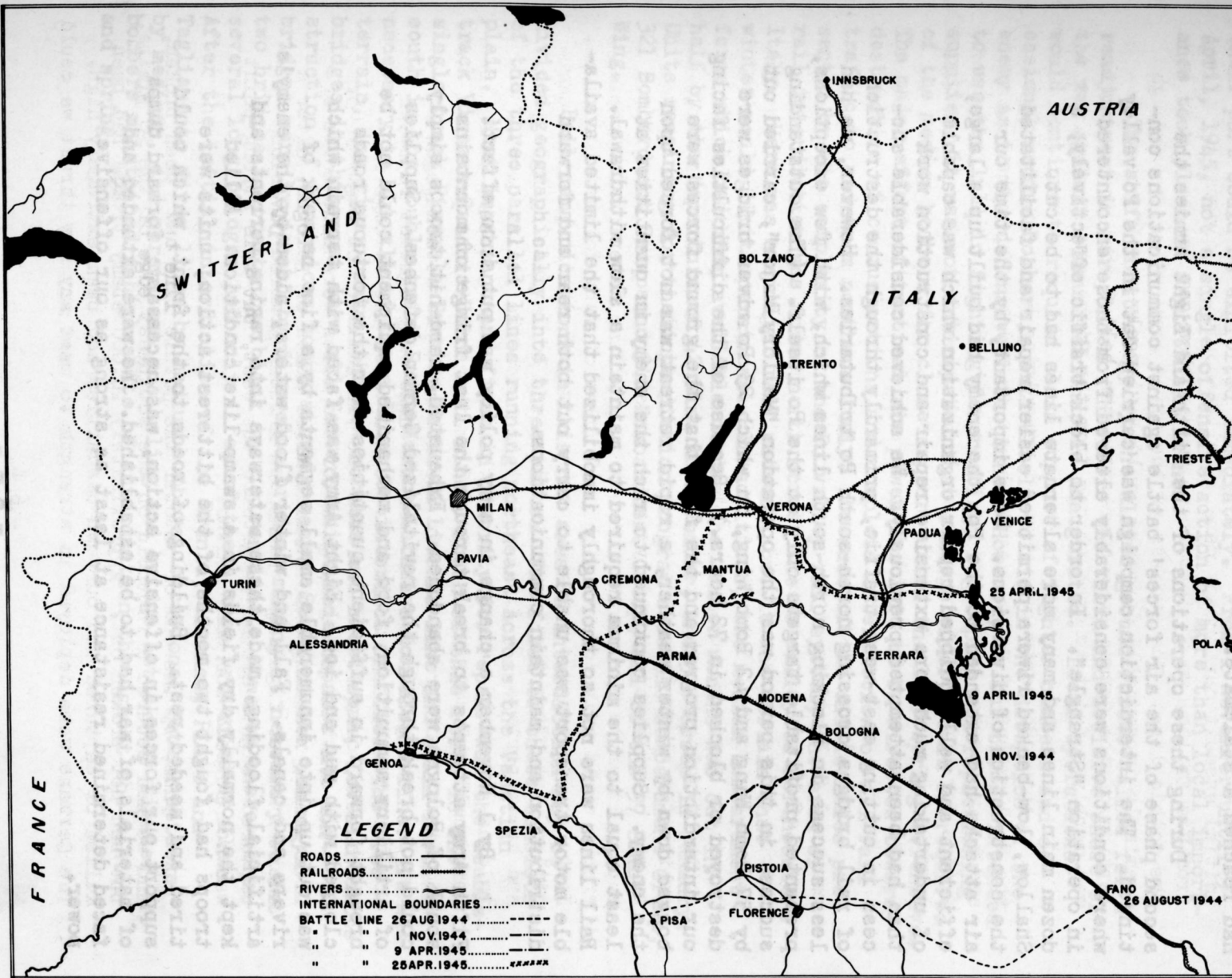
Meanwhile, Fifth Army met only rearguard resistance in the west as Pisa fell on 2 September with Lucca, Pistoia and Prato following in

rapid succession. By mid-September Fifth Army troops had contacted outposts of the Gothic line at many points above Florence. Infantry divisions of II Corps with British troops on the right flank began all-out attacks up the Florence-Bologna, Prato-Bologna and Florence-Forli axes on 13 September. During a week of extremely bitter fighting, mountain positions east of Firenzuola and Futa pass were successively overcome. Before the Germans could recover from the initial assault our troops were 15 miles south of Bologna, 12 miles from Via Emilia, on 23 September, and another gap had been made in the Gothic line. The success of the Fifth Army offensive through seemingly impregnable defenses could be largely attributed to deception of the German commanders into the belief that the operation was merely a feint to draw troops from the Eight Army sector.

About 26 September, Marshal Kesselring began to appreciate the full extent of Fifth Army's threat to Bologna from the south, and to re-dispose his divisions to stop the drive. The bunching of troops for the defense of Bologna built up rapidly after our initial surprise break-through of the Gothic line. At least 10 German divisions were concentrated in this area toward the end of October.

All along the II Corps and XIII Corps fronts gains were measured in hundreds of yards as mountain after mountain became the scene of bloody hand-to-hand fighting. By the second week in October heavy rains and chilling weather brought mud and discomfort comparable to the winter conditions of the previous winter before Cassino. However, our troops edged forward to a point 10 miles south of Bologna. This key city was visible from mountain top OPs on the few clear days, but the remaining mountain positions were by now heavily garrisoned by crack German troops with good, short supply lines to the rear. Our own supply line deteriorated rapidly. Trucks could only come to within 10 miles of many forward positions. Jeeps could struggle forward another five miles with precious ammunition, but often the last five miles had to be made by mule pack and human portage. A final effort to reach the plains between Bologna and Imola was made by Fifth Army in mid-October, but gains were small and costly. Supply and weather conditions prevented close coordination of ground and air operations. The attack began 15 October, but gains were hard won and held only against repeated counter-attacks. By 21 October we had taken the village of Frassineto, only five miles from the Via Emilia. On highway 65, directly south of Bologna, gains of two miles were made north of Livergnano, reaching a point nine miles south of Bologna, after a week of bitter fighting. The South African Armored Division captured heights around Vergato to the west, but this strong point was not to fall for many months.

