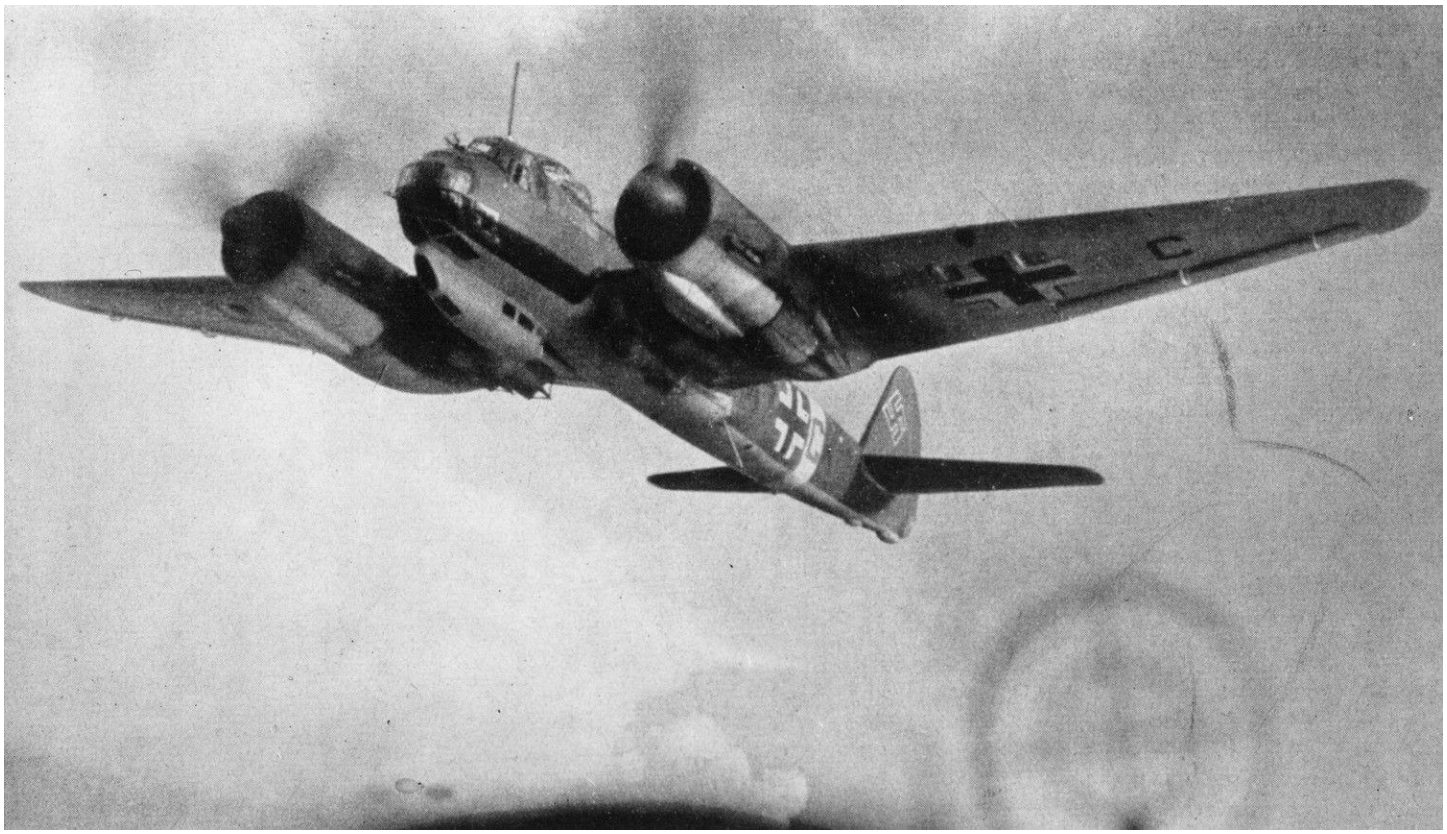
Junkers Ju 88



En août 1935, le RLM (ministère de l'Air du Reich) réclama un bombardier rapide, non armé et ne comptant que sur sa vitesse pour se défendre. Il devait emporter 3 membres d'équipage et 800 à 1000 kg de charge offensive à 500 km/h. La firme Junkers proposa son projet en juin 1936, qui fut conçu par W.H. Evers et Alfred Gassner, sous la direction de Ernst Zindel. Ces deux personnes avaient travaillé auparavant pour des firmes américaines. Il fut opposé au Bf 162, au Hs 127 et à un autre produit de Junkers, le Ju 85. La construction de deux prototypes du Ju 88 fut approuvée. Le Ju 85 ne fut jamais construit, et ne se différenciait du Ju 88 que par sa double dérive. Le premier d'entre eux vola pour la première fois le 21 décembre 1936. Avec sa vitesse de 580 km/h, il dépassait les chasseurs de l'époque. Les deux prototypes étaient dotés de moteurs DB 600. 3 autres prototypes suivirent, motorisés par des Jumo 211 et dotés d'un armement défensif à l'arrière. Le 5e prototype battit un record sur 1000 km le 9 mars 1939, avec une vitesse de 517 km/h pour une charge utile de 2000 kg. A partir du 6e prototype apparut un train d'atterrissage se rétractant sur 90°, à la manière du P-40 : il allait devenir la norme sur le reste de la production. Jusqu'à 10 prototypes furent finalement construits. En octobre 1937 Ernst Udet, indfluencé par le succès du Ju 87, décida de faire du Ju 88 un bombardier en piqué : ses ailes furent renforcées, des freins de piqué ainsi qu'un 4e membre d'équipage ajoutés, le fuselage allongé. Le V4 servant de prototype vola pour la première fois le 13 avril 1938. Il mènera aux versions de série A-1 et A-4. Mais toutes ces modifications retardèrent sa mise en service. Elle était prévue pour 1938, mais trop peu d'exemplaires étaient enregimentés lors de l'attaque de la Pologne. 12 furent choisis par l'Erprobungskommando 88 (Ekdo 88) pour être testés en conditions opérationnelles. Leur influence fut nulle. Le Ju 88 fut réellement engagé pour la première fois au combat en Norvège. Utilisé dans son rôle de bombardier en piqué, il contribua à endommager l'HMS Rodney et à couler l'HMS Gurkha le 9 avril 1940. Mais le KG 30 qui le déployait perdit 4 exemplaires lors de l'attaque.

