

Modeller's Guide to Focke-Wulf Fw 190 Variants

Radial Engine Versions

Part I

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As a companion to last month's walkaround feature [Focke-Wulf Fw 190 A-8 in Detail \(Revisited\)](#), this article provides detailed reference to radial-engined versions of this famous aircraft. Part I below covers the A series fighters. Next month, the guide will continue to cover ground attack and fighter-bomber developments of this famous airplane (Ed.)

The Focke-Wulf 190 was known as one of the best fighters during the Second World War. Created and developed under supervision of Prof. Kurt Tank, an unquestioned genius among aircraft engineers, it set new standards that the contenders had to rise to from its introduction to the end of the war. Produced in a run of more than 20 000 copies of all versions, the Fw 190 was an important factor determining the power and efficiency of the Luftwaffe.

Development History

There were two main reasons for development of the fighter project known later as the Focke-Wulf 190. In the second half of the thirties, the arms race had accelerated and to the Reich Air Ministry (RLM) it was obvious that since only one kind of plane for the fighter mission had been developed for series production, the Messerschmitt Bf-109, the RLM could not guarantee that beyond the immediate future the Luftwaffe would still be in the lead position in world military aviation. Secondly, the RLM administration properly took into account the intelligence information that other major powers were working on, preparing for production of and trying to put into service at least two different types of modern fighters at once.

In this context, the Technical Department of RLM (Technisches Amt) developed specifications for the new fighter plane in the winter of 1937/38. During the spring of 1938 these specifications were sent to manufacturers including Focke-Wulf Flugzeugbau AG. As a result of work under the supervision of Prof. Kurt Tank and engineer Rudolf Blaser, a relatively small fighter of compact construction powered by radial air-cooled engine was developed.

RLM management was dominated by in-line water-cooled engines adherents, who did not share his vision of the new project. This aversion to radial engines was explained by the larger pressure drag in airplanes with this type of powerplant and the lower visibility during takeoff. Arguably, these disadvantages of radial engines can be countered by a number of other capabilities. Certainly, examples of successful aircraft in similar foreign designs existed and the radial engine's disabilities could be minimized by proper installation in the airframe. We can draw the conclusion without hesitation that no less important were informal influences favouring particular producers.

Probably, the Fw 190 fighter project would have been put on the shelf and been completely forgotten if a positive coincidence had not occurred. There were two main reasons for it. Most important was that the hopes for the Heinkel 100 and 112 fighters did not come to fruition and both of designs had not become satisfactory

designs. After initial acceptance each was withdrawn from production by the German aeronautical industry. The small number of He-112Bs produced were withdrawn from service in Luftwaffe units and sold to Romania. Some pre-series He-100D were used, with propaganda aims, as a new German fighter called the He-113. This misinformation project was a success and some RAF pilots reported He-113 kills.

The second reason for the Fw 190's fortunate success was that the two main, modern, liquid-cooled, in-line engines producers (i.e. Junkers in Dessau and Daimler-Benz in Stuttgart-Unterturkheim) could not, in the near future, produce a sufficient number of engines for all the airframe producers needs. At the commencement of the year 1940, it was clear that in spite of newly opened production lines, Daimler-Benz could with great trouble provide a barely adequate number of engines for the Bf-109 and Bf-110 fighters. As a result, all other engine orders besides Bayerische Flugzeugwerke (Messerschmitt) were cancelled. Because of this, Heinkel was forced to drastically reduce and later stop production of the He-111P bomber plane powered by the DB-601 engine and concentrate on production of the He-111H plane powered by the Jumo 211 engine produced by Junkers in quantities that met the requirements of the factories producing the He-111, Ju-87 and Ju-88 planes. Thus, partly from necessity, the fighter project presented by the Focke-Wulf Flugzeugbau AG in Bremen was accepted.

For later development of the Fw 190 fighter, a team was established under the supervision of engineer Rudolf Blaser, consisting of engineers Willi Kather, Ludvig Mittelhauber and factory construction office chief Andreas von Fahlman. During this time, Kurt Tank was deputy technical manager of the factory. After the first order from the RLM for four prototypes, work on the plane began rapidly and moved ahead quickly. First, a wooden mock-up was produced and during the autumn of 1938 production of prototypes started.

Fw 190 V1 (W.Nr.0001)

The new plane was a low wing, cantilever monoplane of semimonocoque metal construction with a fully retractable undercarriage. Previously, a new, 18 cylinder, air-cooled, double row radial engine, the BMW 139, was designed for the plane. This was a new BMW company design created by the joining of two BMW 132 nine-cylinder radial engines. This engine limited pilot's visibility from cockpit even more but rated at 1550 hp (1140 kW) it was about 1/4 more efficient than in-line engines such as the DB-601 or Jumo 211, and able to absorb more battle damage. This high engine power came with troubles with the cooling system that were resolved by introduction in the first prototype, Fw 190 V1, (W.Nr.0001) of a special propeller tunnel spinner covering the engine cooling air inlet in the cowling. The purpose of this cowling was to increase the cooling airflow over the engine while reducing the pressure drag.

The prototype was completed in the late spring of 1939, got the registration number D-OPZE and after introductory ground tests, flew for the first time on June 1, 1939 with Hans Sander, chief test pilot in the Focke-Wulf Company at the controls. In the first test flights, good plane handling characteristics were demonstrated (e.g. precision controls response) but aileron response could have been improved. The engine cowling was not as good as expected and the engine still had a tendency to overheat. This problem was so severe that even during low powered flight cockpit temperature rose to 55°C. In addition, the cockpit was not properly sealed and exhaust gases had leaked into it. The exhaust gas level was dangerous for the pilot and only his oxygen mask saved Hans Sander from asphyxiation during the first flight.

After the first series of tests, the plane was transferred to the main Luftwaffe research and development facility at Rechlin. This station also advised the RLM. During tests conducted in Rechlin, advantages and disadvantages of the new plane were discovered. The Fw 190 had shown a surprisingly high maximum speed during horizontal flight without armament at the altitude of 4000 m - 595 km/hr. Next, the plane was returned to the manufacturer for necessary modifications, especially in the cooling system.

In the case of radial engines there was only one possible solution to all cooling problems: to increase airflow over the engine. This was done by using a ten blade fan on the propeller shaft, in front of the engine, near the cowling. The tunnel spinner was replaced by a traditional spinner, covering only the airscrew hub of the VDM metal propeller. It was decided to use this after tunnel trials which had shown that the big spinner had not given proper airflow for efficient engine cooling and its influence on the reduction of pressure drag was not significant. Engine cooling was improved after this modification, but not to the expected level, and the engine still operated in the high range of acceptable temperatures. In the meantime, civil registration of the plane had been replaced by a military registration: at first WL-FOLY and later FO+LY.

Fw 190 V2 (W.Nr.0002)

In the autumn of 1939, the second prototype, Fw 190-V2, W.Nr.0002, FL+OZ was completed. It flew for the first time on October 31, 1939. This plane was powered by the engine with the fan. The plane's armament consisted of Rheinmetall-Borsig MG-17 7.9 mm machine guns and 13 mm MG 131 machine guns mounted in the wings near the fuselage. Firing tests were conducted on the firing ground of the Rechlin test facility in Tarnowitz.

After changing the registration codes to RM+CA (V1) and RM+CB (V2), both prototypes started the next part of the flight tests for evaluation of the effects of the modifications on the flight characteristics and engine cooling system on January 25, 1940. The Fw 190V2 was demonstrated for Herman Goering. He was impressed by the plane's performance, which doubtless influenced the faster than expected order of a series of 40 pre-production Fw 190A-0 aircraft. A short time later, on March 4, 1940, the V2 prototype had an accident and was badly damaged when during taxiing with Rohlf's at the controls it had flipped. Before this accident the plane had accumulated 50 flying hours.

Fw 190 V5 (W.Nr.0005)

In the meantime, the BMW factory was developing a more advanced, 14 cylinder, air-cooled, double-row, radial engine designated BMW 801. With the aim of concentrating only on the development of the BMW 801 engine, production of the BMW 139 engine was ended. The older engine was recognized as an unsuccessful design. The new engine had a similar diameter to its predecessor but was longer and heavier. The Fw 190 was developed for the lighter BMW 139 engine so the decision to use the BMW 801 forced the Blaser team to make big changes in the airframe.

At this time, two other prototypes, Fw 190V2 and V4 were in an advanced state of completion. However, because of the changes to the engine installation they were abandoned. All efforts were concentrated on the fifth prototype, Fw 190V5, which was built from the beginning to use the BMW 801 engine. Fw 190V3 was used as a source of spare parts and V4 was used for airframe strength tests. Because of the higher weight of the engine it was essential to stress-test the airframe. The testing was also important because of the large number of armament variants to be provided for the same airframe. A large part of the airframe structures were strengthened, the pilot's cockpit was moved back, which reduced the troubles with high temperatures, and gave more space for nose armament. The space in the cockpit was reduced, but thanks to the perfect layout of the instruments, that was not important. The rear cockpit fairing was modified by replacement of Plexiglas glazing with duralumin plate fillets. The only negative side effect of the cockpit move was the further worsening of the pilot's view during taxiing. The vertical tail shape was also changed and its tab was replaced by a metal trim strip adjustable only on the ground.

In view of the expected huge rise (more than 25%) in plane weight main gear were strengthened. New, stiffer undercarriage struts were introduced, the retraction mechanism was changed from hydraulic to electrically

powered, wheels of a bigger diameter were used and new more simple shields were added. To make the needed space for the bigger undercarriage, wheel arches in the wing were enlarged by moving forward the part of the leading edge situated in the wing root. The Fw 190-V5, W.Nr.0005, powered by a BMW 801 C-O engine flew for the first time in the early spring of 1940.

Fw 190 V5g

After comparative tests with the V1 prototype, it was seen that the weight increase had a negative influence on airplane characteristics and it would get worse after armament and military equipment installation. It was essential to redesign the wing planform because increased wing area could markedly improve plane characteristics. This change was made by increasing the wingspan and moving the leading edge forward, increasing the chord. In this way, the new wing was designed with an area increased to 18.30 sq. meter with a span of 10.506 m. Wing profile was not changed. A new, enlarged, 3650 mm span horizontal tail was also developed. Subsequently, the area of vertical tail was also increased by moving the leading edge forward. The new wing was planned to be tested on the one of the new prototypes.