Thus, by the end of October the Gothic line had been broken, and we had secured a foothold on the southeast edge of the Po plains, but had not broken out. Approximately 20,000 enemy troops had been killed or captured and our own casualties had been extremely high. The Germans were deployed in strength to meet any new thrust we could



INNSBRUCK

AUSTRIA

SWITZERLAND

ITALY

BOLZANO

BELLUNO

TRENTO

TRIESTE

MILAN

VERONA

VENICE

TURIN

PAVIA

CREMONA

MANTUA

25 APRIL 1945

ALESSANDRIA

PARMA

FERRARA

POLA

MODENA

9 APRIL 1945

BOLOGNA

1 NOV. 1944

GENOA

SPEZIA

PISTOIA

FLORENCE

PISA

FANO 26 AUGUST 1944

FRANCE

make and, despite our air program, were adequately supplied. Worst of all, the rain, mud and cold of the Italian winter had engulfed the front to make the soldier's life miserable and very nearly to paralyze the movement of supplies and mechanized equipment to and at the fronts. It became apparent that the battle of the Apennines had reached a stalemate.

During these operations of the Fifth and Eight Armies the second phase of the air forces' battle against communications continued. The interdiction campaign was carried out in the Po valley where conditions were considerably altered from those encountered in operation "Strangle". In order to block traffic effectively, a dozen main lines and many more alternate lines had to be cut. Shallow, low-banked rivers permitted easier repair and facilitated the construction of diversions. More important, by the time our air attacks had extended to the Po, the enemy had built up a large, efficient and well-equipped repair organization which was capable of undertaking much more extensive repair and construction work than had been attempted previously. We achieved considerable success in cutting east-west traffic, primarily through the destruction of rail bridges crossing north-south Po tributaries. However, we had less success in blocking north-south lines which, with few exceptions, presented profitable targets only at the Po itself. (The outstanding success in this period was the operation "Mallory Major", carried out by 57 Bomb Wing and 42 Bomb Wing, in which 23 Po river bridges were destroyed or blocked in 72 hours.) Because of the difficulties facing our interdiction program and the fact that the ground forces were bogged down by winter weather, a rapid retreat was not forced upon the enemy. Supplies continued to reach the enemy in quantities at least equal to the minimum required to maintain a slow withdrawal. Rail lines were not so thoroughly immobilized that the limited available motor transport was unable to carry out both rear and forward distribution and maintain communications.

By 1 November a change in army policy was put into effect. Fifth Army attempts to break through the last fringe of mountains south of Bologna were abandoned. Exhausted, hard-hit troops simply could not break through the revitalized German defenses. Supplies of artillery ammunition, food and mechanized equipment could not be brought forward in sufficient quantities over the tortuous roads clogged with mud and ice. Eight Army was faced with terrain which was cut up into innumerable small segments by a fine network of rivers and canals. Fall and winter flood waters, aided by the enemy's artificial flooding, made these waterways into raging torrents and kept the normally dry fields in a swamp-like condition. Allied troops had fought two months of the bitterest action; units were tired and needed rest. Building of roads to the front, which could support our forces in offensive action, was necessary; forward dumps of materials of war had to be established. We were extended and faced determined resistance at least as strong as our offensive power.

Clearly, conditions required a considerable period of time for recuperation and regrouping of troops. Accordingly, large scale offensive intentions were abandoned until the spring of 1945. Army tactics changed over to an aggressive defensive, designed to conceal our essentially defensive intentions from the enemy, but to keep enough pressure on the Germans so that any weakness or withdrawal on their part could be exploited immediately. From 1 November until 9 April, 1945, not a single offensive action of more than local importance took place on the Italian front.

The shift in strategy by the Allied ground forces called for a readjustment in air plans. Therefore the third and decisive phase of the war against communications was inaugurated. Local operations would continue to require close support of fighter bombers and occasional medium bombers, particularly to aid in the deception of the enemy as to our defensive intentions. However, as our troops intended to use the lull in fighting for resting, regrouping and replenishing supplies, it was not anticipated that a large effort would be required of the medium bombers for close support until the 1945 spring offensive. The major effort of tactical air power was left to be directed toward destruction of communications and complete interdiction of all rail traffic to and from northern Italy. Because of the difficulties presented by the complexity of the Po valley rail system, the area of rail interdiction was moved north across the Po valley to northeastern Italy. Here was a similar rail network, but it was certain that winter would limit operations. In addition, the medium bombardment force which had been available during the summer months was cut in half by the departure of 42 Wing in November, and 319 Group in January. Units remaining for the interdiction program were 310 Bombardment Group, 321 Bombardment Group and 340 Bombardment Group, all of the 57 Bomb Wing.

Rail communications in this new area of interdiction may be divided geographically into three parts. The first of these consists of the three parallel lines running northeast across the Venetian plain. Most important and first in priority for repair was the double-track Vicenza-Casarsa-Udine rail line. South of this route is the single-track Piazzola-Treviso-Motta di Livenza line and still further south is the double track Padua-Mestre-Latisana-Monfalcone line. It was necessary to cut all of these lines to interdict traffic. The flat terrain, low river banks, shallow streams and short-span, low-silhouette bridges in this area were all factors which made repairs and construction of diversions comparatively easy. Seven of the ten major bridges were by-passed by diversion bridges making it necessary to cut two bridges to create one block in a given line. However there were several long bridges and only a few of these were protected by flak. After the initial interdiction of the Brenta, Livenza, Piave and Tagliamento river lines by medium bombers, occasional return attacks by mediums, and persistent postholing and bridge attacks by fighter bombers maintained a high state of interdiction throughout the winter and spring.