Junkers Ju 88A au sol

Le Ju 88 fut engagé massivement lors de la Bataille de France. Il s'y montra efficace, que ce soit pour détruire des avions au sol ou des trains. Il coula aussi le paquebot RMS Lancastria près de St-Nazaire, provoquant la mort de 5800 personnes. Cependant, un fort taux d'accidents et de pertes au combat firent que les équipages avaient encore plus peur de leur avion que l'ennemi, au point de demander leur transfert dans une unité de He 111. Il est vrai que le Ju 88 était considéré à l'époque comme un appareil à haute performance. Il fallut d'une part ré-entraîner les pilotes, et d'autre part modifier la série A-1, au standard A-5. Plus encore que le Do 17 et le He 111, le Ju 88 souffrit lors de la Bataille d'Angleterre, avec pas moins de 313 pertes. Des modifications sur le terrain eurent lieu afin de le rendre moins vulnérable, dont un blindage et des mitrailleuses supplémentaires. Le 27 septembre 1940, un équipage abattu récupéra les armes de bord et se battit contre des soldats britanniques lors de la bataille de Graveney Marsh : ce fut la dernière bataille sur le sol anglais contre des envahisseurs. Il servit aussi au-dessus de l'Atlantique (version C-6), afin d'escorter les Fw 200 et de s'attaquer aux avions anti sous-marins. Ils y remporteront 109 victoires pour 117 pertes. Lors de l'été 1941, le Ju 88 remplaça le Do 17. Avec le He 111, il devint le principal bombardier moyen de la Luftwaffe. Il se montra efficace lors de l'invasion de l'URSS dans la destruction de chars, de navires et d'avions au sol, mais subit 23 pertes dès le premier jour. Il dut aussi remplacer les Ju 87, trop peu nombreux à ce moment-là. On le reverra lors de la bataille de Normandie, mais fut complètement surclassé par les appareils Alliés à ce moment-là. A partir de 1943, des équipages de Ju 88 feront défection vers la Grande-Bretagne. La Finlande acheta 24 Ju 88A-4 en avril 1943, alors qu'elle était en guerre contre l'URSS. Un des raids les plus mémorables fut la contre-attaque au-dessus de Leningrad, alors que Tallin venait de subir un raid des VVS, le 9 mars 1944. Ils furent également utilisé pour des raids de reconnaissance et d'attaques de colonnes motorisées allemandes lorsque la Finlande se retourna contre l'Allemagne, en septembre 1944. La dernière mission de guerre intervint le 4 avril 1945. Ils furent utilisés pour l'entraînement jusqu'en 1948, puis ferraillés.

Junkers Ju 88A-4 exposé

Le Ju 88 ne servit pas seulement comme bombardier : un grand nombre de versions furent construites pour des rôles très divers, comme la chasse lourde, l'assaut au sol, la lutte anti-chars, la chasse de nuit, la reconnaissance. Les Ju 88C, par exemple, étaient des chasseur-bombardier au nez plein contenant des mitrailleuses supplémentaires. Le Ju 88R qui en dérive est un chasseur de nuit, de même que le Ju 88G qui ne dispose cependant pas de nacelle ventrale "Bola". Les Ju 88D, Ju 88H et T sont des versions de reconnaissance à long rayon d'action (patrouille maritime et basés sur le Ju 88G dans le deuxième cas). Le Ju 88P était particulièrement destiné à la lutte anti-chars et était équipé d'un canon lourd, parfois de 88 mm. Le Ju 88S revenait au concept de bombardier rapide et fut la variante la plus rapide. Il servit de base au Ju 188, ainsi qu'au Kyūshū Q1W Tokai japonais. Il fut utilisé par la Bulgarie (peut-être), l'Espagne (10 Ju 88A-4 achetés et 15 internés), la Hongrie (83 Ju 88A-4, 1 Ju 88C-6, 30 Ju 88D-1 de 1942 à 1945), la Regia Aeronautica (45 Ju 88A et 1 Ju 88D-1 en 1943), la Roumanie (40 Ju 88A-4 et 10 Ju 88D-1 de 1942 à 1953) pendant la guerre. La RAF (au moins 5 exemplaires) et l'Union soviétique capturèrent des exemplaires, les évaluèrent et en opérèrent peut-être certains. Le Ju 88 influença fortement les Soviétiques, au point de vouloir faire du Tu-2 son équivalent. Enfin, la France utilisa 22 Ju 88A-4 de 1944 à 1951, et 38 d'une autre version, au sein de l'armée de l'air comme de la Marine. Un Ju 88S-3 fut également utilisé. 5 exemplaires furent utilisés par la Marine, dont un Ju 88A-17 et 3 Ju 88A-14. Ils seront intégrés à la 10S et serviront à l'essai de torpilles. Ils connaîtront de gros problèmes de pannes mécaniques, aggravés par le manque de pièces détachées. 14676 Ju 88 furent construits de 1936 à 1945, sans interruption et déclinés en 60 variantes (pour lesquelles on compte 104 prototypes). Il fut donc le bimoteur le plus produit de la Luftwaffe. Malgré des débuts et une mise au point difficile, il s'avéra un excellent appareil polyvalent, au point d'être comparé au Mosquito (il est vrai qu'ils ont été tous deux conçus comme bombardiers rapides). Cependant, il s'agissait aussi d'une machine complexe et difficile à piloter, qui souffrit de pertes. Aujourd'hui, 2 appareils sont exposés, complets, l'un au musée de l'USAF à Dayton et l'autre au musée de la RAF. 3 autres exemplaires ont été restaurés.

