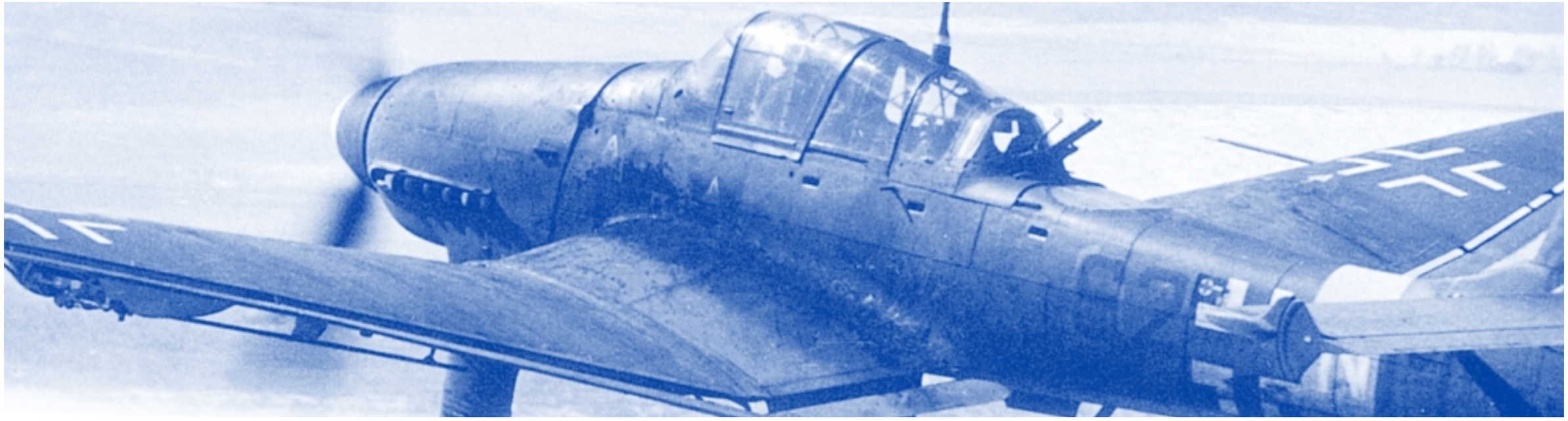
The RISE AND DEMISE of the STUKA

By Dr Alfred Price



With its angular outline and screaming siren, on our TV screens the steep-diving Junkers Ju 87 *Stuka* has come to epitomise the fast-moving hard-hitting “Blitzkrieg” tactics employed so successfully by German forces early in World War II. With a front-line strength that never exceeded 350 aircraft, during that period the *Stuka* units had an impact on military operations that went far beyond their modest numbers. This article examines the ingredients of this aircraft's success, and the countermeasures that brought an end to its run of successes.

Until the advent of guided weapons, the steep diving attack was the most accurate method for delivering bombs on a defended target. As the well-informed readers of this journal are fully aware, a small load of high explosive delivered accurately will have a far greater military effect than many times that weight of explosives delivered inaccurately. For the first two years of the Second World War, usually operating under conditions of air supremacy, the *Stuka* units were the only force on either side that could deliver accurate bombing attacks on pin-point targets. Therein lay the basis of the Junkers 87’s formidable reputation.

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The word *Stuka* is a contraction of the German word *Sturzkampfflugzeug*, “dive-bomber”. Strictly speaking that term refers to all aircraft capable of performing the role and not merely to a particular type. Yet by common usage over many years, “Junkers 87” and *Stuka* have become synonymous and they will be treated as such in this account.

The Junkers 87 had been designed without compromise as a steep-diving bomber and everything else was subordinated to that requirement. The B variant, the main production version up to 1941, carried a bomb load of only 500 kg (1,100 pounds). Usually this was made up of one 250 kg weapon mounted under the fuselage and four 50 kg bombs under the wings; alternatively it could carry a single 500 kg bomb under the fuselage. The forward-firing armament comprised two 7.9 mm machine guns. The two-man crew comprised a pilot and a wireless operator/rear gunner with a 7.9 mm machine gun on a flexible mounting.