However, in August 1940, during a landing with an accidentally open engine cowling panel, Hans Sander damaged the V5 prototype's wing. The decision was made to apply the new wing to this plane instead of one of the prototypes under construction. The modified prototype got the designation V5g (g=grosser - bigger) and to distinguish one version from another, the unmodified prototype was designated in documents as V5k (k=kleiner - smaller). As proven by flight tests, introduction of the bigger wing reduced top speed by only 10 km/hr, but other characteristics, especially climb rate, were significantly increased.

Fw 190 A-0

In October 1940, the first of 40 Fw 190A-0 on order came from the production line. They received designations characteristic of prototypes: Fw 190V6 W.Nr.0006 and Fw 190V7. Both had the old wing because production started before introduction of the new wing and the first nine airframes were so advanced that the decision was made to introduce the modification from W.Nr.0015 plane. So, the two prototypes and seven of the Fw 190A-0 had the smaller wing. Simultaneously with the new wing, a bigger horizontal tail was introduced. However, the enlarged vertical tail not applied until later, from the A-2 version.

The Fw 190 V6 was used for characteristics and performances tests. Fw 190V7 was used for testing of a heavier armament consisting of two 20 mm Rheinmetall-Borsig (Oerlikon licence) MG FF cannons (in addition to the four MG 17 machine guns), mounted in the wing centre section just aft of the main gears attachment point. After firing tests at Tarnewitz, this armament was standardized for the Fw 190A-1 planes until the introduction of the 20 mm Mauser MG 151/20 cannons in place of the wing mounted MG 17. This became possible after the introduction of the new synchronizer (for firing through the propeller arc) that had not been ready for the series production.

Starting in November 1940, deliveries of the Fw 190A-0, with BMW 801 C-1 engine in place of pre-series C-O, began with the W.Nr.0010 plane. From the 40 planes ordered, only 28 were built (to W.Nr.0035), most of which were later converted to prototypes used for various armament configuration tests. On some planes new engines and special equipment were tested; e.g. in the summer of 1943 on the Fw 190A-0 (W.Nr.0022, SB+IE) an ejection seat was tested in Langenhagen under the supervision of Hans Sander. It was ejected by a powder charge. These planes received variously the modification designation V used for prototypes or the supplemented letter designation U (*Umrüstbausatz*). There are a large number of U modifications of Fw 190A-0 (from U1 to U13) known of various A-0 airframes. Because of limited space in this article it's impossible to present each modification in detail.

Before beginning the planned series production of the first Fw 190A-1 it was necessary to finish up details of the plane and get some experience in maintenance and service use in line units. Among the desired experience was operation from operational airfields and preliminary training of pilots and support personnel.

Because of this II./JG 26 squadron pilots and maintenance personnel team were taken from their unit and formed the basis of experimental squadron (Erprobungsstaffel) 190, formed in March 1941. The unit was commanded by technical officer Oberleutnant Otto Bahrens and received six Fw 190A-0 (W.Nr.0013, 0014, 0018, 0021, 0022). The first training was conducted under the supervision of specialists from the Rechlin establishment on these planes. Flights were made from Rechlin-Roggenthin airfield.

Later this unit was transferred to Le Bourget near Paris. During these intensive tests frequent engine failures occurred. The BMW 801 engine still had a tendency to overheat, especially the back bank of cylinders. Overheating occurred generally on the ground during long runs at low power when the flow of cooling air was reduced to a minimum. Troubles were encountered with the automatic control unit (Kommandogerat) of the BMW 801 engine, with leaks in the fuel and lubricating pipe system and also with fast wear of the spark plugs. Troubles with the constant speed VDM propeller continued. During tests it was discovered that engine cowlings had a tendency to open during flight because of weak cowling lock construction.

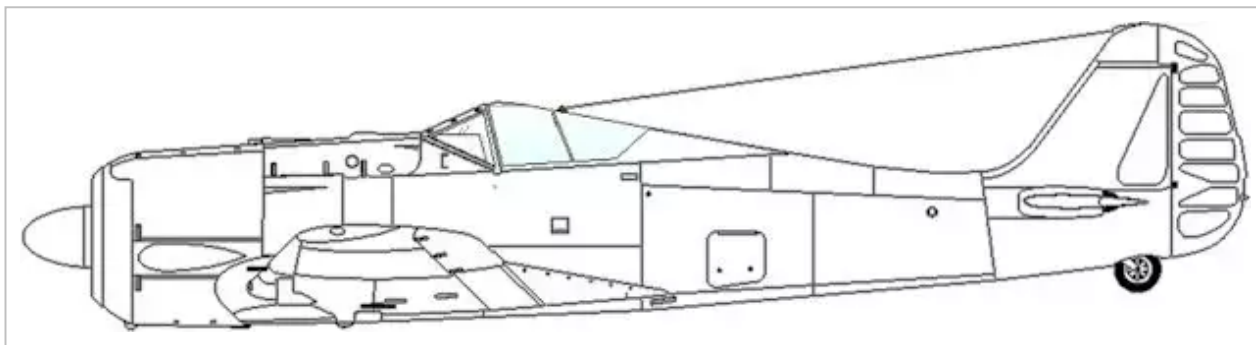
A more dangerous surprise was with the emergency ejection of the rear cockpit canopy, especially during flights with speeds over 250 km/hr, that was caused by airflow pressing the canopy to the fuselage. This problem was solved by addition of a small powder charge used for firing of canopy. The large number of such serious defects was the reason that a special RLM Commission came to Le Bourget and ordered the test program to stop until all defects would be remedied. After about 50 modifications, the RLM approved Fw 190 deployment to Luftwaffe service units.

The RLM placed an order with the Focke-Wulf factory for 100 Fw 190A-1 planes. Because of plans to increase the order it was obvious that the Fw 190 program should include factories producing the plane on licence. Initially, production lines in Focke-Wulf Bremen and Marienburg factories were prepared. The first Fw 190 planes produced on licence would be made at the Arado factory in Warnemünde and at the AGO factory in Oschersleben.

Summary of features

Fw 190A-0 could be distinguished by the following external features:

- No cooling slots behind the engine
- Small-chord wings (first fourteen aircraft only)
- Cowling cheek blisters with symmetrical teardrop shape.
- Initial short propeller spinner
- Upper cowling panel partially overlapping the (unarmoured) forward oil ring.
- Unbraced armoured headrest
- Inner undercarriage doors open on the ground
- Armament of MG 17s only, both in the fuselage and wings, recognizable by lack of protruding barrels or blisters in inboard wing positions
- No undercarriage indicator pins



Fw 190 A-0 (large wing)

Fw 190 A-1

The first Fw 190A-1 planes came off the production line at the Focke-Wulf Marienburg factory in June 1941. During August the output rose to 30 planes a month. During this month, deliveries of licence production from Arado Warnemünde factory started and were joined in October by deliveries from AGO Oschersleben so that by the end of September, 82 planes were delivered to Luftwaffe units and by end of October all 102 planes ordered were built.

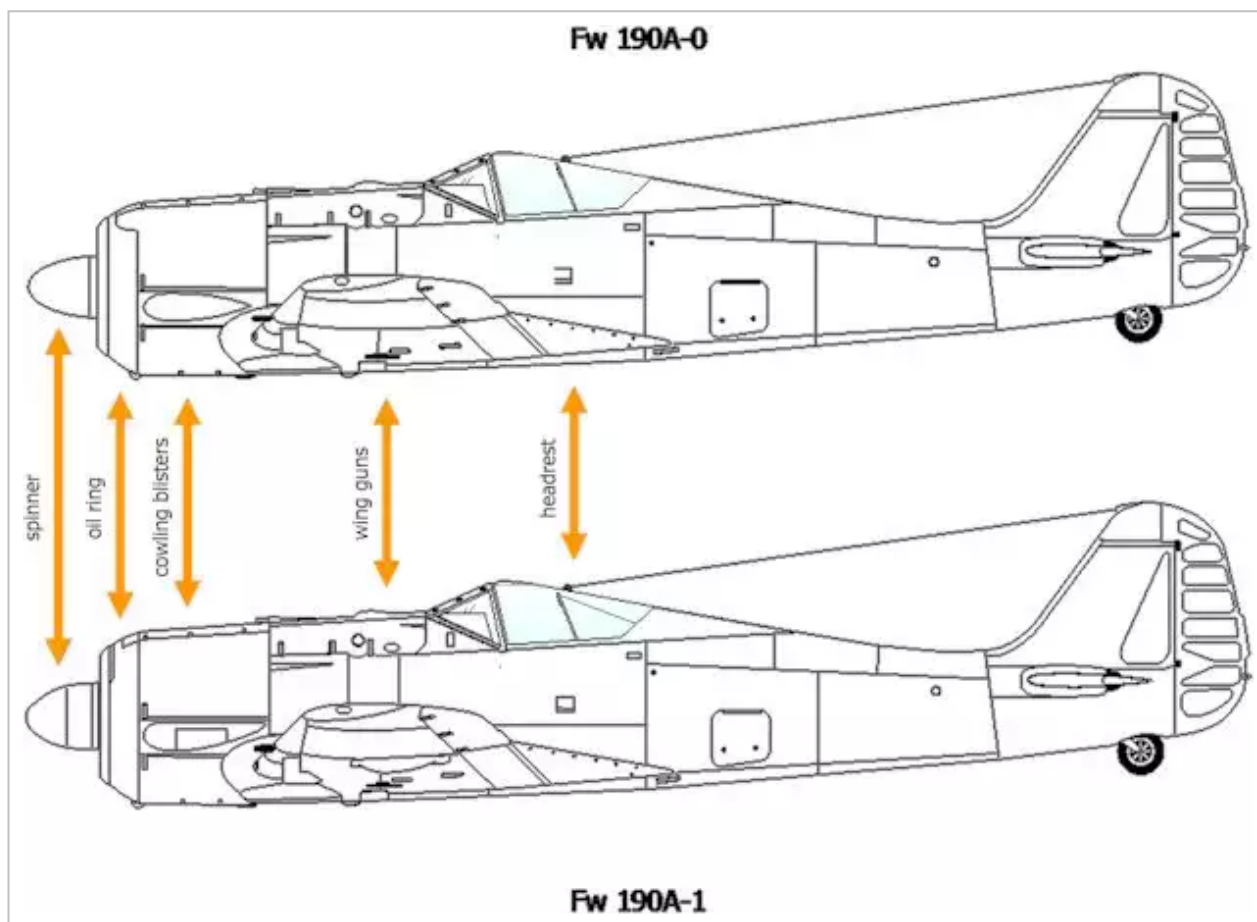
In the A-1 series planes', oil tank and oil cooler armour became standard.