The second geographical part of rail communication is the northeastern frontier which includes three of the four frontier routes which were available to the enemy. In order of importance these routes were the Tarvisio, the Postumia and the Piedicolle. Attacks were extended to this zone, northeast of the Venetian plain, in December in an effort to cut the enemy rail lines at points where repairs and construction of diversions would be most difficult. Though terrain imposed moderate difficulties, there were several high, long-span bridges on each line. Because of this and outstanding bombing results, a very high level of interdiction was achieved and maintained. On 27 December, 1944, the 120-foot-high Borovnica rail viaduct on the Postumia route was attacked by bombers of 57 Bomb Wing and one span was destroyed. Although construction of a long, difficult diversion was begun shortly thereafter and work progressed steadily, it had not been completed when the line was over-run by Tito's forces in April, 1945. The Piedicolle route was blocked by B-25s with the destruction of a single span of the Canale d'Isonzo bridge, ten miles north of Gorizia, on 31 December. The bridge was passable for a few days late in January and early in February. This bridge, as well as the bridge at Dogna, five miles northeast, which was also out in February, remained impassable until the cessation of hostilities.

The third geographical part of the rail communications involved in the third phase of the air war was the Brenner pass line. Its northern terminus is at Innsbruck, Austria, and the line runs south through the Alps to Verona, ten miles east of the southern tip of Lake Garda. Three rail lines funneled supplies, equipment and troops from the north into Innsbruck for passage over the Brenner route into Italy. The most important of the three feeder routes was the double-track line from the northeast, running along the Inn river from Munich and Rosenheim. The second passed south through the mountains from Munich and the third ran east from Lake Constance. All three of these lines were fed in turn by the complex Austrian and south German rail systems. At Verona, the southern terminus of the route, rail lines fanned out east, west and south into the Po valley. The main lateral line ran west to Milan and Turin and east to Vicenza. Three single-track lines ran south to the Po and the battlefields beyond.

The electrified, double-track Brenner line was the most direct route from Germany into Italy and, even when operating at a fraction of normal capacity, it was capable of supplying fully the needs of the German armies in Italy. At the height of its traffic, 72 trains of German troops and supplies passed south over this route each day. Verona, by virtue of its position at the southern terminus of the Brenner line, became the center of the largest concentration of military installations and dumps in Italy. Some 30 factories, ammunition, fuel and general stores dumps, and motor transport depots, all fed by the Brenner line, were located there. Of the routes between Germany and Italy, the Brenner ranked first in importance for transporting troops and supplies into Italy. It ranked first in importance as well for any possible German withdrawal from Italy. It was the enemy's best escape route, the gateway to any possible Austrian redoubt and his best means of transporting troops to other fronts and stolen Italian machinery and food back to the Reich. The Brenner was the key to the enemy's communication system in Italy and its destruction was essential to the Allied armies in Italy.

THE BRENNER RAIL LINE





TARGETS TERRAIN AND WEATHER

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The greatest difficulty confronting B-25 medium bombers in the interdiction of the Brenner rail line was the lack of suitable targets. Guided by past experience it was known that to create lasting breaks in the line it would be necessary to destroy bridges. Long term cuts were essential during winter weather which cancelled operations for days at a time. Damage to marshalling facilities, tunnels, open track, fills and cuts could be repaired quickly and easily. But on the Brenner there were only eight bridges 200 feet or more in length. Bolzano, Ora, San Michele and Lavis were four bridges by-passed by diversions. The fifth bridge, Verona, was so strongly protected with flak that it was not considered profitable to attack. Campodazzo, the sixth, could not be bombed because of terrain difficulties. The remaining two, Bressanone and Vipiteno bridges, after the first successful strikes, were defended by large concentrations of heavy flak guns, making them uneconomical targets.

This lack of long, vulnerable bridges forced attention to small bridges, some only 40 to 60 feet long. Targets of this size demanded the most accurate pin-point bombing and their low, short-span construction facilitated repairs or building of by-passes. Fills were attacked and marshalling yards bombed when the more important yards were clogged with backed-up rolling stock. Some small effort was directed against landslides, tunnel-mouths and cuts with unsatisfactory results the rule. Excellent results were achieved against three transformer stations.

In the six months of operations, B-25s of 57 Bomb Wing attacked 70 different rail targets on the 168 miles of track between Verona and Innsbruck. A total of 370 individual attacks were carried out. The following chart shows the scale of effort on the several types of targets:

<u>Type target</u>	<u>No. targets attacked of this type</u>	<u>Total No. attacks on this type target</u>	<u>Sorties</u>	<u>Tons Dropped</u>
Bridge	30	250	4843	7110
Fill	20	75	1254	2084
Marshalling yards	10	21	384	560
Transformer station	3	5	102	183
Possible landslide	3	8	159	176
Tunnel mouth	3	10	88	137
Cut	1	1	9	17
	<u>70</u>	<u>370</u>	<u>6839</u>	<u>10267</u>

In addition to the scarcity of good medium bombardment targets, other factors made interdiction particularly difficult. The rugged mountainous terrain imposed burdens upon aircraft and the combat crews by forcing them to fly at 13,000, 14,000 and even 15,000 feet to reach their objectives. Many targets were nestled against hillsides in deep, V-shaped valleys, complicating the task of the pilot-navigator-bombardier team. Many times the target was visible for only three or four miles from the bomb release point, making it essential that the aircraft come in on the bomb run exactly on course. In the few seconds available to him, the bombardier had to pick up the small, shadow-covered target, make all necessary corrections and release bombs. Approach photographs proved of great value in such operations. (K-8A-B cameras were installed in the nose of several aircraft and oblique photographs were taken at intervals along the bomb run. On later missions to the same target the bombardier could study the series of pictures. He would then be able to make an accurate bomb run, even though the target were hidden, by synchronizing on a higher, visible point.) The terrain surrounding some targets permitted only one axis of attack. Almost all approaches to the Rovereto, Ala and Calliano bridges, for example, were made on an axis of between 285 and 305 degrees magnetic heading.