The fixed spatted undercarriage gave the Ju 87 a decidedly out-dated look, and in horizontal flight its maximum speed was only 206 kts.[1] Yet for its intended role the drag from that fixed undercarriage was an asset for, combined with that from the dive brakes extended under the wings, it made for a stable aiming platform

once the aircraft was established in its 80-degree attack dive.[2] In the dive the speed built up until the machine reached its terminal velocity of around 300 kts. A less draggy aircraft would reach a higher terminal velocity in the dive, forcing the pilot to release the bombs and begin the pull-out much higher, at the expense of bombing accuracy.

Junkers Ju 87B

THE ATTACK DIVE

The description that follows covers a typical dive-bombing attack by Ju 87s. On the way to the target these aircraft typically flew at altitudes around 3,000 metres (about 10,000 feet). The basic tactical unit was the three-plane "Vic" and, depending on the size and importance of the target, a *Staffel* (up to 9 aircraft) or *Gruppe* (up to 30 aircraft) flew with Vics in line astern with intervals of about 300 metres between each.[3]

For an accurate attack it was important that the aircraft was heading into wind during its dive. As he neared the target the formation leader kept an eye open for smoke plumes rising from the ground to determine the wind direction, and aligned his attack run accordingly. Immediately before commencing his dive each Ju 87 pilot re-trimmed his aircraft for the dive and set the briefed bomb release altitude (above sea level) on the plane's contacting altimeter.

Inset into the cockpit floor, between the pilot's legs, was a window through which he could observe the ground beneath the aircraft. As the target slid into position, a series of parallel lines etched in the perspex assisted him to judge when to

commence the dive. Immediately before commencing the dive, the pilot operated a lever to rotate the dive brakes to the maximum-drag position. That produced a severe nose-up trim change, and an elevator trim tab lowered automatically to compensate for it.[4]

After the formation leader commenced his dive, the rest of the aircraft in the formation followed in turn. Against targets of small horizontal extent, for example bridges or individual buildings, the Ju 87s usually approached in echelon formation, peeled into the dive and attacked in line astern. Against larger or better-defended targets, for example harbours or marshalling yards, the dive-bombers would usually bunt into their dives in three-aircraft Vics and attack together to split the defensive fire.

Once the Ju 87 was established in its 80-degree dive the pilot would position the target under his reflector sight and hold it there. The attack dive lasted about 15 seconds, allowing plenty of time align the sight on the target. The accuracy of the attack depended on maintaining a constant dive angle, and to assist in this a protractor was etched into the perspex on the side of the cockpit canopy so that the pilot could read off his angle during the dive.[5]

When the aircraft reached a point 600 metres (about 2,000 feet) above the bomb release altitude previously set on the contacting altimeter, a warning horn sounded in the cockpit. When the aircraft reached the previously-set bomb release altitude, typically 700 metres (2,300 feet) above the ground, the warning horn ceased. The pilot pressed the button on his stick to release the bombs. As the fuselage-mounted bomb fell clear, a crutch mechanism pushed it away from the fuselage and safely clear of the propeller disc.[6]

It will be remembered that when the dive brakes were placed in the high-drag position, before commencing the dive, a trim tab fitted to the elevators had lowered automatically to compensate for the resultant nose-up pitching moment. The operation of releasing the bombs activated a powerful spring, which returned that trim tab sharply to the neutral position. The nose of the aircraft now pitched up at 6 G, to pull the aircraft firmly but smoothly out of the dive. The plane bottomed out of the dive at about 300 metres (about 1,000 ft) above the target, to give a margin of safety from splinters from the exploding bombs and enemy small-arms fire.[7]

As the nose of the aircraft rose above the horizon the pilot returned the dive brakes in the low-drag position, opened the throttle, re-trimmed the aircraft and turned on to the pre-briefed escape heading.