On one of the aircraft, designated as Fw 190A-1/U-1, a new engine was mounted: the BMW 801D-2. Some of the Fw 190A-1, like some of the A-0, got a FuG 25 IFF device in addition to the radio transceiver set FuG 7. In the Technical Office, reports concerning the Fw 190A-1 main problems still were concentrated on engine overheating and fires.

Summary of features

Fw 190A-1 could be distinguished by the following external features:

- No cooling slots behind the engine
- Cowling cheek blisters with lop-sided asymmetrical shape
- Final shape of the propeller spinner, longer than the A-0 spinner.
- Armoured oil ring with straight cowling joint line
- Armoured headrest braced with two rods
- Inner undercarriage doors closed on the ground
- Fuselage armament of MG 17
- Wing armament of MG 17s in inboard positions (with no protruding barrels or wing root blisters) and MG FF in outboard positions, with underwing bulges.
- No undercarriage indicator pins



Fw 190 A-0 to A-1 version comparison

Fw 190 A-2

The Fw 190A-2 was the second series variant and was powered by the modified BMW 801C-2 engine. In this model, problems with the engine rear bank of cylinders overheating were finally solved by the simple introduction of a ventilation slot on the two sides of the engine cowling. The same slots were also introduced in the Fw 190A-1 in service.

In place of wing mounted MG 17 machine guns, the Mauser MG 151/20 E 20 mm cannons were used because of delivery of the new synchronizers. This replacement produced a small convex bulge of the upper armament covers in the wing roots. In place of the Revi C/120, a modern Revi C/12D gunsight was used. As a result of modifications, the aircraft's empty weight rose to 3850 kg. Important modification also included a new, more efficient, electrical gear retraction mechanism.

The Fw 190 airframes, including version A-2, had underfuselage hard points for an ETC 501 bomb rack but there is no indication whether it was mounted in the A-2 version or not. One plane (W.Nr120315, CM+CN), was fitted experimentally with an automatic pilot device and was redesignated Fw 190A-2/U-1. In some sources there is information about a A-2/U-3 reconnaissance version.

420 Fw 190A-2 planes were produced.

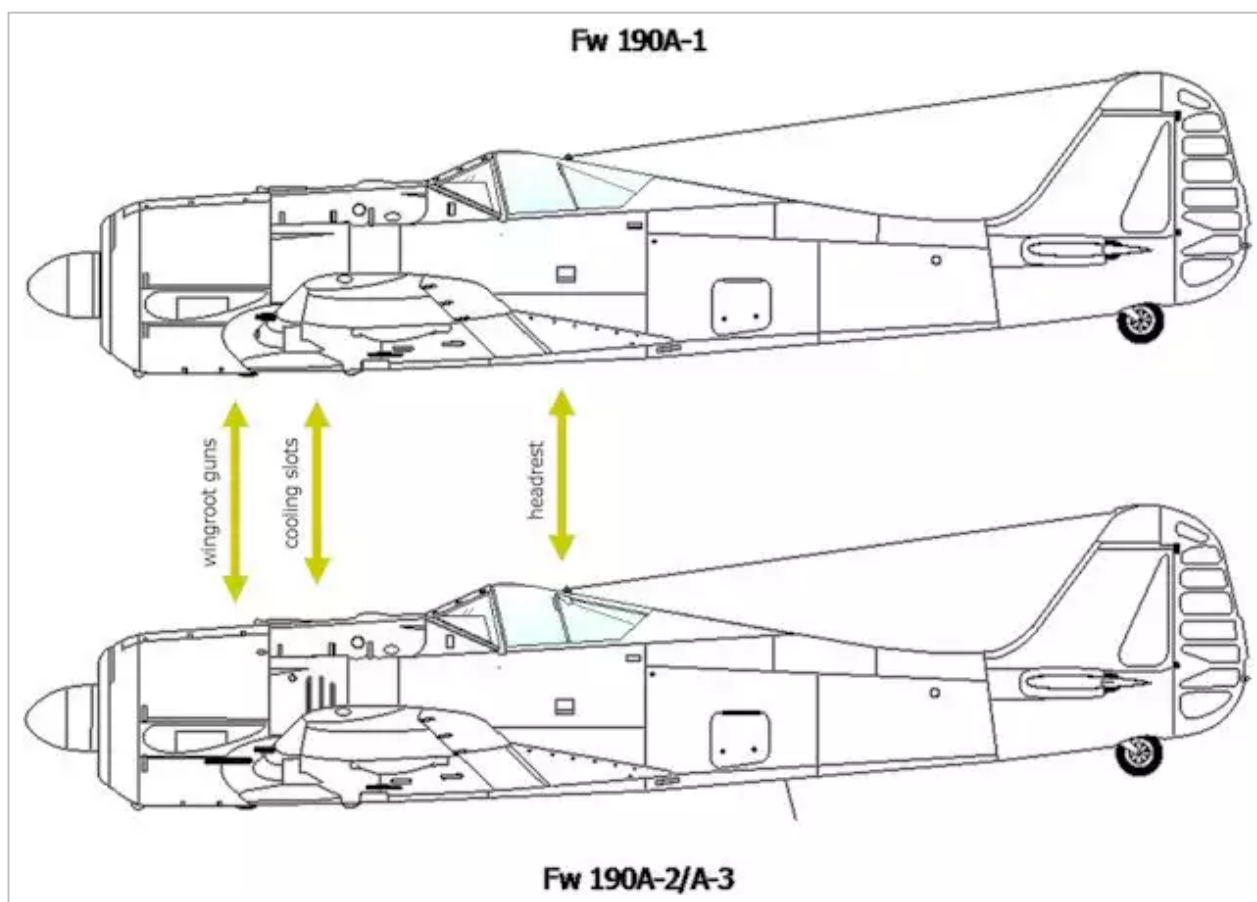
Summary of features

Fw 190A-2 could be distinguished by the following external features:

- Fixed cooling slots behind the engine
- Cowling cheek blisters with lop-sided asymmetrical shape
- Final shape of the propeller spinner

- Armoured oil ring
- Armoured headrest braced with a single, rectangular cross-section strut
- Fuselage armament of MG 17
- Wing armament of MG 151 in inboard positions, with protruding barrels and wing root blisters, plus MG FF in outboard positions, with underwing bulges. Note that the outboard armament was often removed and bulges replaced with flat panels.
- B4 fuel triangles at fuel filling points
- Undercarriage indicator pins protruding from upper wing surface

Visually this variant can be easily confused with the A-3, see below.



Fw 190 A-1 to A-2/A-3 version comparison

Fw 190 A-3

Beginning in the spring of 1942, series production of a more powerful engine version BMW 801D-2 that replaced previous versions in the Fw 190 fighter created a new plane version designated as Fw 190A-3.

The increase in the BMW 801D-2 engine power (to 1730 kW) was due to a higher compression ratio and higher pressure two-speed compressor. A higher compression ratio and charging pressure made it necessary to use high-octane (96 octane) C3 fuel in place of B4 (87 octane) fuel. Armament of standard Fw 190A-3 planes was the same as in the previous version.

Starting from this version, A series airframes were widely used in a big development program with the aim of finding the optimum armament and equipment mix that made it possible to broaden the operational capabilities of the plane beyond fighter operations. The largest part of these modifications were in the form of *Umrüstbausatz* kits, but some did not have special designations and can be recognized only from photographs. The total number of such modified planes is unknown. The best known are the Fw 190A-3 with an under-

fuselage mounted bomb rack ETC 501 for carriage of 500 kg of bombs (1x500 kg, 2x250 kg or 4x50 kg on the ER4 adapter) or an external drop tank of 300 litre capacity for long range fighters.

Some planes used only for fighter operations (without bomb racks) had a reduced armament by removal of wing mounted MG FF cannons, which was not reflected in a designation.

In addition to the previously described modification kits designed for the Fw 190A-3 and later versions other *Umrüstbausatz* kits were prepared; but we must admit that most were unrealized projects or experimental planes that existed only in one or two copies. For example:

- **Fw 190A-3/U1** - only one built, experimental plane (W.Nr. 130270, PG+GY) with engine mount extended for 15 cm, which was used as a prototype of the A-5 version
- **Fw 190A-3/U2** - underwing mounted unguided missile RZ 65 73 mm racks tested on the plane W.Nr. 130386
- **Fw 190A-3/U3** - reconnaissance fighter with Rb 50/30 cameras mounted in the fuselage; armament reduced by removing MG FF cannons, one built
- **Fw 190A-3/U4** reconnaissance fighter with two Rb 12.5/7x9 cameras mounted in the fuselage and camera gun EK 16 or miniature camera Robot II in the leading edge of the left wing root; armament as in U3 version, additional under fuselage mounted ETC 501 bomb rack with stabilizer strips for 300 litre fuel tank, twelve planes built
- **Fw 190A-3/U7** - attempt to create a new high altitude fighter, with reduced weight, with armament consisting of only two MG 151/20 E cannons. Only three planes built (W.Nr. 130528, -530 and -531); they can be recognized by external charger air inlets on both engine cowling sides.

Summary of features

Fw 190A-3 was externally identical to the A-2, which makes the two variants extremely difficult to tell apart. The only positive visual clues could only be seen up-close: the C3 fuel triangles and the *Werknummer*.