Source : https://aviationsmilitaires.net/v3/kb/aircraft/show/1129/junkers-ju-88

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The **Junkers Ju 88** is a German World War II *Luftwaffe* twin-engined multirole combat aircraft. Junkers Aircraft and Motor Works (JFM) designed the plane in the mid-1930s as a so-called *Schnellbomber* ("fast bomber") that would be too fast for fighters of its era to intercept. It suffered from technical problems during its development and early operational periods but became one of the most versatile combat aircraft of the war. Like a number of other *Luftwaffe* bombers, it served as a bomber, dive bomber, night fighter, torpedo bomber, reconnaissance aircraft, heavy fighter and at the end of the war, as a flying bomb.[2] Despite a protracted development, it became one of the *Luftwaffe*'s most important aircraft. The assembly line ran constantly from 1936 to 1945 and more than 15,000 Ju 88s were built in dozens of variants, making it the second-most produced bomber of all time, behind the four-engined Consolidated B-24 Liberator, and the most-produced twin-engine German aircraft of the period. Throughout production the basic structure of the aircraft remained unchanged.[3][4]

Design and development

In August 1935, the German Ministry of Aviation submitted its requirements for an unarmed, three-seat, high-speed bomber with a payload of 800–1,000 kg (1,800–2,200 lb).[5] Design of the Ju 88 began with a study (EF59) which evolved into two parallel designs, Ju 85 and Ju 88.[6] The Ju 85 was a twin-engined bomber aircraft prototype, designed by Junkers in 1935. The Ministry of Aviation requested the aircraft, which differed from the Ju 88 due to the use of a twin fin tail unit. The aircraft was never put into service.[7] Design was initiated by Junkers chief designer Ernst Zindel.[8] He was assisted by Wilhelm Heinrich Evers and American engineer Alfred Gassner.[9] Evers and Gassner had worked together at Fokker Aircraft Corporation of America where Gassner had been Chief Engineer.[*citation needed*] Junkers presented their initial design in June 1936, and were given clearance to build two prototypes (Werknummer 4941 and 4942).[5] The first two aircraft were to have a range of 2,000 km (1,200 mi) and were to be powered by two DB 600s. Three further aircraft, Werknummer *4943*, *4944* and *4945*, were to be powered by Jumo 211 engines.[5] The first two prototypes, Ju 88 V1 and V2, differed from the V3, V4 and V5 in that the latter three models were equipped with three defensive armament positions to the rear of the cockpit, and were able to carry two 1,000 kg (2,200 lb) bombs, one under each inner wing panel. The aircraft's first flight was made by the prototype Ju 88 V1, which bore the civil registration D-AQEN, on 21 December 1936. When it first flew, it managed about 580 km/h (360 mph) and Hermann Göring, head of the *Luftwaffe*, was ecstatic. It was an aircraft that could finally fulfil the promise of the *Schnellbomber*, a high-speed bomber. The streamlined fuselage was modeled after its contemporary, the Dornier Do 17, but with fewer defensive guns because the belief still held that it could outrun late 1930s-era fighters. The fifth prototype set a 1,000 km (620 mi) closed-circuit record in March 1939, carrying a 2,000 kg (4,400 lb) payload at a speed of 517 km/h (321 mph).[10]

Standard Ju 88 main landing gear installation, from the V6 prototype onwards

The first five prototypes had conventionally-operating dual-strut leg rearwards-retracting main gear, but starting with the V6 prototype, a main gear design debuted that twisted the new, single-leg main gear strut through 90° during the retraction sequence, much like that of the American Curtiss P-40 Warhawk fighter. This feature allowed the main wheels to end up above the lower end of the strut when fully retracted[N 1] and was adopted as standard for all future production Ju 88s, and only minimally modified for the later Ju 188 and 388 developments of it. These single-leg landing gear struts also made use of stacks of conical Belleville washers inside them as their main form of suspension for takeoffs and landings. By 1938, radical modifications from the first prototype began to produce a "heavy" dive bomber. The wings were strengthened, dive brakes were added, the fuselage was extended and the number of crewmen was increased to four. Due to these advances, the Ju 88 was to enter the war as a medium bomber.

Annular radiator on a wrecked Ju 88

The choice of annular radiators for engine cooling on the Ju 88, which placed these radiators immediately forward of each engine and directly behind each propeller, allowed the cooling lines for the engine coolant and oil-cooling radiators (integrated within the annular design) to be as short as possible, with integral port and starboard air intakes for cooling the exhaust headers, the starboard inlet also supplying the inlet air for the supercharger.