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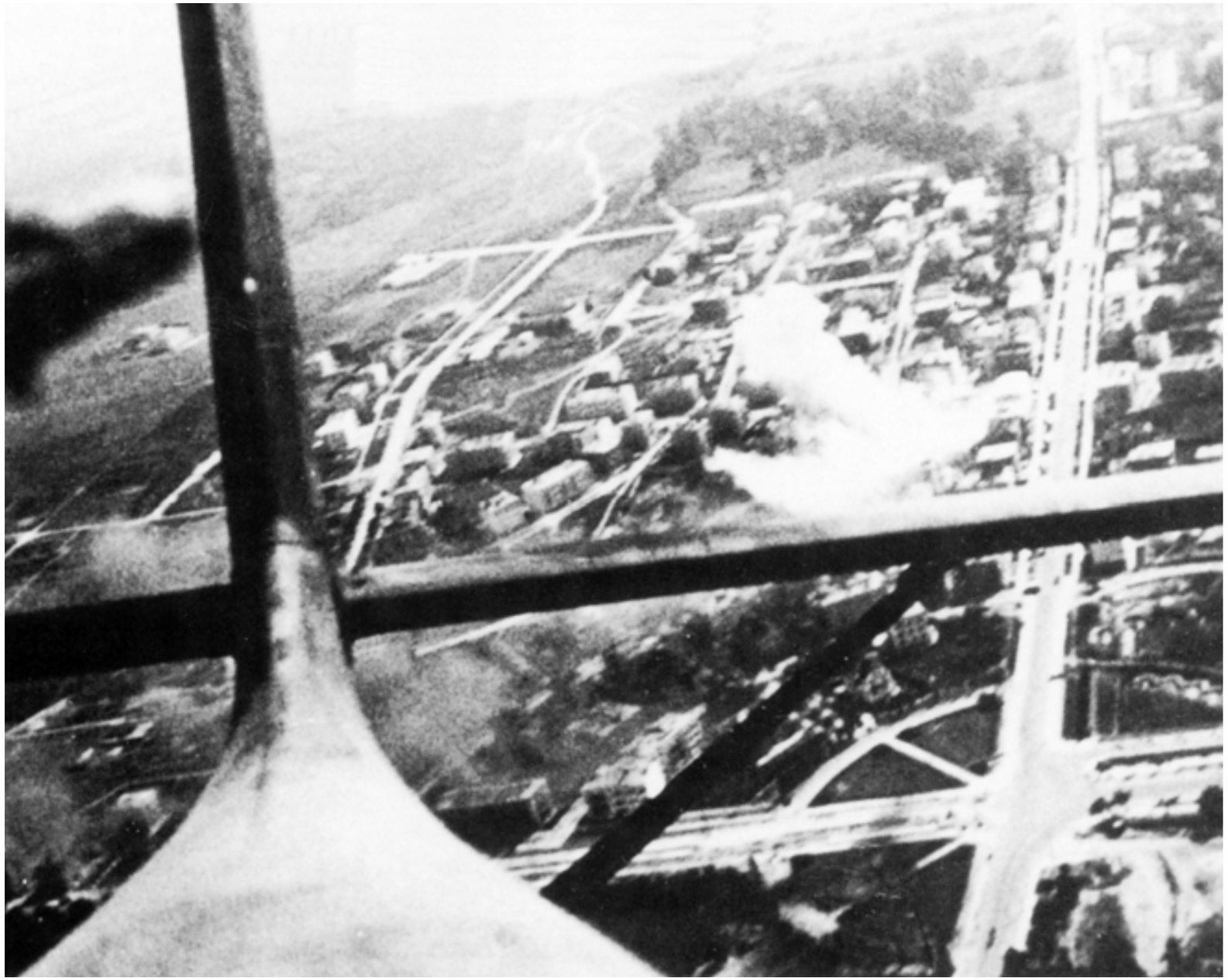