- Fixed cooling slots behind the engine
- Cowling cheek blisters with lop-sided asymmetrical shape
- Final shape of the propeller spinner.
- Armoured oil ring
- Armoured headrest braced with a single, rectangular cross-section strut
- Fuselage armament of MG 17
- Wing armament of MG 151 in inboard positions, with protruding barrels and wing root blisters, plus MG FF in outboard positions, with underwing bulges. Note that the outboard armament was often removed and bulges replaced with flat panels.
- C3 fuel triangles at fuel filling points
- Undercarriage indicator pins protruding from upper wing surface

Fw 190 Aa-3

In Autumn 1942, a political decision diverted 72 new aircraft off the production line for delivery to Turkey in an effort to keep this country friendly with the Axis powers. These were designated Fw 190Aa-3 (a=ausländisch-foreign) and delivered between October 1942 - March 1943.

The Turkish aircraft had the same armament as the A-1 version e.g. 1x4 MG 17 machine guns and 2x1 MG FF cannon, and for obvious reason there was no FuG 25 IFF device in the radio equipment.

Fw 190 A-4

In July 1942, the A-3 was replaced on the production lines by the newer Fw 190A-4 version. The main difference was an BMW 801 D-2 engine adapted to use with a MW 50 system for short period engine power increase by injection of a water-methanol (methyl alcohol CH₃OH) mixture in the proportion of 1:1. In this way it was possible to raise engine power to 2100 kW for 10 minutes, after which a high probability of engine failure prevented longer use. Due to delays in MW 50 device production, this system was not mounted on the Fw 190A-4 engines, which had the capability to accept this system. It was not used and only A-8 and later series planes would use the advantages of this invention.

Another difference in the A-4 variant was the replacement of the FuG 7a radio set by the more modern FuG 16z. A less important change was that the vertical line antenna mount was placed on the fin; this made it easier to distinguish between A-4 and A-3 versions. In the case of the A-2 and A-3 versions, it is often difficult to tell them apart.

During production, in some Fw 190s another modification was applied. In place of the ventilation slots, engine cowling shutters controlled from the cockpit were installed. The pilot could precisely control the engine temperature by regulation of the shutters.

Most Fw 190A-4 planes were used with reduced armament, without MG FF cannons. Trials with different variants of armament and equipment, generally with *Umrustbausatz* kits produced the following versions:

- **Fw 190A-4/U1** - bomber-fighter with an under-fuselage mounted ETC 501 bomb rack and reduced armament (without MG FF cannons). As a result of small deliveries of BMW 801 D-2 engines in the autumn of 1943, several dozens of these planes got older C-2 version engines
- **Fw 190A-4/U3** - bomber-fighter with armament as in the U1 version, but with BMW 801 D-2 engine. Planes for night operation got a landing light, mounted in the leading edge of the left wing root. Designation was later changed to F-1 and in the future the plane was developed as a new attack Fw 190F version
- **Fw 190A-4/U4** - reconnaissance fighter with two Rb 12.5/7x9 cameras and without MG FF cannons
- **Fw 190A-4/U8** - long range fighter-bomber with two drop tanks of 300 litre capacity each, mounted under the wings (on the VTr-Ju 87 racks produced by Weserflug company, with duralumin fairings); bombs were placed on the under-fuselage ETC 501 rack. In an attempt to reduce weight, only two MG 151/20 E cannons were retained. This modification was a prototype of a new fighter-bomber Fw 190G version and its first variant (G-1) simultaneously. There also existed a transitional variant similar to the U8 (probably in one copy) with modernized V. Mtt-Schlos type racks for underwing fuel tanks; armament: 2x1 MG 17 and 2x1 MG 151/20E.

In addition to the *Umrustbausatz* modifications, from the Fw 190A-4 planes, easier to install *Rustsatz* (R) kits were produced. Sometimes, the set could be mounted in the field workshops but the plane could also be previously prepared in the factory for such kit application. We must refute the myth of the exceptional ease of application and interchangeability with other kits in particular planes, especially since some of them were as complicated as the U kits. More than once, classification to U or R group was just for convenience, later most of the U versions was redesignated as R versions.

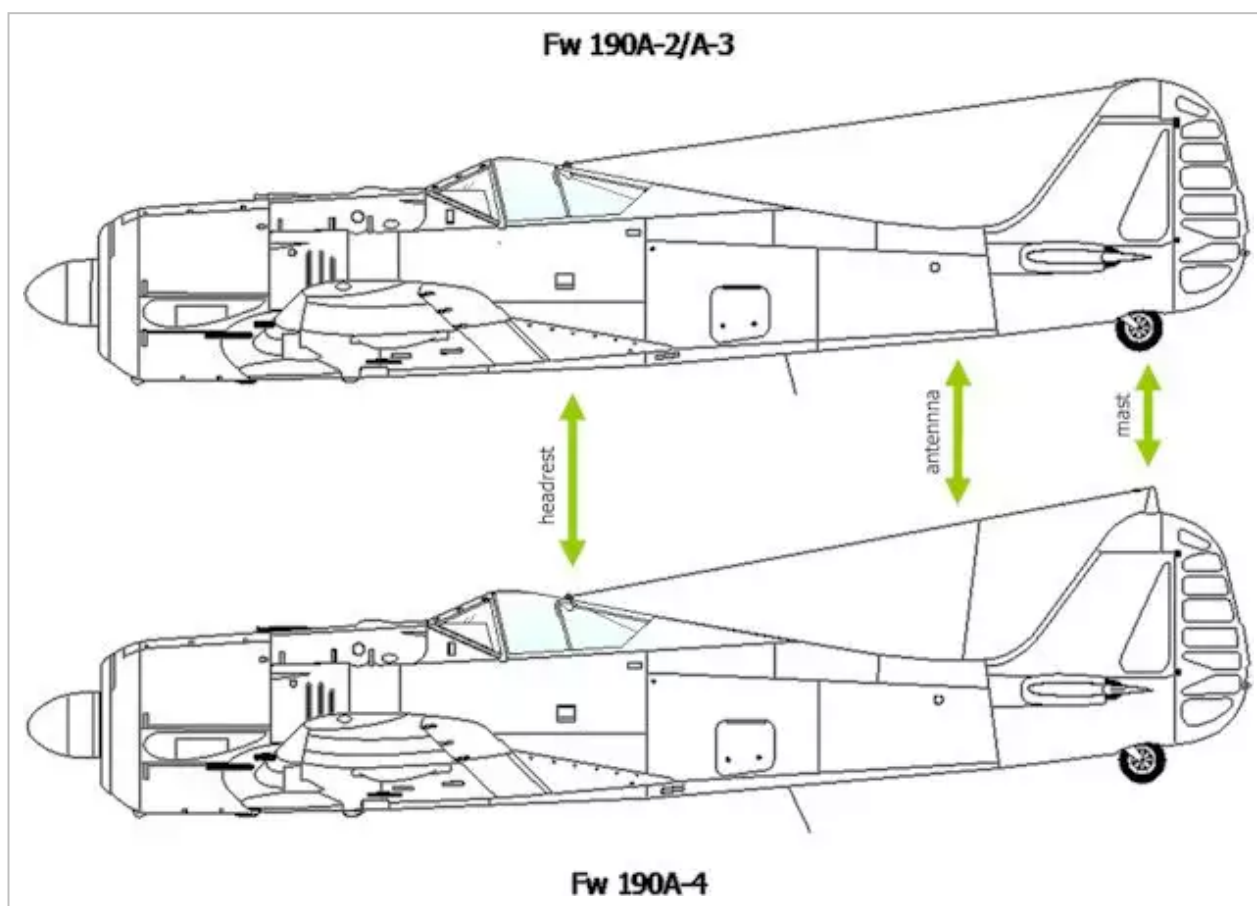
The first *Rustsatz* kit widely used was a two tube air-to-air missile launcher W.Gr. 21 210 mm destined for destroying defence formations used by USAAF bomber aircraft. Planes so equipped were designated **Fw 190A-4/R6**. Some authors have told about the existence of a **Fw 190A-4/R1** variant, with the FuG 16 ZE radioset and Morane type antenna installed under the left wing. Very small numbers of such planes existed, but it has not been fully confirmed that it had its own destination in U or R kits.

In consideration of increasing number of planes ordered the A-4 production was expanded to additional factories and companies - among others Fiesler in Kassel-Waldau. Total production of Fw 190A-4 planes came to more than 900.

Summary of features

Fw 190A-4 could be distinguished by the following external features:

- Fixed cooling slots behind the engine (except for final production batches which were fitted with adjustable slots of the A-5 version)
- Cowling cheek blisters with lop-sided asymmetrical shape
- Final shape of the propeller spinner.
- Armoured oil ring
- Wide armoured headrest with cushion, braced with a single, rectangular cross-section strut
- Fuselage armament of MG 17
- Wing armament of MG 151 in inboard positions, with protruding barrels and wing root blisters, plus MG FF in outboard positions, with underwing bulges. Note that the outboard armament was often removed and bulges replaced with flat panels.
- Small radio antenna mast at the top of the fin
- T-shaped antenna wire



Fw 190 A-2/A-3 to A-4 version comparison

Fw 190 A-5

On the basis of data collected during tests of the experimental Fw 190A3/U1, Blaser's designer team became convinced that the planned additional armament would move the plane centre of gravity forward. The best solution to offset this was to move the engine forward. This was done with a 15 cm steel tube engine mount extension. This change (new engine mount) was introduced on the all production lines. It also led to an increase

of the plane length to 9.10 m and gave life to the new Fw 190A-5 variant that from November 1942 replaced previous the A-4.