Ju 88 assembly line, 1941

As the outbreak of WW II in Europe approached, by the time *Luftwaffe* planners like Ernst Udet had their opportunities to have their own "pet" features added (including dive-bombing by Udet), the Ju 88's top speed had dropped to around 450 km/h (280 mph). The Ju 88 V7 was fitted with cable-cutting equipment to combat the potential threat of British barrage balloons, and was successfully tested in this role. The V7 then had the Ju 88 A-1 "beetle's eye" faceted nose glazing installed, complete with the *Bola* undernose ventral defensive machine gun emplacement, and was put through a series of dive-bombing tests with 250 and 500 kg (550 and 1,100 lb) bombs, and in early 1940, with 1,000 kg (2,200 lb) bombs. The Ju 88 V8 (*Stammkennzeichen* of DG+BF, Wrk Nr 4948) flew on October 3, 1938. The A-0 series was developed through the V9 and V10 prototypes. The A-1 series prototypes were Wrk Nrs 0003, 0004 and 0005. The A-1s were given the Jumo 211B-1 or G powerplants.[12] Dr. Heinrich Koppenberg (managing director of Jumo) assured Göring in the autumn of 1938 that 300 Ju 88s per month was definitely possible. Göring was in favour of the A-1 variant for mass production. Production was delayed drastically by developmental problems. Although planned for a service introduction in 1938, the Ju 88 finally entered squadron service (with only 12 aircraft) on the first day of the invasion of Poland in 1939. Production was painfully slow, with only one Ju 88 manufactured per week, as problems kept cropping up. The Ju 88C series of heavy fighter was also designed very early in 1940, but kept secret from Göring, as he wanted only bombers.

Dive bomber

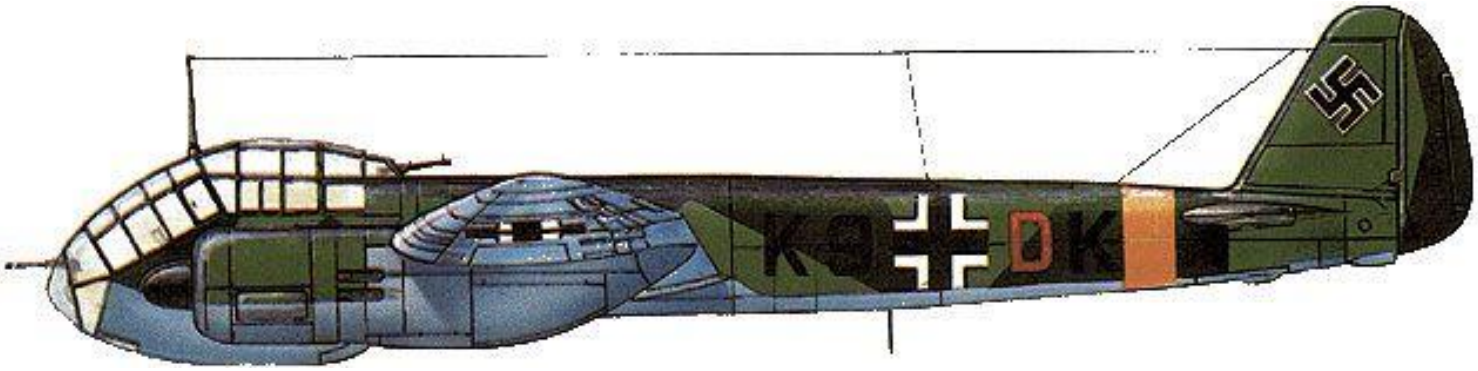
Three Ju 88s in flight over Astypalaia, Greece, 1943

In October 1937 *Generalluftzeugmeister* Ernst Udet had ordered the development of the Ju 88 as a heavy dive bomber. This decision was influenced by the success of the Ju 87 *Stuka* in this role. The Junkers development centre at Dessau gave priority to the study of pull-out systems and dive brakes.[13] The first prototype to be tested as a dive bomber was the Ju 88 V4 followed by the V5 and V6. These models became the planned prototype for the A-1 series. The V5 made its maiden flight on 13 April 1938, and the V6 on 28 June 1938. Both the V5 and V6 were fitted with four-blade propellers, an extra bomb bay and a central "control system".[13] As a dive bomber, the Ju 88 was capable of pinpoint deliveries of heavy loads; however, despite all the modifications, dive bombing still proved too stressful for the airframe, and in 1943, tactics were changed so that bombs were delivered from a shallower, 45° diving angle. Aircraft and bomb sights were accordingly modified and dive brakes were removed. With an advanced *Stuvi* dive-bombsight, accuracy remained very good for its time. Maximum bomb load of the A-4 was 3,000 kg (6,600 lb), but in practice, standard bomb load was 1,500–2,000 kg (3,300–4,400 lb).[14] Junkers later used the A-4 airframe for the A-17 torpedo carrier, which did not have the undernose *Bola* gondola for a ventral gun position.[13]