Hidden by steep mountains several targets were not visible on the bomb run. In the photo above, taken by a K-8A-B camera mounted in the nose of a B-25, the Calliano bridge has not yet come into view. Its position in the valley is indicated by the white arrow. Approach photos similar to the one above proved of great value to bombardiers in locating difficult targets.

Although the enemy reaction to our bombing will be discussed at greater length in subsequent pages, it should be mentioned here that it was opposed by strong concentrations of flak. About one-third of the 1,400 heavy enemy flak guns in Italy were allocated to the Brenner. Nature also played her part in the form of adverse weather, cancelling some operations and imposing difficulties on others.

The Brenner pass rail line is standard-gauge, electrified and double-tracked throughout its 168 miles. For purposes of discussing targets, the line may be divided into three sections, the lower Brenner from Verona to Trento, the middle Brenner from Trento to Bolzano and the upper Brenner from Bolzano to Innsbruck.

On the lower Brenner section, the line runs from Verona north to Trento along the steep-sided Adige river valley, on the east bank of the river. At points where the heavily wooded Alpine foothills rise abruptly from the river's edge, the rail line runs along fills at the bottom of the steep slopes; where the valley is wider, it often leaves the river and runs in the shadow of the mountains one-half mile distant. At times, within two miles of the line, the hills rise to 4,000 feet above the track level. At Trento a secondary, single-track line branches southeast to join the lateral Udine-Vicenza-Verona line, 40 miles away at Cittadella. This route threatened to be an effective alternate to the lower section, but only a comparatively small effort was required to keep it blocked.

On the lower Brenner, attacks were carried out against 38 individual targets. These included 10 rail bridges, 14 fills, three transformer stations, three possible landslides, two tunnel entrances, and one cut. One hundred and eighty-six, 50 per cent of the total number of 57 Wing's attacks on the Brenner, were carried out against these targets during the entire campaign.

There was only one bridge on the lower Brenner over 135 feet long, the heavily defended bridge at Verona. The 10 remaining bridges crossed small streams feeding into the Adige river, averaged 95 feet in length and, with the exception of the Rovereto and Ala bridges, were squat, strong, masonry structures. The most attacked target on the entire Brenner line was the Rovereto rail bridge, 12 miles south of Trento. A total of 27 attacks were carried out against this target. The original 135-foot parallel-span steel structure was destroyed in December and four replacement bridges were subsequently destroyed. In addition, several times the replacement bridges were damaged or the line blocked. The 120-foot Ala bridge was attacked 24 times and destroyed on seven occasions. Despite the fact that the bridges were extremely short, experience proved, as had been anticipated, that they were more profitable as interdiction targets than as fills or cuts. While these bridges could be replaced in from two to five days, they created longer cuts than the easily repaired fills or marshalling yards.

The lower Brenner offered a large number of fills or embankments, carrying the track over low ground, and 14 of these were attacked. The fills varied from a few hundred feet to several thousand feet in length and in places were 20 to 30 feet high. The best fill targets proved to be those closest to the river, as those at Marco, Dolce, and Ossenigo, where water conditions hindered repair. The greatest weight of bombs fell on the Ossenigo rail fill which was attacked seven times. However, fills continued to be considered as secondary in importance, to be attacked only when the bridge targets were already cut or blocked or when it seemed advisable to forego temporarily attacks on heavily defended bridges.

The essential purpose of attacks on the Brenner was to interdict traffic and not to destroy rolling stock or rail facilities. Supplies coming over the Brenner from Innsbruck were consigned directly to destinations in Italy and no marshalling or break-down of trains was required north of Verona. So attacks on marshalling yards delayed the movement of traffic only so long as it took to repair a single line through the yard. As the enemy always had sufficient rolling stock to carry essential freight, the destruction of the rolling stock itself contributed only in delaying the repair of track. Rail yards were seldom congested but a few precious steam engines and repair facilities were of course, destroyed or damaged. As the battle of the Brenner progressed, and the air front was pushed further north, valuable shipments of equipment and supplies were being isolated between the cuts. This forced the enemy to keep his trains in marshalling yards or disperse them along the track. Some of the yards were quite small and as few as 150 to 300 units of rolling stock filled them to 75 per cent of capacity. When the yards became congested they were attacked both to interdict traffic further and to destroy valuable supplies.

North of San Ambrogio, ten miles northwest of Verona, the rail line passes under a series of 300-foot limestone cliffs. This formation had been weakened through the dissolving by water of a stratum along its base. According to reports of geologists of the Italian railroad association, two dangerous rocks, several hundred cubic meters in volume, were displaced as a result of subsidence and had long been in danger of collapsing onto the railroad below. Temporary steps had already been taken by the Italian government to prevent such an occurrence. B-25s made eight attacks with three different aiming points along this formation in an effort to create a landslide. These attacks enjoyed only fair success, and though the tracks were cratered, only an insignificant amount of rubble was brought down. Attacks on the tunnel at San Ambrogio, just north of the landslide target, were also unsuccessful and the limestone formation appeared too sturdy to be dislocated by 1,000-pound bombs.

North of Trento on the middle Brenner the valley floor widens slightly as the line runs north to Bolzano. The mountains rise steeply from the valley floor and in places, eight to ten miles from the river, tower over 10,000 feet above sea level. In this section of the line, 16 targets were attacked, including nine bridges, five fills and two marshalling yards.