The A-5 also introduced small changes in the equipment (e.g. a new electrical artificial horizon and modernized oxygen respirator, and wide use of the FuG 25a IFF device). Radio equipment in the rear fuselage section was slightly moved back and the compartment cover was enlarged. Standard armament did not change and it remained 2x1 MG 17, 2x1 MG 151/20 E, 2x1 MG FF. Proper airframe design provisions meant that the Fw 190A-5 plane was prepared from the beginning to accommodate a large number of *Umrüstbausatz* kits:

- **Fw 190A-5/U1** - similar (with extended engine mount) to A-4/U1 airplane, temporary powered by a BMW 801 C-2 engine
- **Fw 190A-5/U2** - long range fighter-bomber plane adapted to the night operation; it was fitted with anti-reflective strips over engine exhaust pipes on both sides. Mounted under the fuselage, an ETC 501 bomb rack for 250 or 500 kg bombs was added, additional fuel was placed in two external tanks of 300 l capacity each mounted under the wings on V.Mtt-Schloss (*Verkleidetes Messerschmitt Schloss*) shackles. In the wing leading edge an EK 16 camera and a doubled landing light were installed; the MG FF cannons were deleted in this modification. Based on this version, a night fighter with FuG 217 Neptun J-2 radar was built. However, number of planes built is unknown; the only known specimen of this variant had no bomb rack, camera or landing lights.
- **Fw 190A-5/U3** - fighter-bomber with the ETC 501 bomb rack and without MG FF cannons. After a change of designation this was serially produced as Fw 190F-2. There was also a desert variant with dust filters designated as A-5/U3/tp (F-2tp).
- **Fw 190A-5/U4** - reconnaissance fighter fitted with two Rb 12.5/7x9 mm cameras and reduced armament (2x1 MG 17 and 2x1 MG 151/20 E); produced also in a desert variant designated A-5/U4/tp.
- **Fw 190A-5/U8** - long range fighter-bomber with two underwing mounted external fuel tanks (capacity 2x300 litres) and an under-fuselage mounted ETC 501 bomb rack; armament consisted of only two MG 151/20 E cannons. It was developed into Fw 190G-2 plane and later serially produced.
- **Fw 190A-5/U9** - experimental plane with heavier armament, it was fitted with 2x1 MG 131 13 mm machine guns in place of MG 17 guns in the fuselage; in the wings the MG FF cannons were replaced by MG 151/20 E cannons. Only two were built (W.Nr. 150812, and 150816). The W.Nr 150816, BH+CF plane was later used as test bed for more powerful BMW 801 engine versions.
- **Fw 190A-5/U10** - experimental plane (only two built W.Nr. 150861 and 150862). It was used as a test bed for a strengthened wing adapted to serial application of heavier armament, generally 20 and 30 mm cannons. Armament consisted of 2x1 MG 17 in the fuselage and 4x1 MG 151/20 E in the wings, later become a standard for A-6 version.
- **Fw 190A-5/U11** - attack aircraft with two 30 mm Rheinmetall-Borsig MK 103 cannons mounted in underwing pods; only one plane existed (W.Nr. 151303, RG+ZA). This kind of armament became later standard as *Rustsatz 3* (R3) kit.
- **Fw 190A-5/U12** - proposal for heavier armament consisting of six MG 151/20 E cannons. They were mounted under the wing in two additional WB 151/20 pods with two cannons in each pod; complete armament could be 2x1 MG 17, 2x1 MG 151/20 E and 2x2 MG 151/20 E. It was also a model for *Rustsatz 1* (R1) kit for Fw 190A; two planes (BH+CC, W.Nr. 150813 and BH+CD, W.Nr. 150814) with such armament were completed.
- **Fw 190A-5/U13** - three prototypes (V42, W.Nr. 151083, GC+LA; V43, W.Nr 150817, BH+CG and V44, W.Nr. 150855) built, long range fighterbomber with two underwing V.Fw Trg. (*Verkleideter Focke-Wulf Trager*) bomb racks, adapted for carriage of 300 litre capacity fuel tank or 250 kg bomb. The plane was equipped with an automated pilot device and application of knives for barrage balloons lines cutting on the wing leading edge was considered; one plane was experimentally equipped with a lacunar exhaust flame

damper (GC+LA?). Armament consisted of two MG 151/20 E mounted in the wing roots. Plane was later produced under designation Fw 190G-3.

- **Fw 190A-5/U14** - torpedo plane adopted for transportation of one aerial torpedo LT F 5b mounted on the under-fuselage ETC 502 rack; plane had an enlarged fin (similar to Ta 152) and heightened tail wheel strut to eliminate the possibility ground contact by the torpedo; armament consisted of only 2x1 MG 151/20 E cannons. Two planes were tested TD+SI, W.Nr. 150871 and TD+SJ, W.Nr. 150872.
- **Fw 190A-5/U15** - experimental plane adopted for transportation of the unpowered Blohm und Voss 246 Hagelkorn (LT 950) flying bomb for destroying of naval targets, radio controlled by an Askania company produced ALSK 121 device. Extensively tested during second half of the 1943, later in the test program an A-8/F-8 series plane (W.Nr 130975) was also included, but tests were cancelled shortly after it was found that because of poor construction, the BV 246 had frequent defects.
- **Fw 190A-5/U16** - prototype of a fighter plane with heavier armament (W.Nr. 130975), for destruction of bomber formations. The MG FF cannons were replaced by heavier 30 mm cannons Rheinmetall-Borsig MK 108. This armament was later standardized as the *Rustsatz 2* (R2) kit.
- **Fw 190A-5/U17** - fighter-bomber with under-fuselage mounted ETC 501 bomb rack and four underwing mounted ETC 50 bomb racks (2x2 50kg bombs). With A-5/U3, this variant was a model for the Fw 190F attack aircraft; basic version for the later Fw 190F-3/R1 variant. Armament was standard without MG FF cannons. Also used in a desert modification.

Finally, in response to the intensifying of the Allies' bombing, numerous **Fw 190A-5/R6** planes belonged to units operated in Reich defence system (Reichsverteidigung) have been found.

As an interesting detail, we must mention the existence of a Fw 190A-5 plane with external turbosupercharger inlets. The engine cowling with these inlets was proposed as an alternative, but was not used widely because of higher induced aerodynamic drag.

There exists also a photograph of an A-5 fighter from a II./JG 54 unit deployed to the Eastern Front temporary adopted to bomber missions by four (2x2) under-fuselage mounted ETC 50 bomb racks.

In the autumn 1943, one A-5 plane (W.Nr. 157347) were used as the V45 prototype for tests of the GM 1 system that by injection of pressurized nitrogen monoxide as an oxidant to increase engine efficiency at high altitudes. This device was later standardized as the *Rustsatz 4* (R4) kit.

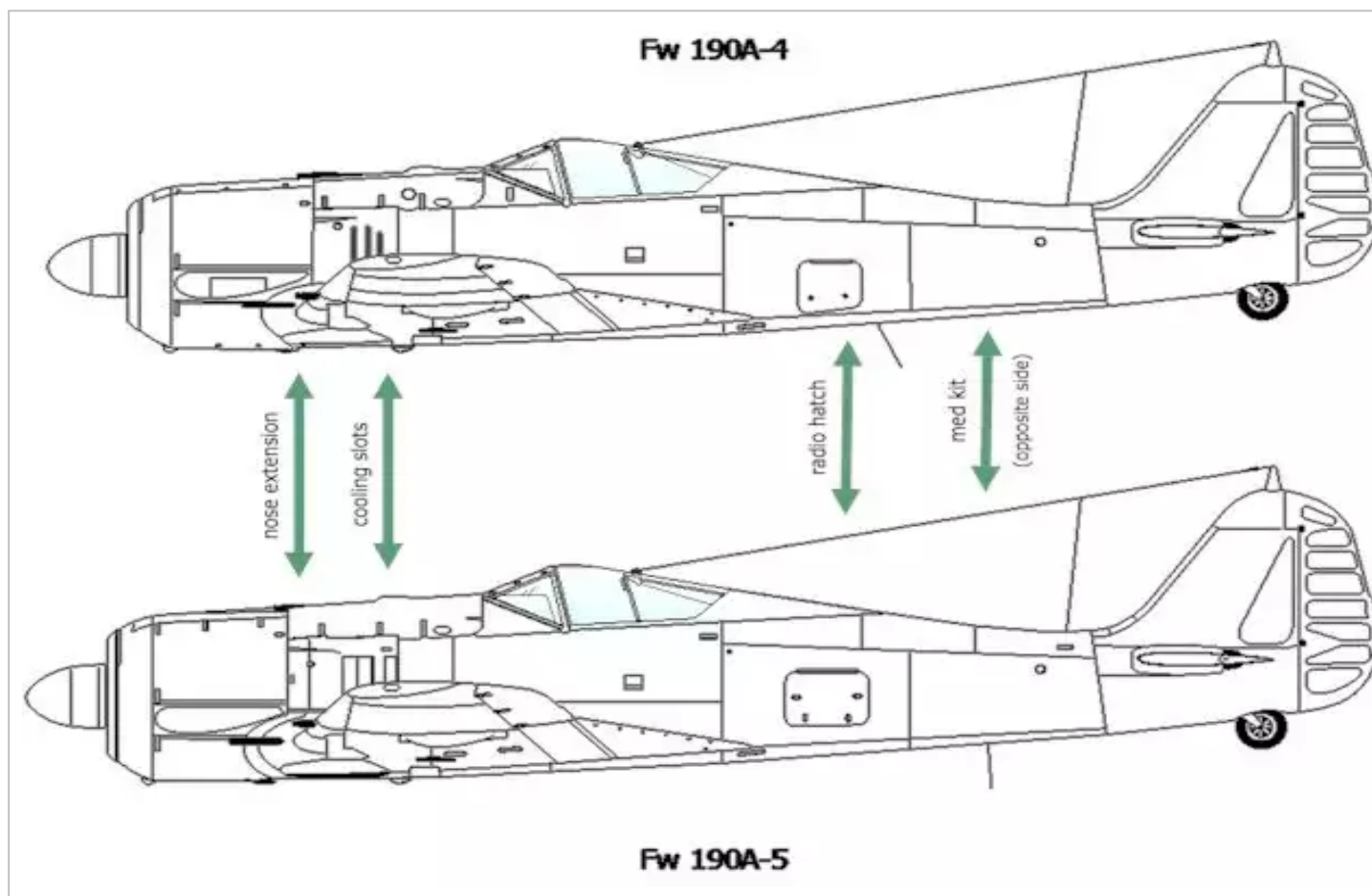
In connection with the planned 1765 kW (2400 KM) BMW 801 F engine production to be used for A-9 and A-10 series planes, in December 1943 Focke-Wulf was ordered to prepare an A-5 airframe (W.Nr. 410230) as the V34 prototype for tests with the experimental BMW 801 V 85 engine; however, we have no evidence that the engine was supplied and mounted on that particular Fw 190 plane. Serial production of BMW 801 F engines never started and A-9 series planes had TS/TU engines mounted.