Ju 88 preparing for take off, Tunisia, c. 1942–43

Fighter-bomber

The Ju 88C series of standard fighter-bomber versions from the C-2 onwards culminated in the **Ju 88 C-6**, applying experience acquired with the A-4 bomber, equipped with the same Jumo 211J engines but replacing the "beetle's eye" nose glazing with a smoothly curved all-metal nose, pierced only by the barrels of its forward-firing offensive armament. The C-6 was used mostly as fighter-bomber and therefore assigned to bomber units. As a reaction to the increasing number of attacks on German shipping, especially on U-boats in the Bay of Biscay, from July 1942 it started flying anti-shipping patrols and escort missions from bases in France.[15] *V./Kampfgeschwader 40* being formed to operate the C-6. The aircraft of V./KG 40 (which was redesignated I./*Zerstörergeschwader 1* in 1943[16]) were a significant threat to antisubmarine aircraft and operated as escort fighters for the more vulnerable Focke-Wulf Fw 200 Condor maritime patrol bombers. Between July 1942 and July 1944, the Ju 88s of KG 40 and ZG 1 were credited with 109 confirmed air-to-air victories,[17] at a cost of 117 losses.[18] They were finally deployed against the Allied Invasion of Normandy in June 1944, incurring heavy losses for little effect before being disbanded on 5 August 1944.[19] Some Ju 88 variants were also used as radio controlled bombs in the Mistel composite aircraft configuration, by coupling a bomber filled with explosive with a fighter such as the Focke-Wulf Fw 56 or the Messerschmitt Bf 109E.



Attack bomber

Ju 88 in 1944

The **Ju 88P** was a specialized variant for ground attack and to function as a bomber destroyer, designed starting from 1942[20] and produced in small numbers, using examples of the *Bordkanone* heavy calibre aviation autocannon series, which required the omission of the *Bola* undernose gondola for clearance. The prototype, derived from a standard Ju 88 A-4, was armed with a 7.5 cm (3.0 in) anti-tank gun derived from the 7.5 cm PaK 40 installed in a large conformal gun pod under the fuselage. This was followed by a small batch of **Ju 88 P-1**, which standardized the solid sheet metal nose of the C version for all known examples of the P-series, and used the new 7.5 cm PaK 40L semi-automatic gun, also known as the *Bordkanone* BK 7,5,[21] which was also meant for use in both the later Henschel Hs 129B-3 dedicated anti-armor aircraft, and a never-achieved production version of the He 177A-3/R5 ground-attack *Flak*-suppression *Stalingradtyp* field-improvised version. The Ju 88P-1 was produced in some 40 units, but with the massive cannon installation resulting in a slow and vulnerable aircraft,[20] it was soon replaced by the **Ju 88 P-2**, featuring two *Bordkanone* 3.7 cm (1.5 in) BK 3,7 guns, whose higher muzzle velocity proved useful against the Russian tanks in the Eastern Front. This aircraft was used by *Erprobungskommando* 25. The **Ju 88 P-3** also used the twin BK 3,7 guns, and added further armor for the crew, and was delivered at one *Staffel* of the *Nachtschlachtgruppen* 1, 2, 4, 8 and 9 for night attacks in the Eastern Front, in northern Norway (NSGr 8) and Italy (NSGr 9).[20] Finally, the **Ju 88 P-4** mounted a smaller-volume ventral gun pod housing a 5 cm (2.0 in) auto-loading *Bordkanone* BK 5 cannon (the same ordnance used for the field-improvised handful of *Stalingradtyp* He 177As created) and, in some cases, 6.5 cm (2.6 in) solid propellant rockets.[20]

Heavy fighter and night fighter

Ju 88C

Ju 88C series heavy fighter in flight

The Ju 88C was originally intended as a fighter-bomber and heavy fighter by adding fixed, forward-firing guns to the nose while retaining some bomb carrying ability of the A-series bomber. The C-series had a solid metal nose, typically housing one 20 mm (0.787 in) MG FF cannon and three 7.92 mm (0.312 in) MG 17 machine guns. The aircraft retained the ventral *Bola* gondola under the crew compartment though individual units sometimes removed this to reduce weight and drag to enhance performance. The Ju 88C was later used as a night fighter, and this became its main role. The first version of the Ju 88C was the **C-1** with 20 aircraft converted from **A-1** airframes. Some of them entered service in the *Zerstörerstaffel* of KG 30 which became part of II./NJG 1 in July 1940. The C-1 was followed by the **C-2** of which 20 aircraft were converted from A-5 airframes with enlarged wingspan. The **C-4** became the first production version with 60 produced and 60 converted from A-5 airframes. The **C-6**, of which 900 aircraft were produced, was based on the A-4 airframe with more powerful engines and stronger defensive armament (single- or dual-mount belt-fed 7.92 mm (0.312 in) MG 81 or 13 mm (0.512 in) MG 131 instead of drum-fed MG 15 machine guns).

The *Matratze* 32-dipole antenna for the Lichtenstein UHF radar

Ju 88 C-6 with the improved *Hirschgeweih* radar system

The **C-6** as night fighter was typically equipped with FuG 202 *Lichtenstein* BC low-UHF band airborne intercept radar, using the complex 32-dipole *Matratze* antennas. The first four C-6 night fighters were tested in early 1942 by NJG 2. The trials were successful and the aircraft was ordered into production. In October 1943, many C-6s were upgraded with new radar systems. The first new radar equipment was the FuG 212 Lichtenstein C-1. After the UHF-band Lichtenstein radars had been compromised to the Allies in the late spring of 1943, the next development in German AI radar was the VHF-band FuG 220 *Lichtenstein* SN-2, discarding the 32-dipole *Matratze* antennae for the much larger eight-dipole *Hirschgeweih* (stag's antlers) aerials, required for the longer wavelength SN-2 system. Many Ju 88C's had their Bola gondolas modified to hold up to two forward firing 20 mm (0.787 in) cannons. Several C-6 night fighters were equipped with two "Schräge-Musik" upward-firing 20 mm cannons in trial fittings, and from mid 1943 onward, there was an official field modification kit available for this arrangement. A small number of the C-series day fighters had their new solid-metal noses specially painted to resemble the bomber A-series' "beetle's eye" faceted clear view nose glazing, in an attempt to deceive Allied pilots into thinking the fighters were actually bombers; the unusual "camouflage" attempt did result initially in a number of Allied aerial losses.