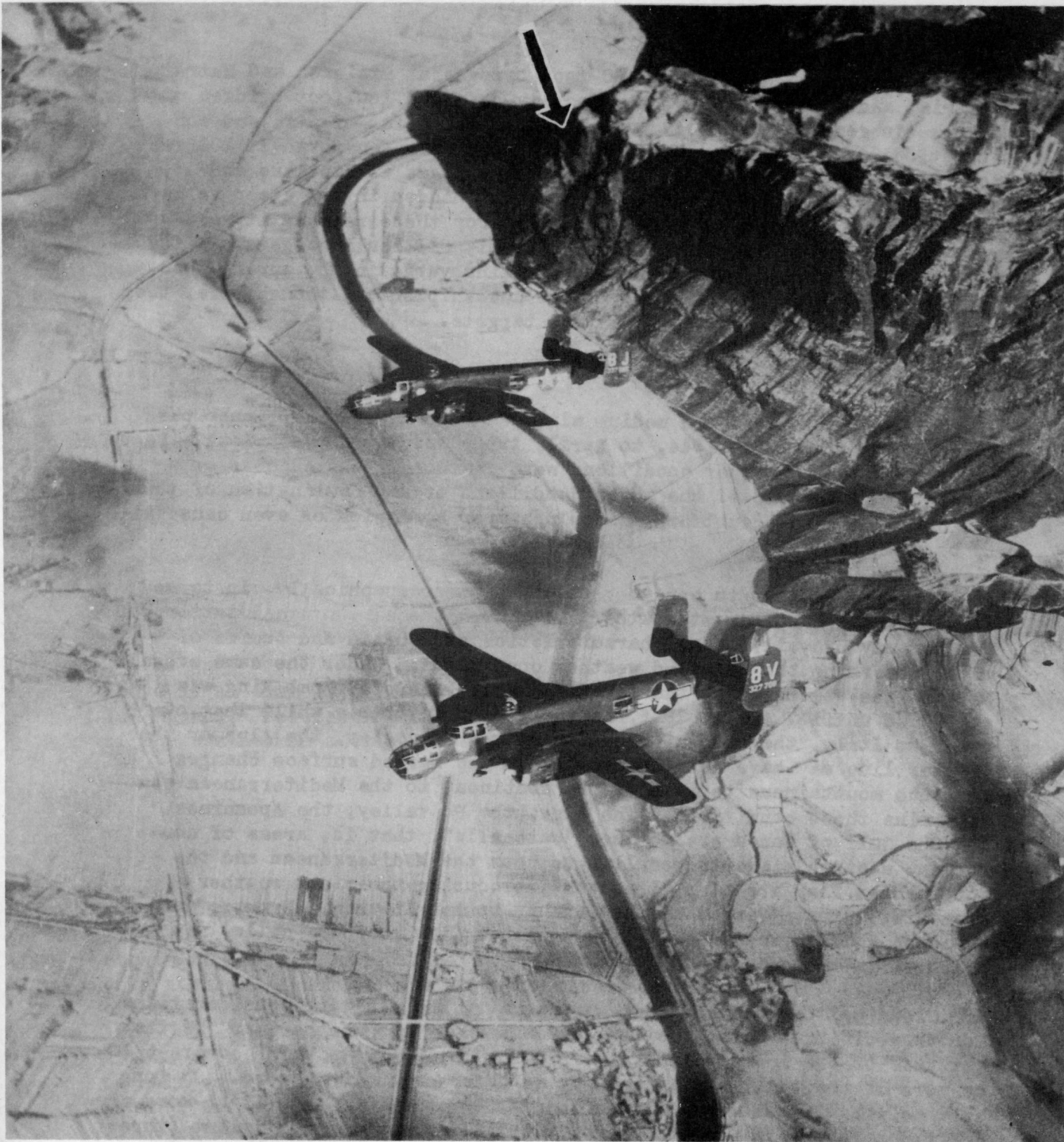
Unlike the lower Brenner, this section offered few small bridges or fills. The greatest problem confronting the interdiction program was the enemy's construction of three diversions. These offered alternate routes for one-half the distance of the main line between Trento and Bolzano. On the main line between the diversions there were no targets of importance making it necessary to block both the main and the main diversion lines.

Five miles north of Trento was the 3,000 foot, 35-span, masonry Lavis viaduct carrying the tracks across the Avisio river. This target was attacked seven times and spans were destroyed on four occasions. The viaduct was by-passed by a two-mile diversion, begun in May 1944. The 90- and 170-foot bridges on the diversion were attacked 21 times, blocked on several occasions and destroyed three times. The viaduct and the diversion had to be destroyed or damaged repeatedly as the enemy made an effort to keep both serviceable. At San Michele All'Adige, eight miles north of Trento, the track crosses to the west bank of the Adige river and proceeds 15 miles further north to Ora where it recrosses to the east bank. Two of the best targets were the 350-foot steel bridges over the Adige at Ora and San Michele. However, both these bridges, as well as several smaller bridges on this section of the main line, were by-passed by the 15-mile Ora-San Michele diversion on the east bank of the river. It was reported that 5,000 men were employed in the construction of the diversion and its completion on 5 December 1944 made it necessary to block both it and the main line. There were only two short bridges on the diversion. A total of 48 attacks were carried out against the diversion, 24 against the 120-foot San Michele diversion bridge and 12 against a short fill at Salorno. The third diversion by-passed a large bridge just south of Bolzano. Because two cuts would have to be made and a heavy flak concentration was in the area, these targets were never attacked.

At Bolzano, approximately half way between Verona and Innsbruck, a single-track electrified line runs northwest to Merano and from there west to its terminus at Malles Venosta. This line was used to disperse trains and several dumps were built up along it but it was not employed for through traffic.