IN ACTION IN POLAND

During the invasion of Poland in September 1939, the Ju 87 established a formidable reputation in combat. As part of its establishment each Ju 87 *Gruppe* possessed three twin-engined Dornier 17 reconnaissance aircraft (later replaced by converted Messerschmitt 110 twin-engined fighters). These machines took the pre-strike photographs, led dive bomber formations to their targets, and took post-strike photographs for bomb damage assessment.[8]

In Poland the dive-bombers delivered pin-point attacks on bridges, rail targets and troop concentrations well behind from the front line – what we would now term Air Interdiction missions. They also attacked airfields, though with less success. During the period of tension preceding the invasion, the Polish Air Force re-deployed most of its combat flying units to well-camouflaged field landing grounds. As a result few front-line aircraft were lost during the initial onslaught. Yet although the main body of the Polish Air Force survived, it was too small and its equipment too outdated to pose any serious threat to German air operations. The Polish forces were also poorly equipped with anti-aircraft guns for the protection of targets and, operating with little hindrance, the Ju 87s struck with great accuracy and effect.

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Despite numerous assertions to the contrary, only a small proportion of Ju 87 missions were Close Air Support operations against enemy ground forces in contact with friendly troops. To carry out the accurate steep-diving attack a *Stuka* pilot needed to discern his target from at least 5,000 feet, and camouflaged troop positions in the battle area were difficult to see from such an altitude.

The dive-bomber was a new and effective weapon and, above all, it was predominantly a *German* weapon. In those circumstances the German propaganda machine can hardly be blamed for playing the aircraft for all it was worth. Among friends and foes alike, the legend of the invincibility of the *Stuka* was established.

BLITZKRIEG IN THE WEST

On 10 May 1940 German forces launched their all-out Blitzkrieg campaign in the West, and from the first the Stuka units were heavily committed. One of these was *Trägergruppe 186 (Träger* = aircraft carrier; the unit was earmarked to operate from the aircraft carrier *Graf Zeppelin* when the warship was completed). With an establishment of about 35 dive bombers and 40 crews, the unit's combat record was typical for a dive-bomber *Gruppe* at this time. TGr 186 went into action on almost every day that the weather allowed, with crews flying as many as four missions per day. It flew about 1,500 sorties, in the course of which it lost 15 crews. The overall loss rate was about 1 per cent, but the cumulative loss during the six weeks of hard fighting mounted to 40 per cent of the aircrew.[9] At that stage of the war the war losses in crews and aircraft were replaced almost immediately from the replacement units, but it was an uncomfortable pointer to the problems that would arise during a lengthy campaign.

At the beginning of World War II, the latest heavy AA guns and prediction systems could make life hazardous for bomber crews making horizontal attacks at altitudes below 10,000 feet. Firing time-fused high explosive shells, these weapons forced horizontal bombers to attack from altitudes of 15,000 feet and above. That greatly reduced the accuracy of their bombing. Against planes attacking in the dive, however, the predicted fire from heavy AAA was ineffective. The rate of closure of range was too rapid for time-fused shells to cope (radar proximity fused shells did not become available until 1944). Nor were dive bombers particularly vulnerable to ground fire as they pulled out of their dives. They bottomed out of the dive at about 1,000 feet, which made them difficult targets for infantry automatic weapons even if their crews were brave enough to ignore the bombs exploding around them.