Ju 88R

Ju 88 R-1 night fighter captured by British forces at Copenhagen-Kastrup airfield, May 1945

The Ju 88R series night fighters were basically versions of the Ju 88 C-6, powered by unitized BMW 801 radial engines. The R-1 had 1,147 kW (1,539 hp) BMW 801L engines and the R-2 had 1,250 kW (1,677 hp) BMW 801 G-2 engines. One of the first aircraft from the R-1 series that went into service (*Werknummer* 360 043) was involved in one of the most significant defections from the *Luftwaffe*. On 9 May 1943, this night fighter (D5+EV), which was stationed with 10./NJG 3 in Aalborg Denmark, flew to the RAF Station at Dyce (now Aberdeen Airport) with its entire crew and complete electronic equipment on board. The fact that Spitfire Vb fighters No.165 (Ceylon) Squadron escorted it towards the end of its flight could indicate that its arrival had been expected. It was immediately transferred to Farnborough Airfield, received RAF markings and serial number PJ876, and was tested in great detail.[22] The preserved aircraft is on exhibit at the RAF Museum, as one of the first two intact Ju 88s in aviation museums. The *Luftwaffe* learned of this defection only the following month when members of the crew, pilot *Oberleutnant* Heinrich Schmitt (son of the former secretary to the ministry for foreign affairs (1923–1929) Gustav Stresemann) and *Oberfeldwebel* Paul Rosenberger made broadcasts on British radio.[23] [N 2] The third crew-member, Erich Kantwill, refused to co-operate with the British and was treated as a normal prisoner-of-war.

Ju 88G

All previous night fighter versions of the Ju 88 used a modified A-series fuselage. The *G-series* fuselage was purpose-built for the special needs of a night fighter, with the A-series' *Bola* ventral under-nose defensive gun position omitted for lower aerodynamic drag and less weight, and adding the enlarged squared-off vertical fin/rudder tail unit of the Ju 188. **G-1** aircraft possessed more powerful armament and like the earlier R-1, used a pair of 1,250 kW (1,677 hp) BMW 801 radial engines, the G-1 using the later BMW 801G-2 version. Electronic equipment consisted of the then-standard FuG 220 Lichtenstein SN-2 90 MHz VHF radar using eight-dipole *Hirschgeweih* antennas, which could include fitment of the borderline-SHF-band *FuG 350* Naxos radar detector with its receiving antenna housed in a teardrop-shaped streamlined fairing above the canopy, or FuG 227 *Flensburg* radar detector homing devices that had their own trio of twin-dipole antennae: one on each wing leading edge and one under the tail. One Ju 88G-1 of 7. *Staffel*/NJG 2 was flown by mistake to RAF Woodbridge in July 1944, giving the Royal Air Force its first chance to check out the VHF-band Lichtenstein SN-2 radar and Flensburg radar detector gear.[24]

A British-captured Ju 88 G-6 night fighter equipped with the FuG 240 Berlin cavity magnetron radar, with smooth radome nose

G-6 versions were equipped with 1,287 kW (1,726 hp) Jumo 213A inverted V-12 engines (using the same redesigned annular radiator cores as the Ju 188s powered by them), enlarged fuel tanks and often one or two 20 mm MG 151/20 cannons in a *Schräge Musik* ("Jazz Music", i.e. slanted) installation. These guns were pointed obliquely upwards and forwards from the upper fuselage – usually at an angle of 70°. Some of the final G-series models received updates to the engines, using a pair of high-altitude Jumo 213E inverted V-12s with the same revised annular radiator design as the 213As already used, or to the radar, using the mid-VHF band FuG 218 Neptun AI radar with either the standardized *Hirschgeweih* aerials with shorter dipoles to suit the higher frequencies used, or more rarely the advanced *Morgenstern* 90° crossed-element, six-dipole Yagi-form antenna. Only a very few Ju 88G-6 night fighters were ever fitted with the semi-experimental FuG 240 Berlin N-1 cavity magnetron based, 3 GHz-band (centimetric) radar, whose dish antenna was housed in a smoothly contoured radome on the G-6's nose. Only about 15 of the Berlin systems were completed before V-E Day. Many *Luftwaffe* night fighter aces, such as Helmut Lent (110 victories) and Heinrich Prinz zu Sayn-Wittgenstein (87 victories) flew Ju 88s during their careers.

Operational history

Invasion of Poland

Only 12 Ju 88s saw action during the invasion of Poland. The unit *Erprobungskommando* 88 (Ekdo 88) was responsible for testing new bomber designs and their crews under hostile conditions. They selected 12 aircraft and their crews and attached them to 1./*Kampfgeschwader* 25.[25] As a result of its small operational numbers, the type made no impact.