On its difficult passage north to Brenner, the upper Brenner line runs northeast from Bolzano up the narrow Isarco river valley. Crossing the river at several points, the line is closely confined in the narrow valley and passes through numerous tunnels and under avalanche hoods. At Aica, a single-track line branches east, crosses into Austria near Sillian and joins the main line running north from Villach at Spittal. At Brennero the rail line crosses the Alpine watershed, 4,600 feet above sea level, and enters Austria. From here it descends the Sill river valley to Innsbruck, 22 miles north. Tracks of the northern end of the route again pass along a narrow confined valley.

On the upper Brenner the problem of terrain became most acute. Attacking formations had to pick their way through the mountainous areas where the snow-covered peaks reached 12,000 and 13,000 feet above sea level. The targets were practically hidden in the steep shadow-filled valleys and a successful mission required the greatest skill on the part of the combat crews. Forty-three attacks were carried out against 11 bridges, three marshalling yards, two fills and a tunnel. Sixteen of



Shadow often made pin-point targets difficult to pick up. Such a target was the 120-foot San Michele diversion bridge indicated by the arrow in the above photograph. For most hours of the day this small target was all but hidden in the shadow of a nearby outcropping.

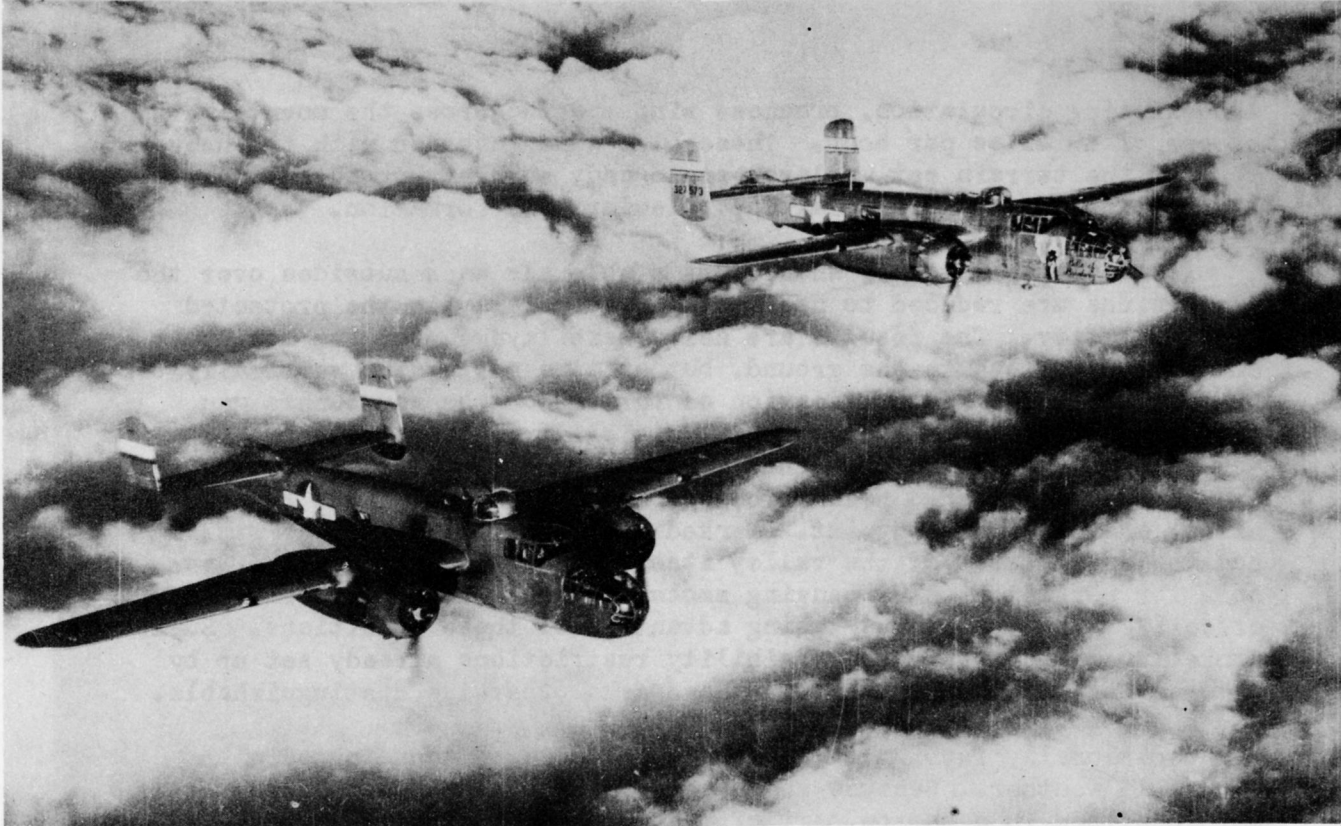
these attacks were against the 90-foot bridges at Steinach and Matrei, Austria, and 12 were against the heavily-defended 150-foot bridges at Campo. In general, the best targets, from the point of size and construction, were on the upper Brenner. There were four bridges 200 feet long and none was by-passed. However the bridges at Vipiteno and Bressanone were the only two which were not hidden in the steep valleys, and both were strongly defended by flak. For these reasons it was again necessary to concentrate on the small, difficult targets. A few attacks were carried out against marshalling yards in the spring when they were being used extensively for trans-shipment, although here, too, bridges were considered the principal targets.

Weather as it affected medium altitude bombing of the Brenner pass targets from November, 1944, to April, 1945, was often precarious. Base, route and target weather conditions were factors in the success of a mission. If any one of the three conditions or any combination of them was unfavorable or doubtful, it could hamper a mission or even cause it to be abortive.