REVERSE DURING THE BATTLE OF BRITAIN

The Battle of Britain opened in July 1940, and the large-scale bombardment of targets on the mainland of England began on 12 August. That day dive bombers attacked the radar stations at Pevensey, Rye, Dover, Dunkirk (in Kent) and Ventnor. The radars proved difficult targets, however. They were small objectives and their vital parts were protected by blast walls. Moreover, although the openwork metal towers supporting the aerial arrays appeared fragile, they presented only a small vulnerable area to blast pressure or bomb splinters. It required a direct hit on the base of a tower to knock one down, and this was rarely achieved. All the radar stations suffered damage, but following hasty repairs all except one were back in operation on the following day.

The largest co-ordinated attack ever mounted by *Stukas* took place on 18 August 1940. One hundred and nine Ju 87s drawn from four *Gruppen*, escorted by more than a hundred and fifty Messerschmitt Bf 109 fighters, set out to attack the airfields at Gosport, Ford and Thorney Island and the radar station at Poling.

British radar observed the approaching attack force in good time, and sixty-eight Spitfires and Hurricanes scrambled to meet it. As the formations crossed the coast, the escort of Messerschmitts split into two. One half remained with the dive-bombers at altitude, while the other descended to 3,000 feet to be in position to protect the Ju 87s when they pulled out of the dives.

At that moment, when the high level escort was at its weakest, eighteen Hurricanes of Nos 43 and 601 Squadrons hit the *Gruppe* about to dive on Thorney Island. At least four dive bombers were shot down before they began their dives. Once the Ju 87s were in the dive, however, they were almost invulnerable to fighter attack. Flight Lieutenant Frank Carey of No 43 Squadron, who led the Hurricane attack that day, told this writer:

> “In the dive they were very difficult to hit, because in a fighter one's speed built up so rapidly that one went screaming past it. But he couldn't dive for ever…” [10]

As the dive-bombers had pulled out of their dives, their tactic was to leave the target in a loose gaggle flying at cruising speed. If one of their number came under fighter attack, the pilot opened his throttle and accelerated past the dive bombers in front. If the fighter followed, its pilot came under fire from the forward-firing guns of the Ju 87s behind him.[11] In the past that tactic had been effective in forcing fighters to break off the chase, but now several British squadrons were piling into the fight. The 25-mile strip of coastline between Bognor and Gosport became a turmoil of over three hundred aircraft twisting and turning to bring guns to bear, or to avoid guns being brought to bear.

This *Stuka* of STG 77 failed to pull out of its dive after it was hit by an RAF fighter during the action on 18 August 1940. The aircraft crashed at West Broyle, near Chichester.

The *Gruppe* attacking Thorney Island was hit particularly hard: of the 28 *Stukas* taking part ten were shot down, one returned damaged beyond repair and four returned with serious damage. The *Gruppe* commander was among those killed. The other three *Gruppen* lost six aircraft shot down and two damaged between them.[12] Considered as a whole, the raiding force lost 21 per cent of its aircraft destroyed or damaged. That was too great a loss to be accepted as a matter of course.

Although the *Stukas* had taken heavy losses, they had hit their targets with great precision. Scarcely a single bomb landed outside the immediate area surrounding each target. Ford airfield was put out of action for several weeks, those at Thorney

The *Stukas* usually delivered their attacks with great precision. This German reconnaissance photo shows fires burning at the airfield at Ford, after the attack on 18 August.

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Island and Gosport continued in use though at reduced efficiency. Twenty-one RAF and Fleet Air Arm aircraft were wrecked on the ground. The radar station at Poling suffered severe damage, though following repairs it was back in operation after a few days.

The action on 18 August 1940 was the first real setback suffered by the *Stukas*, and it served to highlight a weakness that would be demonstrated again and again as the war progressed: the aircraft was a fine offensive weapon, but only if it could operate without hindrance from enemy fighters. If air superiority had not been secured, the dive-bomber units risked heavy losses. The *Stukas* had a vitally important roles to play in the planned invasion of southern England, and it was important that the units be conserved for the main battle. Accordingly, the Ju 87 units were pulled out of the Battle of Britain and played no further significant part in it.