Battle of Norway

The Luftwaffe committed II./*Kampfgeschwader* 30 to the campaign under X. *Fliegerkorps* for Operation Weserübung.[26] The unit was equipped with Ju 88s and engaged Allied shipping as its main target. On 9 April 1940, Ju 88s of KG 30 dive-bombed, in cooperation with high-level bombing Heinkel He 111s of KG 26, and helped damage the battleship HMS *Rodney* and sink the destroyer HMS *Gurkha*. However, the unit lost four Ju 88s in the action, the highest single loss of the aircraft in combat throughout the campaign.[27]

Battle of France

Junkers Ju 88A-1 of the Stab/KG 51, June 1940

Ju 88A, circa 1940

The Luftwaffe's order of battle for the French campaign reveals all but one of the Luftwaffe's *Fliegerkorps* (I. *Fliegerkorps*) contained Ju 88s in the combat role. The mixed bomber units, including the Ju 88, of *Kampfgeschwader* 51 (under the command of *Luftflotte* 3) helped claim between 233 and 248 Allied aircraft on the ground between 10 and 13 May 1940.[28] The Ju 88 was particularly effective at dive-bombing. Between 13 and 24 May, I. and II./KG 54 flew 174 attack against rail systems, paralysing French logistics and mobility.[29] On 17 June 1940, Junkers Ju 88s (mainly from *Kampfgeschwader* 30) destroyed a "10,000 tonne ship", the 16,243 grt ocean liner RMS *Lancastria*, off Saint-Nazaire, killing some 5,800 Allied personnel.[30] Some 133 Ju 88s were pressed into the *Blitzkrieg*, but very high combat losses and accidents forced a quick withdrawal from action to re-train crews to fly this very high-performance aircraft. Some crews were reported to be more scared of the Ju 88 than the enemy, and requested a transfer to an He 111 unit.[31] By this time, major performance deficiencies in the A-1 led to an all-out effort in a major design rework.

The outcome was a longer, 20.08 m (65.9 ft) wingspan, from extended rounded wing tips that had already been standardised on the A-4 version, that was deemed needed for all A-1s; thus the A-5 was born. Surviving A-1s were modified as quickly as possible, with new wings to A-5 specifications.

Battle of Britain

A Junkers 88 A-1, of *Kampfgeschwader* 51 with its crew (1940)

By August 1940, A-1s and A-5s were reaching operational units just as the battle was intensifying. The Battle of Britain proved very costly. Its higher speed did not prevent Ju 88 losses from exceeding those of its Dornier Do 17 and Heinkel He 111 stablemates despite being deployed in smaller numbers than either. Ju 88 losses over Britain in 1940 totaled 303 aircraft between July and October 1940.[32] Do 17 and He 111 losses for the same period were 132 and 252 machines destroyed respectively.[33][34] Of all the losses suffered by the Ju 88 at that time, however, a number were due to the tricky behavior of the plane, especially when compared with the proven He 111, and to the crews' lack of experience on the type – many having converted to the Ju 88 only shortly before. Of the 39 losses recorded for July 1940, for example, only 20 were due to enemy action. The others being written off in training accidents, crashes, or malfunctions over mainland Europe.[32] A series of field modifications were made to make the Ju 88 less vulnerable, including the replacement of the single MG 15 rear machine gun by a twin-barreled MG 81Z machine gun and the fitting of additional cockpit armour. One incident involved ground fighting between the crew of an A-1 and soldiers from the London Irish Rifles during the Battle of Graveney Marsh on 27 September 1940. It was the last action between British and foreign military forces on British mainland soil.[35] The flagship Ju 88 A-4 went into service during the closing days of the Battle of Britain. Although slower than the A-1, it solved nearly all of the troubles of the A-1. The A-4 actually saw additional improvements including more powerful engines but, unlike other aircraft in the Luftwaffe, did not see a model code change. The Ju 88 C-series also benefited from the A-4 changes.

The Balkans and Greece

The Ju 88 was used by VIII Fliegerkorps during the German invasion of Yugoslavia in April 1941. Ju 88s were also used during the German invasion of Greece (Operation Marita) in April 1941 and during the German invasion of Crete in May 1941. Following the Italian surrender in 1943 Ju 88s were also used during the German invasion of the Italian-held Dodecanese Islands, which took place between September and November 1943.

Eastern Front

By the summer of 1941, most of the units equipped with the Dornier Do 17 were upgrading to the Ju 88. With a few exceptions, most of the German bomber units were now flying the He 111 and Ju 88. The Ju 88 was to prove a very capable and valuable asset to the Luftwaffe in the east. The Ju 88 units met with instant success, attacking enemy airfields and positions at low level and causing enormous losses for little damage in return. 3./*Kampfgeschwader 3* attacked Pinsk airfield in the morning of the 22 June 1941. It caught, and claimed destroyed, 60 Soviet bombers on the ground. The 39 SBAP Regiment of the 10 Division SAD actually lost 43 Tupolev SBa and five Petlyakov Pe-2s. Ju 88s from *Kampfgeschwader 51* destroyed over 100 aircraft after dispatching 80 Ju 88s to hit airfields. In general the Soviet aircraft were not dispersed and the Luftwaffe found them easy targets.[36] A report from the Soviet 23rd Tank Division of the 12th Armoured Corps described a low-level attack by Ju 88s on 22 June, resulting in the loss of 40 tanks. However, the Ju 88s were to suffer steady attritional losses. At 0415 on 22 June 1941, III./KG 51 attacked the airfield at Kurovitsa. Despite destroying 34 Polikarpov I-153s, the Ju 88s were intercepted by 66 ShAP I-153s. Six Ju 88s were shot down before the German fighter escort dealt with the threat.[37] By the end of the first day of the campaign, Ju 88 losses amounted to 23 destroyed.[38]