Summary of features

Fw 190A-5 could be distinguished by the following external features:

- Adjustable cooling slots behind the engine
- Long-nose cowling
- Wide armoured headrest with cushion, braced with a single, rectangular cross-section strut
- Fuselage armament of MG 17 with "straight" upper cowling
- Wing armament of MG 151 in inboard positions, with protruding barrels and wing root blisters, plus MG FF in outboard positions, with underwing bulges.
- Small radio antenna mast at the top of the fin
- Large rectangular radio hatch in port rear fuselage
- First aid kit hatch in starboard rear fuselage moved aft behind the canopy

Beside these features, solid wheel hubs appeared on some aircraft, perhaps in conjunction with some of the R kits or as result of field upgrades.



Fw 190 A-4 to A-5 version comparison

Fw 190A-6

The main difference of this variant from the previous was the standardized mounting of MG 151/20 E cannons. For this to be possible, it was necessary to redesign the wing for the heavier cannon mount and carriage of a larger ammunition box. Experience obtained during Fw 190A-5/U9 and U10 tests was incorporated in this type. Reinforcements and sockets were made in such a way that serially produced wings would be adapted for internal installation of either 20 or 30 mm cannon ammunition boxes or for installation of underwing armament with the ammunition box installed inside the wing. Proper electrical connections were also provided for the cannons.

The manufacturer started serial production of the FuG 16 ZE radio with an additional radial antenna for radio navigation purposes placed under the rear fuselage. This antenna was used also in the some A-5 planes.

Standard Fw 190A-6 armament consisted of 2x1 MG 17 machine guns and 4x1 MG 151/20 E cannons. Some planes mounted ETC 501 bomb racks for transportation of an additional fuel tank (300 l capacity), these were not distinguished by separate designation.

Unlike other versions, models with different armament or equipment received designations as *Rustsatz* kits. A lot of these designations had not been previously used:

- **Fw 190A-6/R1** - attack fighter with armament increased to six cannons and two machine guns (2x1 MG 17, 2x1 MG 151/20 E and 2x2 MG 151/20 E), by mounting of the WB 151/20 underwing pylons with cannons. This modification was based on the A-5/U12 version. In spite of previous plans, only a few

planes with this armament were in Luftwaffe service units (e.g. in JG 11).

- **Fw 190A-6/R2** - equivalent to the A-5/U6 model, armament: 2x1 MG 17 machine guns, 2x1 MG 151/20 E and 2x1 MK 108 cannons; not serially produced.
- **Fw 190A-6/R3** - equivalent to the A-5/U11 model, armament: 2x1 MG 17 machine guns, 2x1 MG 151/20 E and 2x1 MK 103 cannons; not serially produced.
- **Fw 190A-6/R6** - plane with standard armament and the addition of W.Gr. 21 missile launchers.
- **Fw 190A-6/R2/R6** - plane adapted for destruction of bomber formations, with increased armament and missile launchers, only one prototype, V51 (W.Nr. 530765), built. Total armament consisted of 2x1 MG 17, 2x1 MG 151/20 E, 2x1 MK 108 and 2x1 W.Gr. 21.
- **Fw 190A-6/R7** - armoured fighter with standard armament; in service with Reich defence units; often with additional 300 l capacity fuel tank mounted on the ETC 501 bomb rack.
- **Fw 190A-6/R8** - the *Rustsatz* kit made by application of both R2 (MK108) kit and R7 kit (armour), often machine guns in the fuselage were removed; efficient as a fighter against American bomber aircraft.
- **Fw 190A-6/R11** - all weather and night fighter, with anti-reflection strips, landing light, autopilot device PKS 12 and heated windscreen windows. Some planes mounted a FuG 217 Neptun J-2 radar. Generally, these planes used dropable fuel tanks mounted on the ETC 501 bomb rack.
- **Fw 190A-6/R12** - the *Rustsatz* kit created by application of both R2 and R11 kits. Apart from this modification, one or two planes experimentally mounted more the higher power BMW 801 TS engine with three blade wooden VDM propeller with blades of larger area. The aircraft with code letters VO+LY had an additionally armoured radiator and oil tank; it's armament was reduced to two MG 151/20 E cannons mounted in the wing roots.

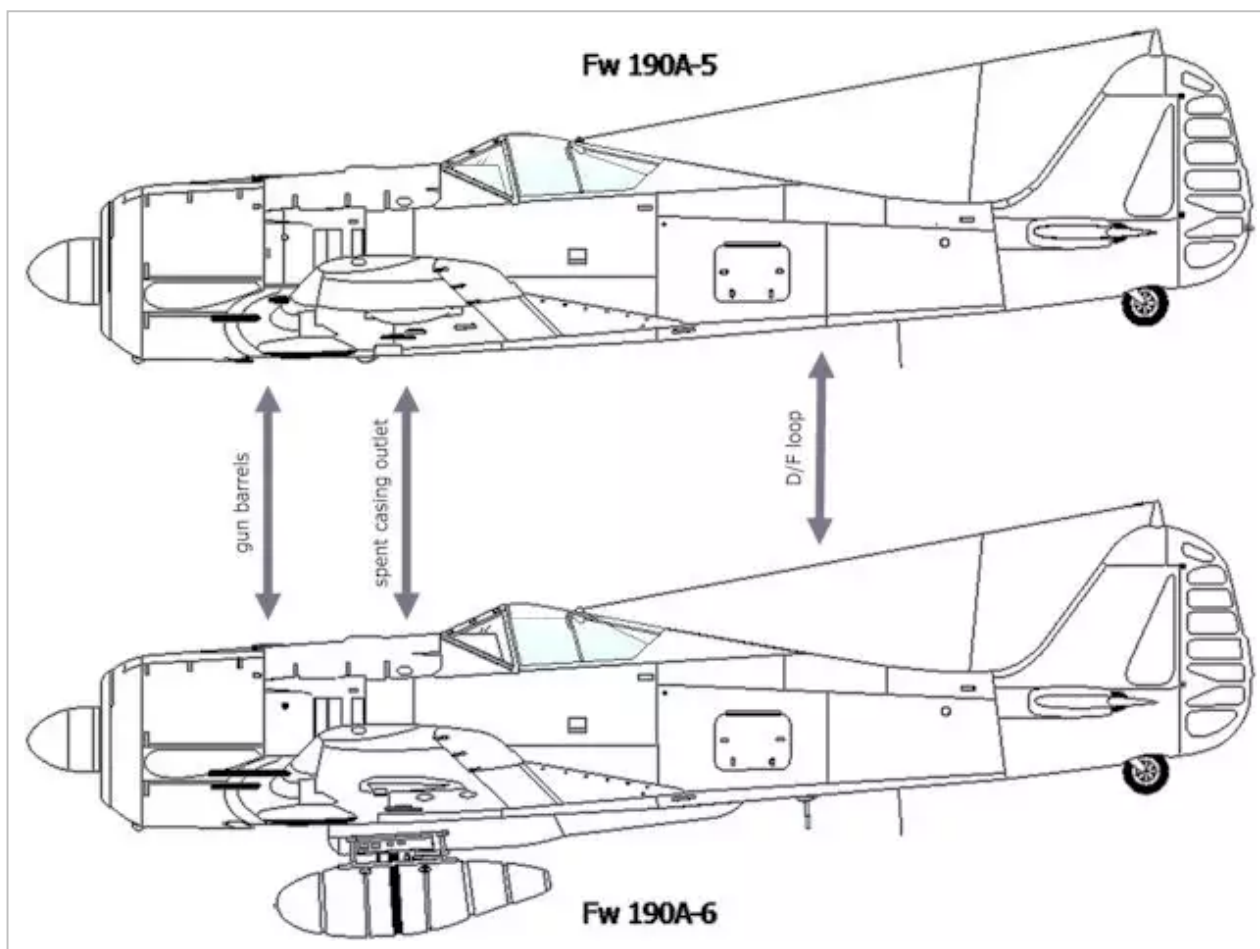
Serial production of the A-6 variant started in July 1943 and ended in November 1943 after the completion of 569 planes.

Summary of features

Fw 190A-6 could be distinguished by the following external features:

- Adjustable cooling slots behind the engine
- Long-nose cowling
- Wide armoured headrest with cushion, braced with a single, rectangular cross-section strut
- Fuselage armament of MG 17 with "straight" upper cowling
- Wing armament of MG 151 in four positions, with four protruding barrels, wing root blisters and spent casing outlet below the wing.
- Small radio antenna mast at the top of the fin
- Large rectangular radio hatch in port rear fuselage
- First aid kit hatch in starboard rear fuselage behind the canopy
- FuG 16 loop antenna below rear fuselage (not on the initial production batches)

Beside these features, solid wheel hubs appeared on some aircraft, possibly in conjunction with some of the R kits or as result of field upgrades.



Fw 190 A-5 to A-6 version comparison

Fw 190 A-7

In November 1943 production of the Fw 190A-7 version began. It was developed by standardizing the armament of the A5/U9 modification - 2x1 MG 131 machine guns and 4x1 MG 151/20 E cannons. Cigar-shaped bulges emerged on the upper engine cowling in front of the cockpit because of the bigger dimensions of the MG 131 machine gun. The Revi C/12D sight was replaced by a new model 16 B.

Strengthened wheel rims as previously used in the F version were mounted as standard on the undercarriage.

Apart from standard A-7 models there were three modification kits (*Rustsatz*) provided : R1, R2, R3. These corresponded to the same kits of the A-6 model.

Generally, planes were equipped with ETC 501 bomb racks, that were used for 300 litre fuel tanks. There exists also a photograph of the Fw 190A-7 with under-fuselage mounted light rack for fuel tank and reduced armament (2x1 MG 131 machine guns and 2x1 MG 151/20 E cannons). There is evidence that this particular plane was used for dogfighting with Allied fighters. There is no information about the number of A-7 planes with this equipment. Probably it was a field modification performed on the pilots' or Staffel staff's request.