IN ACTION OVER THE MEDITERRANEAN

The *Stukas* next saw major action over the Mediterranean, after 150 of these aircraft were deployed to Sicily to support the Italian bombardment of Malta and the convoys taking supplies there. In attacks on ships manoeuvring in open water, dive-bombing was far more effective than horizontal bombing. A dive-bomber pilot could follow the ship during its evasive turn, re-aligning his sight to aim at a point in the sea immediately in front of the vessel. The short time-of-flight of the bombs after release was too short for any subsequent change of helm to take effect.

On 10 January 1941 the Ju 87 revealed its devastating effectiveness against capital ships, during an attack on a Royal Navy battle group comprising the new aircraft carrier *Illustrious*, two battleships and eight destroyers escorting a convoy carrying supplies to Malta and Greece. The striking force comprised 43 Ju 87s drawn from two *Gruppen*. At the time the German aircraft

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were first detected on radar, the four defending Fulmar fighters were at low altitude having driven off an attack by Italian torpedo bombers. The carrier immediately launched four more fighters, but it was too late for any of them to climb into position to engage the raiders before the attack opened.

The Ju 87s concentrated their attack on *Illustrious*. Admiral Cunningham, the Royal Navy force commander, later wrote:

> "One was too interested in this new form of dive-bombing attack to be frightened, and there was no doubt we were watching complete experts. Formed roughly in a large circle over the fleet they peeled off one by one when reaching the attacking position. We could not but admire the skill and precision of it all. The attacks were pressed home to point blank range, and as they pulled out of their dives, some of them were seen to fly along the flight deck of *Illustrious* below the level of the funnel."[13]

From start to finish the action took less than seven minutes. By the end of it the Royal Navy's newest aircraft carrier had suffered seven direct hits from 1,100 pound bombs and was in a dire condition. With several fires blazing out of control below decks she could no longer operate her aircraft. The rudders jammed, the vessel headed for Malta steered by using differential revolutions on her main engines.[14]

A follow-up attack that afternoon by fifteen Ju 87s caused a direct hit near the after-lift and two near-misses close to the stern. That evening, with the fires inside her hull still burning out of control, the carrier limped into Valetta harbour. Eighty-three of her crew had been killed and more than a hundred wounded. [15]

While *Illustrious* underwent temporary repairs in Valetta she was subjected to further attacks by dive bombers. Yet another direct hit near the after lift added to the damage to that part of the ship. Near-misses caused damage to machinery in the boiler room. Despite these intrusions, essential repairs were completed in a remarkably short time. After dark on 23 January, still unable to operate her aircraft but unobserved by the enemy, the carrier limped out from Malta and made a dash for Alexandria. More than a year would elapse before she was again ready to go into action.

AGAINST THE SOVIET UNION

Operation Barbarossa, the invasion of the USSR, opened on 21 June 1941. Beforehand, eight Ju 87 *Gruppen* with a total of 324 aircraft had concentrated at forward airfields. The Luftwaffe supported the Blitzkrieg onslaught in its now established fashion, and when the weather allowed the dive-bomber units maintained average daily sortie rates of about 75 per cent of their strength in aircraft. This effort was maintained day in, day out for more than four months.[16]

As always when attacking targets in front of advancing friendly forces, there was the risk that the dive-bombers would hit the very troops they were trying to support. Hauptmann (Flight Lieutenant) Otto Schmidt, who flew Ju 87s with Dive Bomber *Geschwader* 77, recalled:

> "The contact between the forward troops and our airfields was often poor, and with a rapidly changing situation on the ground it sometimes happened that we hit our own troops by accident. Map reading and finding targets was often difficult, especially when we were being engaged by flak. If we attacked our own troops they would fire light signals and we would break away. Often the communications were so bad that we did not learn the correct colours of the day before we took off, so we had to break off our attack when we saw light signals. But strangely I cannot remember any instance where the enemy attempted to deceive us by firing false signals."[17]

The high sortie rates brought problems, however. During each of the first hundred days of the campaign in the east the Luftwaffe lost an average of 16 planes of all types destroyed and 10 damaged. That represented only about 0.3 per cent of the sorties flown, a low rate of attrition in percentage terms. Yet the cumulative effect of the losses incurred during this period of intensive air operations, 2,600 aircraft destroyed or damaged, was to prove disastrous.