Ju 88A of LG 1 over the Eastern Front, 25 September 1941

Due to the lack of sufficient numbers of Ju 87 *Stukas*, the Ju 88 was employed in the direct ground support role. This resulted in severe losses from ground fire. *Kampfgeschwader 1*, *Kampfgeschwader 76* and *Kampfgeschwader 77* reported the loss of 18 Ju 88s over enemy territory on 23 June. KG 76 and KG 77 reported the loss of a further four Ju 88s, of which 12 were 100% destroyed.[39] In the north, the VVS North-Western Front lost 465 aircraft on the ground, 148 of them bombers, to the Ju 88s of KG 1. A further 33 were damaged. Out of a total of 1,720 aircraft deployed by the VVS Northern Front on 22 June,[40] it lost 890 and a further 187 suffered battle damage in eight days.[41] The Ju 88s units helped virtually destroy Soviet airpower in the northern sector. Again, the Ju 88 demonstrated its dive-bombing capability. Along with He 111s from KG 55, Ju 88s from KG 51 and 54 destroyed some 220 trucks and 40 tanks on 1 July, which helped repulse the Soviet South Western Front's offensive.

The Ju 88s destroyed most rail links during interdiction missions in the area, allowing *Panzergruppe 1* to maintain the pace of its advance.[42] Ju 88 units operating over the Baltic states during the battle for Estonia inflicted severe losses on Soviet shipping, with the same dive-bombing tactics used over Norway, France and Britain. KGr 806 sank the Soviet destroyer *Karl Marx* on 8 August 1941 in Loksa Bay Tallinn.[43] On 28 August the Ju 88s had more success when KG 77 and KGr 806 sank the 2,026 grt steamer *Vironia*, the 2,317 grt *Lucerne*, the 1,423 grt *Atis Kronvalds* and the ice breaker *Krišjānis Valdemārs* (2,250 grt). The rest of the Soviet "fleet", were forced to change course. This took them through a heavily mined area. As a result, 21 Soviet warships, including five destroyers, struck mines and sank. On 29 August, the Ju 88s accounted for the transport ships *Vtoraya Pyatiletka* (3,974 grt), *Kalpaks* (2,190 grt) and *Leningradsovet* (1,270 grt) sunk. In addition, the ships *Ivan Papanin*, *Saule*, *Kazakhstan* and the *Serp i Molot* were damaged. Some 5,000 Soviet soldiers were lost.[44]

The Mediterranean

Ju 88s first arrived in Sicily in 1940, from which they attacked allied shipping in the Mediterranean and took part in the bombing of Malta during the Siege of Malta.

North Africa

Ju 88s were used in the North African campaign, where they flew operations in support of the Axis forces in North Africa.

Italian Campaign

On 2 December 1943, 105 Ju 88 A-4s, armed with bombs and motobomba circling torpedoes, attacked the Allied-held port of Bari, Italy. The attacking force achieved complete surprise and sunk over 20 Allied ships in the overcrowded harbour, including the U.S. Liberty ship *John Harvey*, which was carrying mustard gas. About 1,000 people were killed and another 1,000 wounded; many fatalities and injuries were as a result of the release of mustard gas. The attacking force lost one aircraft; the Allies had not assigned any fighters to guard Bari as they thought the Luftwaffe incapable of striking in this strength at this stage of the war. The port was completely closed for three weeks from the damage of the raid, and only resumed full operation in February 1944.[45]

Finnish Air Force

Finnish Air Force Junkers Ju 88 A-4. The FAF aircraft code for Ju 88 was JK.

In April 1943, as Finland was fighting its Continuation War against the USSR, the Finnish Air Force bought 24 Ju 88s from Germany.[46] The aircraft were used to equip No. 44 Sqn, which had previously operated Bristol Blenheims, but these were instead transferred to No. 42 Sqn. Due to the complexity of the Ju 88, the FAF spent most of 1943 training crews on the aircraft, and conducted only a handful of bombing missions. The most notable was a raid on the Lehto partisan village on 20 August 1943 (in which the whole squadron participated), and a raid on the Lavansaari air field (leaving seven Ju 88 damaged from forced landing in inclement weather).[47] In the summer of 1943, the Finns noted stress damage on the wings.

This had occurred when the aircraft were used in dive bombing. Restrictions followed: the dive brakes were removed and it was only allowed to dive at a 45-degree angle (compared to 60–80 degrees previously). In this way, they tried to spare the aircraft from unnecessary wear.

Ju 88 cockpit hood preserved at the Finnish Aviation Museum in Vantaa

One of the more remarkable missions was a bombing raid on 9 March 1944 against Soviet Long Range Aviation bases near Leningrad, when the Finnish aircraft, including Ju 88s, followed Soviet bombers returning from a night raid on Tallinn, catching the Soviets unprepared and destroying many Soviet bombers and their fuel reserves, and a raid against the aerosledge base at Petsnajoki on 22 March 1944.[47] The whole bomber regiment took part in the defence against the Soviets during the fourth strategic offensive. All aircraft flew several missions per day, day and night, when the weather permitted.[48] No. 44 Sqn was subordinated *Lentoryhmä Sarko* during the Lapland War (now against Germany), and the Ju 88s were used both for reconnaissance and bombing. The targets were mostly vehicle columns. Reconnaissance flights were also made over northern Norway. The last war mission was flown on 4 April 1945.[49] After the wars, Finland was prohibited from using bomber aircraft with internal bomb stores. Consequently, the Finnish Ju 88s were used for training until 1948. The aircraft were then scrapped over the following years.[49] No Finnish Ju 88s have survived, but an engine is on display at the Central Finland Aviation Museum, and the frame structure of a German Ju 88 cockpit hood is preserved at the Finnish Aviation Museum in Vantaa.

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