It is convenient to consider the problem geographically, in terms of base, route and target weather. Although the same overall pattern of weather may prevail, local characteristics of terrain and bodies of water determine the detailed weather conditions. Under the same overall pattern the weather over the Corsican bases, where 57 Bomb Wing was stationed until 7 April, 1945, may have been favorable while that over water to Italy, the mountains of Italy, the Po valley, the Alps or the Brenner line may have been unfavorable. The marked surface changes from the mountainous terrain of the continent to the Mediterranean sea determine these conditions. The Alps, the Po valley, the Apennines and the Gulf of Genoa are weather "catchalls", that is, areas of convergent weather elements peculiar to both the Mediterranean and the continent. They are also "breeders", producing their own weather elements. Frontal areas may be made or broken in them. Fronts, anticyclones (high pressure cells) or cyclones (low pressure cells) may stagnate in these areas.

Cloud ceiling and coverage were usually the limiting considerations for take-off from base. Ceiling as defined by the weather man, is the altitude of the lowest cloud layer, below 10,000 feet, which covers 5/10 or more of the total sky as seen by an observer on the ground. So long as a ceiling is not more limited than 3,000 or 4,000 feet, 12 or more aircraft can form with room to spare. Visibility must be sufficient (three miles) to allow single aircraft to see the others while joining. Occasionally strong airport surface winds had to be considered. Even less frequently, the condition of the fields after prolonged rains was a factor.

After joining, the formation needed the same ceiling over the water routes to Italy as was needed at base. In addition, an overcast cloud layer below the levels of the east-west range of the Apennines, south of the Po valley, had to be surmounted either before or just after reaching the coast, so that the formation could safely clear the mountains. Upon



Above is an example of stratified cloud coverage which prevented successful attack. Forecasting the dissipation of this type cloud is the bane of the weatherman's existence.

reaching a safe altitude it was necessary that no cloud layer have a solid top at 13,000 feet or over because fully loaded B-25s begin to strain at these altitudes. Also, personnel without additional oxygen, when at these altitudes for any appreciable length of time, suffer ill effects. On the other hand, the bases of a complete overcast had to be 14,000 feet or over since the Alps range up to 10,000, 12,000 and even 15,000 feet along approaches to targets. Similarly, a formation had to be able to top a cloud layer of 5/10 or more at 12,000 feet. Over a Brenner target it was necessary that cloud cover be not more than 5/10, if it were approximately 5,000 feet below the formation, or 3/10 or less if it were nearer the altitude of the formation.

Weather factors, other than cloud ceiling and coverage, which had the most influence on the success or failure of a mission were severe turbulence and heavy haze. With the passage of a cold or occluded front across the Alpine barrier, winds veer into the northerly quadrant and much dense air is banked up in southern Austria. The pressure gradient thus created between southern Austria and the Po valley, augmented by

the existing circulation, produces wind speeds across the mountains in excess of 40 miles per hour. These high winds coupled with the unevenness of the terrain set up large-scale eddy currents or turbulence, a significant hazard to aircraft, particularly in formation.