The reserve of trained crews that had sustained the Luftwaffe since the beginning of the war was quickly exhausted and the trickle of replacements from the operational training units was insufficient to make good those being lost. As a result, at the end of the period many units were operating at well below their establishment of both aircraft and crews.[18] Only the arrival of the autumn rains, then the winter snows, brought a degree of relief from the hectic pace of operations. That winter, one by one, the dive-bomber *Gruppen* withdrew to Germany to rest and refit.

BLITZKRIEG RESUMED

The main German thrust in the late spring of 1942 was to take place on the southern front, to seize the Crimean peninsular and the important naval base at Sebastopol. From there the thrust was to continue east to capture Stalingrad and the valuable oilfields in the Caucasus area to the south east.

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The assault on Sebastopol opened on 2 June, and it was the only occasion during World War II when the siege of a major fortress went to the final reduction. The Luftwaffe quickly established air superiority over the battle area, then the dive-bomber units moved to forward airstrips within ten minutes flying time of Sebastopol. On occasions aircraft and crews flew as many as eight sorties in a day, as they supported infantrymen and army engineers methodically eliminating key strong points in the path of the German advance. Here, against the easily discernible fortress installations, the *Stukas* operated in the Close Air Support role. Otto Schmid recalled:

> "During the operations against Sevastopol there was little flak and no fighter opposition. For us the most difficult thing was when the infantry wanted us to drop each bomb individually, to keep the enemy troops' heads down and send up great clouds of chalk so they could work their way forwards. From out point of view, however, that meant carrying out five separate diving attacks per sortie, which over several sorties per day placed a lot of strain on the body."[19]

Despite stubborn resistance, the outnumbered and outgunned Soviet troops were squeezed into progressively smaller pockets. Resistance in the fortress finally ended on 3 July.

During 1942 life became more hazardous for the dive bomber crews. On each of the battle fronts the enemy fighter opposition became more effective. Most dangerous of all, however, was the large scale deployment of the fast-firing medium calibre anti-aircraft gun. Typical weapons in this class were the 40 mm Bofors gun used by British and Allied forces and the 37 mm M 1939 used by the Soviets; the former fired 2-pound shells at a rate of about 120 per minute, the latter fired 1.6 pound shells at a rate of about 150 per minute. Effective up to 10,000 feet, these weapons fired an impact-fused shell sufficiently powerful to destroy a Ju 87 with a single hit. When viewed from a gun position near the target, an aircraft engaged in a steep-diving attack appeared to hang almost stationary in space. That gave the gunners a zero-deflection shot, and if those manning the Bofors or M 1939 knew their business the effect was often lethal for the attacking aircraft. Otto Schmidt again:

> "At first things were easy in Russia, we had few losses either to flak or fighters. But gradually the Russians gained more experience in dealing with our diving attacks. They learned to stand their ground and fire back at us, instead of running for cover as others had done before. And when that happened, losses began to mount. A further strain was caused by the knowledge that if one was shot down on the enemy side of the lines the chances of survival were minimal. During the early stages of the war the Russians took hardly any prisoners."[20]

The heyday of the *Stuka* was fast drawing to a close. The number of high-value targets lacking effective gun defences dwindled to the point where the highly accurate steep-diving attack had become almost a thing of the past. Increasingly, the Ju 87s were used in shallow dive or low altitude attacks which were less risky but also less accurate. At the same time losses in experienced crews mounted, further reducing the effectiveness of these *Gruppen*.