One A-7 plane (W.Nr. 380394) was used as a test bed for the later droppable flattened streamlined fuel tanks known under the name of Doppelreiter. Each tank had a capacity of 270 litres and was mounted on the upper wing surface. Engineers hoped to get low pressure drag and the smallest possible speed loss with a relatively high tank capacity. Armament was reduced to two MG 151/20 E cannons. Development work on this tank was conducted by the research establishment FGZ (Forschungsanstalt Graf Zeppelin) under engineer Iseemann's

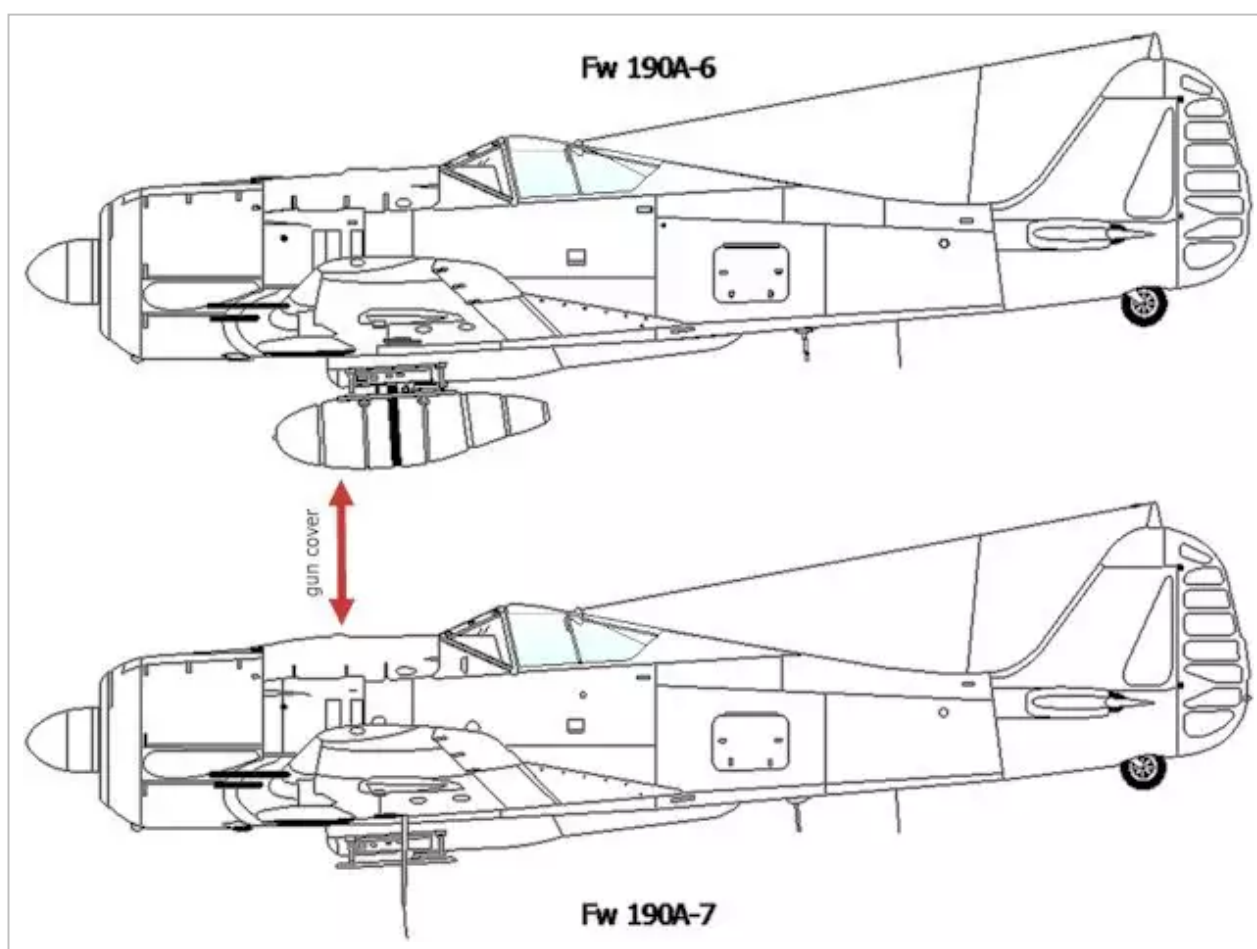
management. After a series of tests that ended with positive results, the RLM, for a big surprise, did not agree to this modification. The reason was: to not to disturb production!

In January 1944 production of all variants of the Fw 190A-7 ended after 80 aircraft were produced. It was replaced on the production lines by the more modern A-8 version.

Summary of features

Fw 190A-7 could be distinguished by the following external features:

- Adjustable cooling slots behind the engine
- Long-nose cowlings
- Wide armoured headrest with cushion, braced with a single, rectangular cross-section strut
- Fuselage armament of MG 131 with bulged upper cowlings
- Shorter gun recesses in the forward upper cowlings
- Wing armament of MG 151 in four positions, with four protruding barrels, wing root blisters and spent casing outlet below the wing.
- Small radio antenna mast at the top of the fin
- Large rectangular radio hatch in port rear fuselage
- First aid kit hatch in starboard rear fuselage behind the canopy
- FuG 16 loop antenna below rear fuselage
- Solid wheel hubs on all aircraft



Fw 190 A-6 to A-7 version comparison

Fw 190 A-8

A new model with different equipment. Most important were parts of the MW 50 injection system, used for short term engine power boost. A cylindrical tank of 118 litres capacity was mounted in the rear fuselage. In an emergency, it could be used as additional fuel tank.

The MW 50 tank installation shifted the centre of gravity backward and, as a cure, the under-fuselage mounted ETC 501 bomb rack was moved 20 cm forward. This rack became a standard from the A-8 model.

The plane was equipped with a FuG 16 ZY radio set that despite the circular radio navigation antenna Morane antenna, was mounted under the left wing.

The outstanding element for differentiation between the A-7 and A-8 is also the Pitot head moved from mid-wing leading edge to right wing tip.

The Fw 190A-8, like previous models, could be equipped with different *Rustsatz* kits: R1, R2, R3, R4, R6, R7, R8, R11, R12; but R1, R3 and R4 were abandoned shortly thereafter and generally R2, R6, R7 and R8 kits were used. Some of the R11 and R12 modifications produced in small quantities had small differences in the equipment (e.g. MG 131 machine guns tube was covered by a plate for reflection limitation, some got more the more efficient BMW 801 TU engines and FuG 125 Hermine radio navigation device).

Apart from the previously described variants, A-8/F-8 series airframes were often used for different armament and equipment testing. These planes also tested several different engines. Unfortunately, only a small part of the documentation concerning these tests survived, making it impossible to describe in detail all of the modifications and resolve some the contradictory information. In spite of this, we know of the following armament modifications:

- **SG 113 Zellendusche** - 3-tube battery based on the MK 103 cannons mounted in the rear fuselage. Firing was made by a photosensor impulse. - SG 117 Zellendusche - 6-tube modification of the previously described battery.
- **Rohrblock 108** - similar construction with 7 tubes based on the elements of the MK 108 cannon, fired by photosensor impulse. Probably, it consisted only of MK 108 cannons barrels with a single cartridge; after firing of the first barrel others were fired automatically by the recoil force of previous barrel. This kind of armament was used for bombers interception and was tested on the Fw 190A-8 (W.Nr. 733713), prototype designation V74.
- **SG ...? Harfe** - set of 3-4 15-barrel, unguided 20 mm missile launchers mounted in the rear fuselage on both sides. At least one prototype plane had such armament and was presented to Gen. Adolf Galland.
- **Ruhrstahl X-4 (Ru 334)** - wire-guided rocket missiles mounted on underwing racks, probably of the ETC 503 type. This armament was developed for destroying ground targets (tanks) and for bombers fighting (different warhead). It was tested on the F-8 version plane.

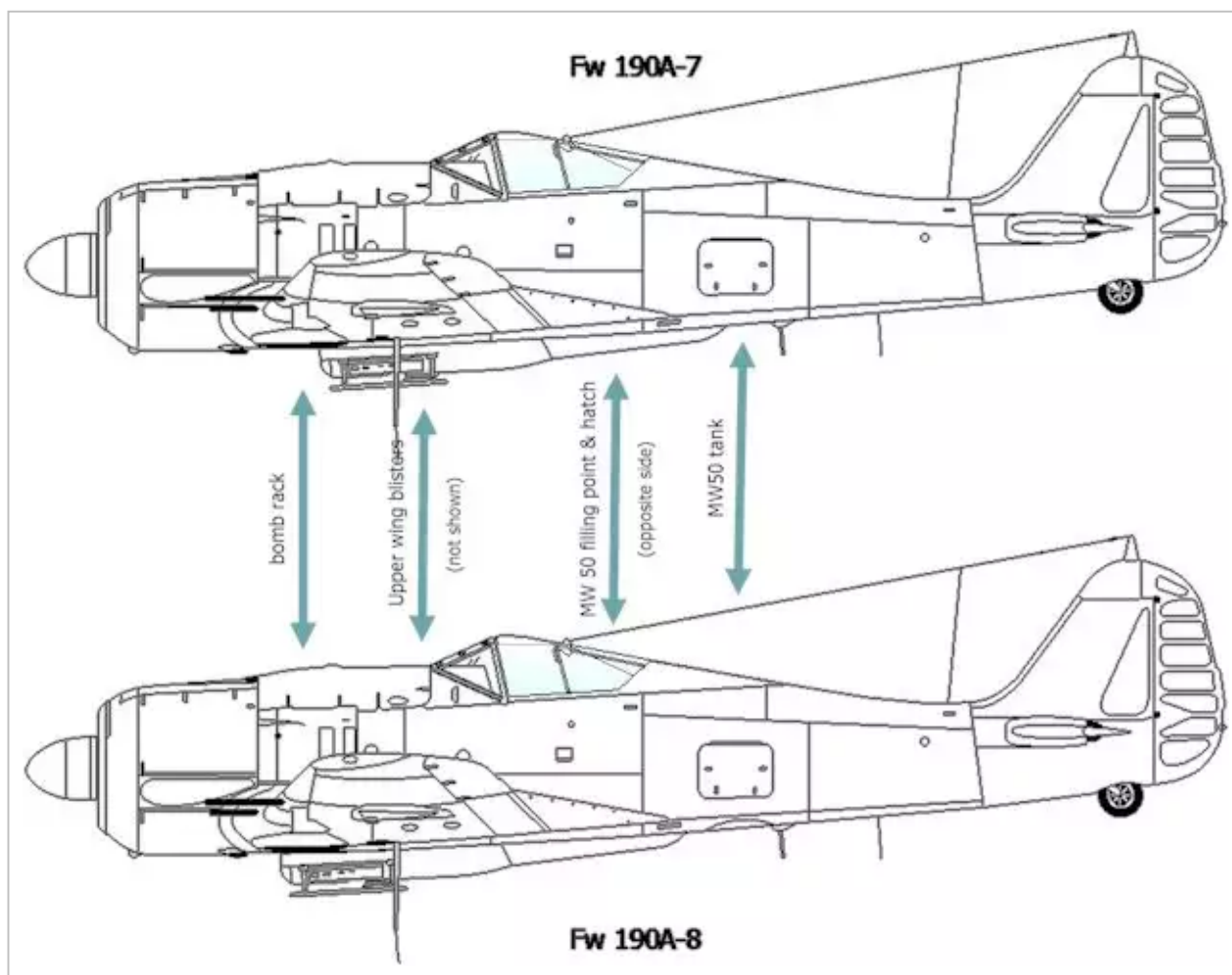
From 1944, production of fighter planes was sharply increased in the so-called *Jagernotprogramm*. This required higher production coordination and development of a cooperative network. As a result, the Fw 180 A-8 was produced in mass numbers in nearly all Focke-Wulf affiliated factories (production started also in Cottbus, Sorau, Poznan). A licence was sold to the NDW (Norddeutsche Dornier Werke) factory in Wismar. Smaller factories performed repair work and recycled the planes withdrawn from service units. They also produced smaller aeroplane parts. Special coordination committees secured efficient work systems and continuous parts delivery. As the result 1334 A-8 series planes were built.