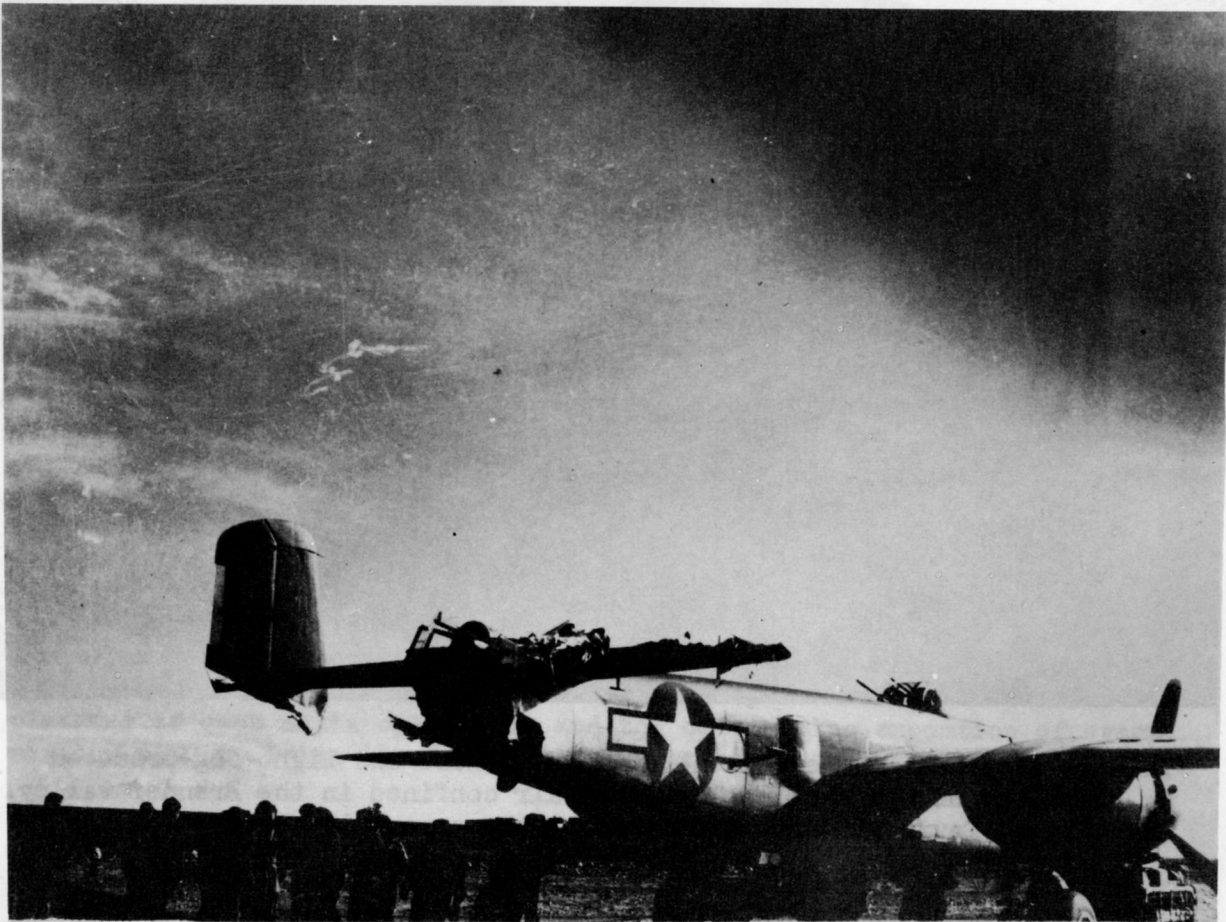
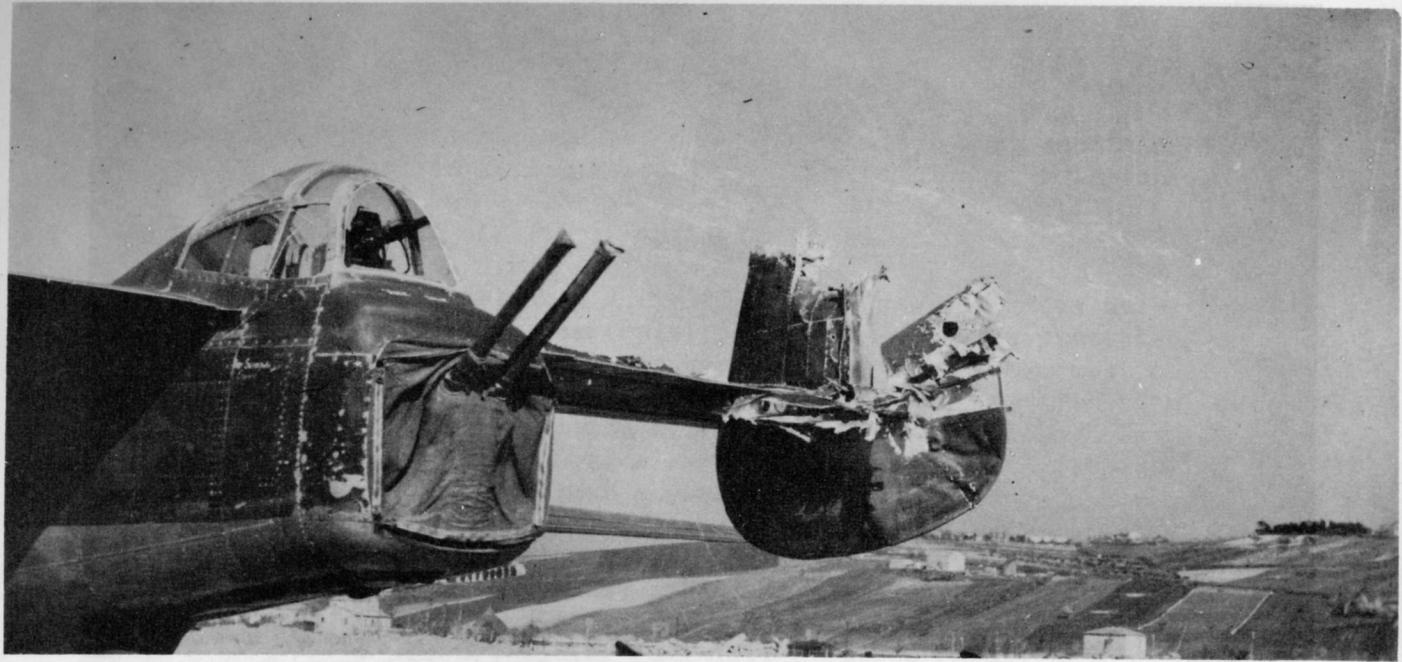
At the other extreme, when a dry stable air mass subsides over the Alps, winds are reduced to near calm, particularly in the protected Brenner valley. The results are heavy haze layers, for the most part concentrated close to the ground, but at times extending vertically to bombing altitude. Identification of targets on the approaches was extremely difficult. Even vertical visibility, aircraft-to-ground, was sometimes so restricted that anywhere from two to four bomb-runs had to be accomplished before the bombardier felt sure that he was aiming at the right pinpoint. Marked stability, light valley winds and the confinement of the valley itself were all particularly favorable for persistent, low-hanging smoke layers. Smoke pots were used effectively by the enemy, taking advantage of these conditions. Such smoke layers increased the visibility restrictions already set up by natural haze and nearly obscured landmarks otherwise distinguishable.

Occasionally favorable sun altitude had to be coordinated with favorable weather. Because some targets lay close to the ledges or were confined in a narrow part of the pass, where mountains rose abruptly on either side, they received direct light from the sun only for a few hours of the day. It was not always possible to coordinate minimum cloud cover with the best sun light. Under operational necessity, when both considerations were critical, favorable weather dictated the time of attack.

57 Bomb Wing inaugurated its attacks on Brenner pass targets on 6 November, 1944. Between that date and 2 May, 1945, when the Brenner was dropped from daily operational directives, there were 118 days when B-25s were able to drop bombs on their targets. On 85, or 72 per cent, of the days when bombing was possible, they dropped successfully. Because of the small targets, natural difficulties of terrain and weather made the interdiction of the Brenner line the most difficult operation of its type undertaken in Italy. Valley haze and smoke screens accompanied by low visibility, difficult weather consisting of clouds and turbulence, and mountainous terrain causing shadow and limited time when targets were visible are the factors to be considered. They demanded most careful planning of each day's operations and the outstanding execution of every mission plan to bring the Battle to a successful conclusion.



This is a typical and excellent example of haze and light fog produced by stability of the shallow layers of air confined in the Brenner valley. The target, Lavis viaduct, indicated by the arrow, is obscured.



The above picture shows the flak-damaged tail of a B-25. Below is shown a similar result from turbulent air which caused two planes, flying in a tight formation, to collide. This one was brought home safely despite its damaged tail chewed by the propellor of another Mitchell, which failed to return.