During 1943 the *Stuka* units started to re-equip with the fighter-bomber version of the Focke Wulf 190 fighter.[21] By the summer of 1944 the Ju 87 had almost passed out of service in its original, daylight, dive bombing role. The rugged and dependable plane now began serving in limited numbers in other specialised roles.

JU 87 TANK BUSTER

In spring of 1943 the Ju 87 took on the role of tank-buster. The G version had the dive brakes, bomb shackles and other systems related to the earlier role removed. In their place it carried a modified 37 mm AA cannon under each wing outboard of the wheel fairing. Each weapon was fitted with a six-round clip of armour-piercing rounds, and both guns fired a single shot with each press of the firing button.[22] The 37 mm weapon was not powerful enough to pierce the front armour of the heavier Soviet tanks, but it was effective against their thinner armour over the engine compartment and rear.

The Ju 87G was at its most effective against tanks that had broken through the German defensive line and outrun their flak protection. On the Eastern Front this happened with disconcerting frequency during the final two years of the war. For brave and skilful crews there were frequent opportunities to engage enemy tanks under optimum conditions. The leading exponent of this role was the legendary Major Hans-Ulrich Rudel, a courageous pilot and an outstanding shot. After the war he wrote:

> "We have always to try to hit the tank in one of its most vulnerable places. The front is always the strongest part of every tank; therefore every tank invariably tries as far as possible to offer its front to the enemy. Its sides are less strongly protected. But the best target for us is the stern. It is there that the engine is housed, and the necessity for cooling this power centre permits of only a thin armour plating. In order to further assist the cooling this plating is perforated with large holes. This is a good spot to aim at because where the engine is there is always petrol. When its engine is running the tank is easily recognizable from the air by the blue fumes of the exhaust."[23]

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Having lined up on his prey, Rudel's usual method was to attack in a shallow descent, closing to within 300 yards before opening fire. He would then press his attack to short range before pulling up to pass close over his victim.

By the end of the war Hans Rudel had been credited with the destruction of 519 Soviet tanks.[24] That claim is impressive, but it needs to be taken with a grain of salt. For most of that time the German army was on the defensive, so very few of those claims were validated by ground examination. Without such evidence, it is unwise to take the claim at its face value.

NIGHT HARASSMENT OPERATIONS

In the final year of the war the Ju 87 took on one further role, that of night harassment raider. Night after night these aircraft flew nuisance raids over the enemy rear areas, where they bombed and strafed any enemy movements they detected on the ground.[25] These operations incurred few losses and exerted pressure on the enemy, but they were never going to secure decisive results. Their greatest effect was that by forcing enemy vehicles to drive at night without lights, leading to a steady toll of deaths and injuries in accidents.

Production of the Ju 87 finally ended in September 1944, after some 5,700 examples had been built.[26] In April 1945, less than a month before the end of the war, the Luftwaffe Order of Battle included sixty-five Ju 87s serving with ground attack and tank busting units, while a further sixty served with the night attack units.[27] Despite its obsolescence, the type continued to fly operational missions until the surrender.

THE STUKA *IN RETROSPECT*

The Ju 87 was in action from the first day of World War II until the last. It served on every major battlefront. In its heyday the crank-winged dive-bomber was the terror of Germany's enemies, but by the mid-war period the Allies had taken its measure. As the gun defences became more effective, the Ju 87's accurate steep-diving attack became progressively more risky for its crews. Yet although the plane had been designed without compromise as a dive-bomber, it proved sufficiently flexible to perform as a tank-buster and a night ground attack aircraft.

The six years of World War II saw greater technological advances in military aviation than in any comparable period before or since. One can count on the fingers of one hand the number of aircraft types in front-line service at the start of the conflict that were still flying combat missions at the end of the war. Circumstances dictated that the Junkers 87 should be numbered in that exclusive band. Moreover, as the first true precision attack aircraft to go into action, the *Stuka* has secured its place in history.

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