Summary of features

Fw 190A-8 could be distinguished by the following external features:

- Adjustable cooling slots behind the engine
- Long-nose cowling
- Wide armoured headrest with cushion, braced with a single, rectangular cross-section strut

- "Blown" canopy and pilot head armour braced with solid armoured pylon (last production batches only)
- Fuselage armament of MG 131 with bulged upper cowling
- Shorter gun recesses in the forward upper cowling
- Wing armament of MG 151 in four positions, or MG 151 in wing roots and MK 108 in outboard positions. Wing root blisters. Outboard gun positions always finished with a rectangular overwing blister and spent casing outlet below the wing.
- Small radio antenna mast at the top of the fin
- Large rectangular radio hatch in port rear fuselage
- First aid kit hatch in starboard rear fuselage behind the canopy
- FuG 16 loop antenna below rear fuselage
- Solid wheel hubs
- ETC 501 rack in forward position, installed on all aircraft
- No inner undercarriage doors
- Ventral MW 50 tank panel in the fuselage aft of the wing
- MW 50 filling point at the port fuselage behind the cockpit
- Small rectangular equipment hatch on the starboard fuselage side below the cockpit.
- Pitot tube placed at starboard wing tip rather than mid-chord.



Fw 190 A-7 to A-8 version comparison

Fw 190 A-9

Next and last production series of the A version aircraft was the Fw 190A-9. Previously, it was thought this plane would have been powered by a 1765 kW (2400 hp) BMW 801 F engine. But the BMW factory had not started production of these engines in time and, as a replacement, the 1470 kW (2000 hp) BMW 801 S engine was used.

These engines were delivered as a power unit BMW 801 TS together with a more efficient radiator and bigger circular armoured oil tank mounted in front of the engine. The cowling length increased by some 30 mm. A more efficient, 14-blade fan replaced the previous 12-blade unit for more efficient cooling. Also, the thickness of the armour on the oil tank increased from 6 to 10 mm.

A new broad-chord wooden propeller with a diameter of 3500 mm should have been used to match the increased engine power. The new propeller was manufactured by Heine or Schwartz companies, but for unknown reasons the majority of the A-9 planes (as opposed to F-9) had the metal VDM 9-12176 A propellers, as used in the previous version.

One difference in the airframe between A-9 and A-8 model was a larger "blown" cockpit canopy, adapted from the Fw 190F-8 version.

A few planes also got tail sections with an enlarged tail as provided for Ta 152 fighters.

Armament and *Rustsatz* kits were the same as in the A-8 version.

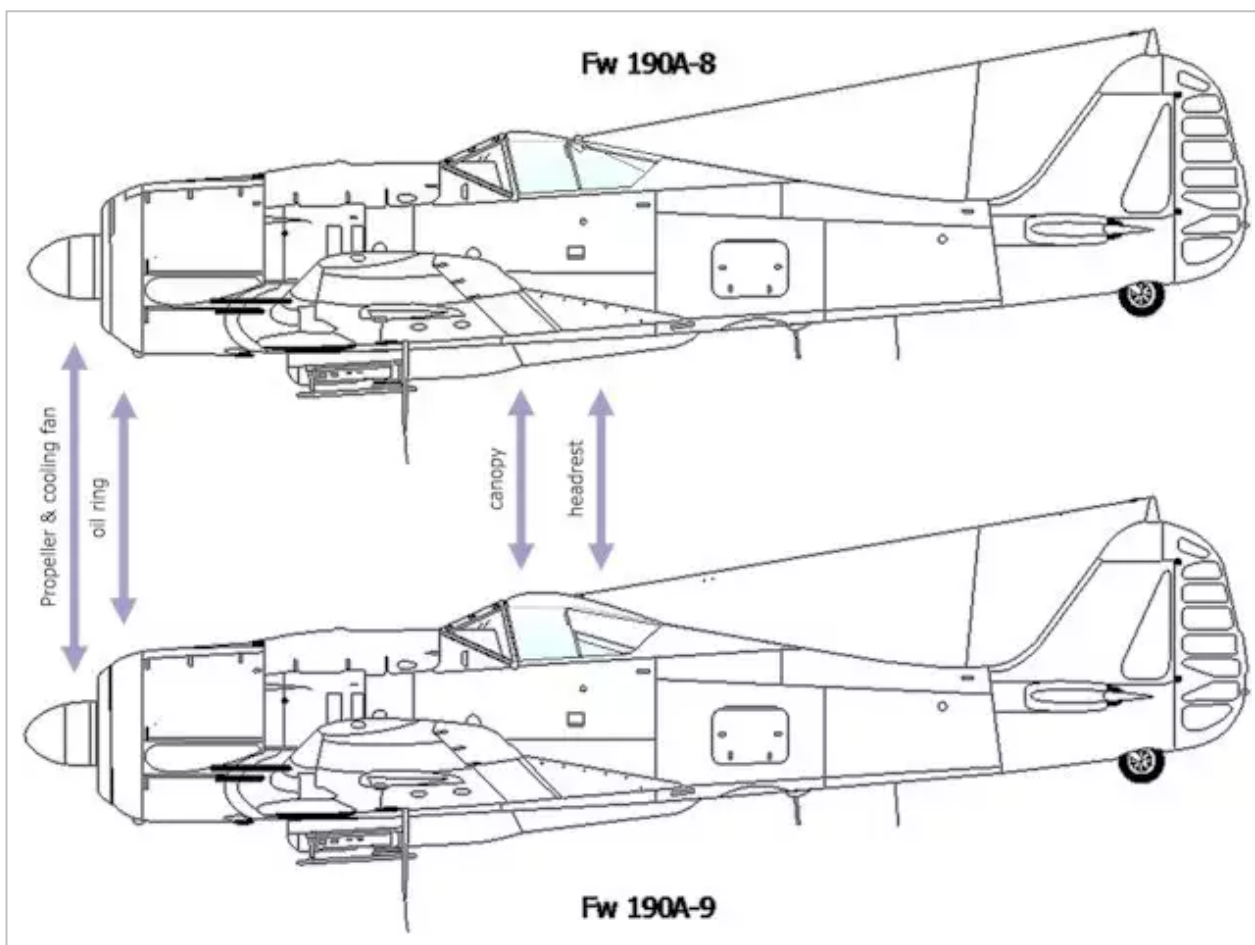
Production of the plane started in the end of autumn 1944 and continued parallel to A-8 version. Monthly output depended on limited deliveries of BMW 801 TS engines.

Also developed was a project for a highly modified Fw 190A-10 fighter powered by a BMW 801 F engine, but it was not completed because of the end of the war.

Summary of features

Fw 190A-9 could be distinguished by the following external features:

- Cowling with enlarged oil tank, 30 mm longer.
- 14-blade fan replacing the previous 12-blader
- Paddle-blade wooden propeller (some aircraft only)
- Armoured headrest with cushion, braced with solid armoured pylon
- "Blown" canopy
- Fuselage armament of MG 131 with bulged upper cowling
- Wing armament of MG 151 in four positions, or MG 151 in wing roots and MK 108 in outboard positions. Wing root blisters. Outboard gun positions always finished with a rectangular overwing blister and spent casing outlet below the wing.
- Small radio antenna mast at the top of the fin
- Large rectangular radio hatch in port rear fuselage
- First aid kit hatch in starboard rear fuselage behind the canopy
- FuG 16 loop antenna below rear fuselage
- Solid wheel hubs
- ETC 501 rack in forward position, installed on all aircraft
- No inner undercarriage doors
- Ventral MW 50 tank panel in the fuselage aft of the wing
- MW 50 filler point at the port fuselage behind the cockpit
- Small rectangular equipment hatch on the starboard fuselage side below the cockpit.
- Wooden Ta 152-style tail (some aircraft only)



Fw 190S-5 and S-8

In connection with the reorganization of diving bomber units into fighter-bomber units and the need to retrain Ju 87 pilots on Fw 190 fighters the Luftwaffe ordered a two-place training version of the Fw 190 fighter.

In the spring of 1944, one A-8 airframe was modified to this standard and received the additional designation U1. The second cockpit was placed just after the first in the place used for the MW 50 installation, this device being removed. The back part of cockpit canopy was also modified. It had a three part, sides opening canopy similar to the Bf 109 G-12, ended with a crude metal fairing in the upper rear fuselage. Three planes were modified and designed as a masters for serial fighter planes modification. To this should be added the damaged planes removed from frontline units and modified by field repair stores. For this reason, it is difficult to find a precise number of A-5, A-8 and F-8 planes modified to the two place version. It was a relatively small number and planes were designated Fw 190 S-5 and S-8 (S = *Schulflugzeug* - training plane) respectively.

Of course, the development of the Fw 190 fighter did not end with the A versions, but continued with water-cooled in-line engines.

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